UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

Date: 27 December 2006

Subject: **Lambda-Cyhalothrin. Petitions Requesting Permanent Tolerances (Associated with Section 3 Registration) for Food/Feed Use of the Insecticide on Cucurbit Vegetables (Group 9), Tuberous and Corm Vegetables (Subgroup 1C), Grass Forage, Fodder, and Hay (Group 17), Barley, Buckwheat, Oat, Rye, Wild Rice, and Pistachios. Summary of Analytical Chemistry and Residue Data. Petition Numbers 5F6994, 3E6593, and 6E7077.**

DP Numbers:	**313315, 324219, 330542**	**Decision Numbers:**	**353815, 361053, 367977**
PC Code:	**128897**	**MRID Numbers:**	**46658301, 46665301, 46665302, 46665303, 46665304, 46665305, 46686001**
40CFR §180.	**438**		
Chemical Class:	**Synthetic Pyrethroid Insecticide**		

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This document was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Durham, NC 27713). The document has been reviewed by the Health Effects Division (HED), and revised to reflect current Office of Pesticide Programs (OPP) policies.

Executive Summary

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food/feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones [40CFR §180.438(a)(1)]. Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances are also established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection (Syngenta) and Interregional Research Project #4 (IR-4) have submitted petitions supporting new or expanded uses for lambda-cyhalothrin as a microencapsulated formulation (capsule suspension, CS) containing either 1.0 or 2.08 pounds of active ingredient per gallon (lb ai/gal). The proposed uses are for up to 6 broadcast foliar applications using ground or aerial equipment. The proposed uses on barley, buckwheat, oats, and rye are identical to the existing use on wheat, and allow for up to two applications at 0.03 pounds ai per acre (lb ai/A), for a total rate of 0.06 lb ai/A per season, with a 7-day pre-harvest interval (PHI) for forage and hay, and a 30-day PHI for grain and straw. For cucurbit vegetables, the proposed use is for up to six applications at 0.03 lb ai/A, for a total rate of 0.18 lb ai/A per season, with a PHI of 1 day. For grasses, the proposed use is for up to three applications at 0.03 lb ai/A per cutting, for a total rate of 0.09 lb ai/A per season, with PHIs of 1 day for forage, and 7 days for hay, straw, and seed screenings. For tuberous and corm vegetables, the proposed use is for up to four applications at 0.03 lb ai/A, for a total rate of 0.12 ai/A per season, with a PHI of 7 days. The proposed use for wild rice is identical to the existing use on rice, and allows for up to three applications at 0.04 lb ai/A, for a total rate of 0.12 lb ai/A per season, with a PHI of 21 days. The proposed use for pistachios is identical to the existing uses on other tree nuts, and allows for up to four applications at 0.04 lb ai/A, for a total rate of 0.16 lb ai/A per season, with a PHI of 14 days. In conjunction with these uses, Syngenta and IR-4 are proposing the following permanent tolerances for the combined residues of lambda-cyhalothrin and its epimer R157836:

Barley, bran	0.2 ppm
Barley, grain	0.05 ppm
Barley, hay	2.0 ppm
Barley, straw	2.0 ppm
Buckwheat, grain	0.05 ppm
Cucurbit vegetables	0.05 ppm
Grass, forage, fodder, and hay	9.0 ppm
Oat, forage	2.0 ppm
Oat, grain	0.05 ppm
Oat, hay	2.0 ppm
Oat, straw	2.0 ppm
Pistachio	0.05 ppm
Rice, wild, grain	1.0 ppm

Rye, grain ..... 0.05 ppm
Rye, forage ..... 2.0 ppm
Rye, straw ..... 2.0 ppm
Tuberous and corm vegetables ..... 0.05 ppm

The nature of the residue in plants and animals is understood, based on adequate cotton, cabbage, soybean, wheat, ruminant, and poultry metabolism studies. HED has determined that the residue to be regulated in both plant and animal commodities includes lambda-cyhalothrin and its epimer R157836 for purposes of both the tolerance expression and risk assessment.

Adequate gas chromatographic/electron capture detection (GC/ECD) methods are available for enforcing tolerances on both plant (Method PRAM 81) and animal (Method PRAM 86) commodities. For both methods, residues are extracted with acetone/hexane (1:1, v/v), then cleaned up using liquid-liquid chromatography and Florisil column chromatography. Residues are determined by GC/ECD; the method limit of quantitation (LOQ) is 0.01 ppm for each analyte.

Samples of cucurbit vegetables, grass commodities, and potatoes from the submitted field trials were analyzed for residues of lambda-cyhalothrin and R157836 using GC/ECD methods, which are derived from the current tolerance enforcement method for plant commodities. Each method was adequately validated in conjunction with the analysis of field trial samples. The validated LOQs are 0.01 ppm for each analyte in/on potatoes and cucurbit vegetables, for a combined LOQ of 0.02 ppm. For the grass matrices, the method LOQ is 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, for a combined LOQ of 0.01 ppm.

Adequate storage stability data are available indicating that both lambda-cyhalothrin and R157836 are stable under frozen storage in a wide variety of raw and processed commodities for intervals of 26-36 months. These data support the storage durations (2.9-8.5 months) and conditions for samples from the field trials and processing studies submitted with the current petitions.

The available field trial data on potatoes, cucumbers, muskmelons, summer squash, and grasses are adequate, and support the proposed use patterns for lambda-cyhalothrin (CS) on tuberous and corm vegetables, cucurbit vegetables, and grasses. The number and geographic distribution of the field trials are adequate, and the appropriate samples were collected at the proposed PHIs. Following four broadcast foliar applications of lambda-cyhalothrin (CS) to potatoes during tuber development, at rates totaling 0.117-0.124 lb ai/A (~1x rate), combined residues of lambda-cyhalothrin and R157836 were less than the LOQ (<0.02 ppm) in/on all 32 potato samples harvested at the proposed 7-day PHI. Following six broadcast foliar applications of lambda-cyhalothrin (CS) to representative cucurbit vegetables during fruit development, at rates totaling 0.176-0.184 lb ai/A (~1x rate), combined residues at the proposed 1-day PHI were <0.02-<0.03 ppm in/on 12 samples of muskmelons and 14 samples of cucumbers, and <0.02-<0.04 ppm in/on 10 samples of summer squash. Following single broadcast applications of lambda-cyhalothrin (CS) to grasses at 0.03 lb ai/A per cutting (1x rate), combined residues were 0.13-8.04 ppm in/on 136 samples of forage harvested at 0-3 days after treatment (DAT), and <0.01-6.01 ppm in/on 68 samples of hay harvested at 5-11 DAT. Following a single application at 0.03 lb ai/A to grasses grown for seed, combined

residues were 0.35-7.80 ppm in/on 16 samples of straw, and 0.80-3.23 ppm in/on 16 samples of seed screenings harvested at maturity, 7-19 DAT.

In addition to the new field trial data, adequate field trial data are available on rice, wheat, almonds, and pecans from previously reviewed petitions. The data on rice will be translated to support an identical use on wild rice; the data on almonds and pecans will be translated to support an identical use on pistachios; and the data on wheat will be translated to support identical uses on barley, buckwheat, oats, and rye.

Adequate processing studies are available for potato and wheat grain; processing data are not required for cucurbit vegetables, grass, nor wild rice. Based on residues in potatoes (less than the LOQ) treated at a 5x rate, residues are unlikely to be detectable in processed commodities from potatoes treated at 1x; therefore, separate tolerances are not required for potato processed fractions. However, based on the available wheat grain processing data, in which residues concentrated by 3x in bran, separate tolerances are required for both barley and rye bran, each at 0.2 ppm.

Adequate cattle and poultry feeding studies, and a cattle dermal application study are available to support the existing and proposed uses. Based on the existing and recommended tolerances for plant commodities, the calculated theoretical dietary burden (TDB) for lambda-cyhalothrin residues is 10.6 ppm for beef cattle, 10.4 ppm for dairy cattle, 0.9 ppm for swine, and 1.0 ppm for poultry. Using these TDBs and the available livestock residue data, the maximum expected lambda-cyhalothrin residues in cattle commodities are 0.35 ppm in whole milk (reflecting 8.8 ppm in milk fat), 2.5 ppm in fat, 0.11 ppm in muscle, 0.06 ppm in liver, and 0.15 ppm in kidney. The maximum expected residues in hog commodities would be 0.16 ppm in fat, 0.006 ppm in meat, and 0.011 ppm in meat-byproducts. The maximum expected residues in poultry commodities would be 0.003 ppm in eggs, 0.022 ppm in fat, 0.002 ppm in meat, and 0.003 ppm in meat-byproducts. These residue levels indicate that the current tolerances in poultry commodities, as well as in the fat, meat, and meat by-products of cattle, goats, horses, and sheep, are all adequate. However, the tolerance should be increased in milk fat (from 5 ppm to 10 ppm). The data also indicate that the current tolerances in hog commodities could be lowered to 0.2 ppm in fat, 0.01 ppm in meat, and 0.02 ppm in meat-byproducts.

Adequate confined rotational crop data are available indicating that rotational crop restrictions and tolerances are not required for the current or proposed uses.

Regulatory Recommendations and Residue Chemistry Deficiencies

No major deficiencies were noted in the subject petitions that would preclude the establishment of permanent tolerances for lambda-cyhalothrin on the proposed commodities. Only minor deficiencies were noted pertaining to the proposed label directions and recommended tolerance levels (listed below). HED recommends in favor of establishing permanent tolerances for lambda-cyhalothrin residues at the levels recommended in Table 9.

(1) Use directions for grasses should be clarified to specify that the restriction of 0.03 lb ai/A per cutting includes pastures and rangeland in addition to grasses grown for seed. A minimum re-treatment interval (RTI) of 30 days should be specified for pastures and rangeland which are not cut between applications. In addition, the PHI for forage should be

changed to 0 days, as PHIs for forage are not practical for rangeland applications.

(2) A tolerance was not proposed in rye bran. Based on the available wheat residue data, a separate tolerance is required at 0.2 ppm in rye, bran.

(3) Based on the calculated TDBs for livestock, and the available livestock residue studies, the current tolerance for lambda-cyhalothrin in milk fat is too low. An increased tolerance should be proposed in milk fat (10 ppm). The data also indicate that the current tolerances in hog commodities could be lowered to 0.2 ppm in fat, 0.01 ppm in meat, and 0.02 ppm in meat-byproducts.

Background

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones [40CFR §180.438(a)(1)] . Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances have also been established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection has submitted a petition (PP#5F6994) supporting the use of 1.0 and 2.08 lb ai/gal CS formulations of lambda-cyhalothrin on tuberous and corm vegetables (subgroup 1C), cucurbit vegetables (group 9), and grasses (group 17). In addition, IR-4 submitted two petitions (PPs#3E6593 and 6E7077) proposing to expand the use of lambda-cyhalothrin (CS) to include barley, buckwheat, oats, rye, wild rice, and pistachios, based on the existing residue data and tolerances on wheat, rice, and tree nuts.

The nomenclature and physicochemical properties of lambda-cyhalothrin are presented below in Tables 1 and 2.

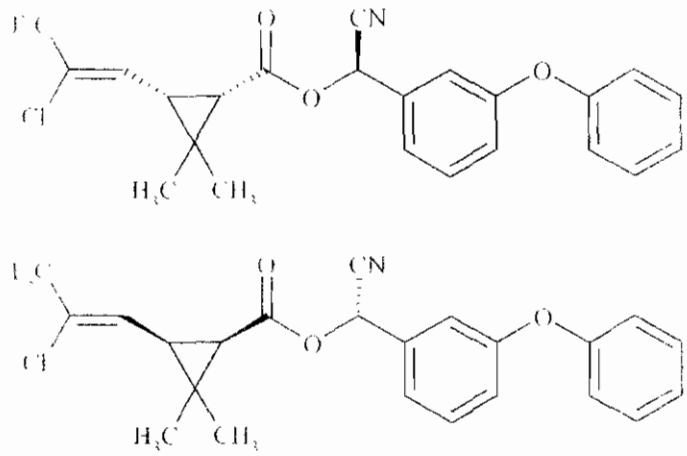
Table 1. Lambda-Cyhalothrin Nomenclature.	
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common Name	Lambda-Cyhalothrin
Company Experimental Name	ICIA0321
Molecular Formula	$C_{23}H_{19}ClF_3NO_3$
Molecular Weight	449.9
IUPAC Name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Registry Number	91465-08-6
End-use Products (EP)	1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™; EPA Registration #100-1112) 2.08 lb ai/gal CS (Karate® Insecticide with Zeon Technology™; EPA Registration #100-1097)

Table 2. Physicochemical Properties of Lambda-Cyhalothrin.		
Parameter	**Value**	**Reference**
Melting Point/Range (°C)	49.2	D284860[1]
pH	NA[2]	
Density (g/cm^3 at 25°C)	1.33	
Water Solubility (mg/L at 20°C, pH 6.5)	0.005	
Solvent Solubility (g/L)	NA	
Vapor Pressure (mm Hg at 20°C)	1.5×10^{-9}	
Dissociation Constant (pK_a at 20°C)	~9	
Octanol/water Partition Coefficient (Log[K_{OW}])	7.00	
UV/visible Absorption Spectrum	NA	

1. Kit Farwell, 8/15/2002.
2. NA = Not Available.

860.1200 Directions for Use

Syngenta and IR-4 are proposing new uses of lambda-cyhalothrin on barley, buckwheat, oats, rye, cucurbit vegetables, grasses, tuberous and corm vegetables, wild rice, and pistachios for the control of a wide variety of insect pests. The formulations being proposed for these uses include a 1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™, EPA Registration #100-1112) and a 2.08 lb ai/gal CS (Karate® Insecticide with Zeon Technology™, EPA Registration #100-1097). These formulations are currently registered to Syngenta for use on a wide variety of food and feed crops at seasonal rates of 0.06-0.48 lb ai/A. The petitioners provided proposed labels from Syngenta containing the use directions, which are summarized in Table 3. below.

Table 3. Summary of Directions for Use of Lambda-Cyhalothrin.

Application Timing, Type, and Equipment	Formulation [EPA Reg. #]	Use Rate (lb ai/A)	Max. # Applic. per Season	Max. Seasonal Use Rate (lb ai/A)	PHI (Days)	Use Directions and Limitations
Cereal Grains (including Wheat, Wheat Hay, Triticale, Barley, Buckwheat, Oats, and Rye)						
Broadcast foliar applications using ground or aerial equipment	1.0 lb ai/gal CS [100-1112] 2.08 lb ai/gal CS [100-1097]	0.03	2	0.06	7 [forage, hay] 30 [grain, straw]	The minimum RTI is 3 days. Do not allow livestock to graze within 7 days of treatment. Use a minimum of 2 and 10 gal/A for aerial and ground applications, respectively.
Cucurbit Vegetables						
Broadcast foliar applications using ground or aerial equipment	1.0 lb ai/gal CS [100-1112]	0.03	6	0.18	1	The minimum RTI is 5 days. Use a minimum of 2 and 10 gal/A for aerial and ground applications, respectively.
Grass Forage, Fodder and Hay						
Broadcast foliar applications using ground or aerial equipment	1.0 lb ai/gal CS [100-1112] 2.08 lb ai/gal CS [100-1097]	0.03	3	0.09	1 [forage] 7 [hay, straw, and seed screenings]	Do not apply more than 0.03 lb ai/A per cutting. Following application to grasses grown for seed, regrowth may be cut for forage or hay 30 days after harvest of seed. Use a minimum of 2 and 7 gal/A for aerial and ground applications, respectively.
Tuberous and Corm Vegetables						
Broadcast foliar applications using ground or aerial equipment	1.0 lb ai/gal CS [100-1112]	0.03	4	0.12	7	The minimum RTI is 7 days. Use a minimum of 2 and 10 gal/A for aerial and ground applications, respectively.

Table 3. Summary of Directions for Use of Lambda-Cyhalothrin.						
Application Timing, Type, and Equipment	**Formulation [EPA Reg. #]**	**Use Rate (lb ai/A)**	**Max. # Applic. per Season**	**Max. Seasonal Use Rate (lb ai/A)**	**PHI (Days)**	**Use Directions and Limitations**
Rice and Wild Rice						
Broadcast foliar applications using ground or aerial equipment	1.0 lb ai/gal CS [100-1112] 2.08 lb ai/gal CS [100-1097]	0.04	3	0.12	21	Do not apply more than 0.08 lb ai/A within 28 days of harvest, or more than 0.04 lb ai/A within 21 days of harvest. The minimum RTI is 5 days. Do not release flood water within 7 days of application. Do not use treated rice fields for the aquaculture of edible fish and crustacaea. Do not apply as an ULV spray. Use a minimum of 2 gal/A for aerial applications.
Tree Nuts (including Pistachio)						
Broadcast foliar applications during growing season using ground or aerial equipment	1.0 lb ai/gal CS [100-1112]	0.04	4	0.16	14	Do not apply more than 0.12 lb ai/A/year post-bloom. The minimum RTI is 5 days. Use a minimum of 5 gal/A for aerial applications.

Conclusions. The proposed use directions reflect the applications used in the available crop field trials, and are adequate, provided that the following change (below) is made for the use directions on grasses. The proposed uses for barley, buckwheat, oats, and rye are identical to the existing uses on wheat; the proposed use on wild rice is identical to the existing use on rice; and the proposed use on pistachios is identical to the existing use on tree nuts.

Use directions for grasses should be clarified to specify that the restriction of 0.03 lb ai/A per cutting includes pastures and rangeland in addition to grasses grown for seed. For pastures and rangeland, which are not cut between applications, the label should specify a minimum RTI of 30 days. In addition, the Agency has previously determined that PHIs for forage on rangeland are not practical; therefore, a PHI for grass forage should be amended to 0 days.

860.1300 Nature of the Residue - Plants

The nature of the residue in plants is adequately understood, based on adequate cotton, cabbage, soybean, and wheat metabolism studies (PPs#7F3560 and 7H5543; M. Flood; 1/22/1992). Lambda-cyhalothrin is metabolized by cleavage of the ester linkage to form cyclopropanecarboxylic acids and the corresponding phenoxybenzoic acids or alcohols. In most cases the parent compound is the principal constituent of the residue. However, in the cabbage metabolism study the cis- and trans-cyclopropanecarboxylic acids were the major constituents. HED has concluded that the plant metabolites need not appear in the tolerance expression at this time owing to lack of toxicological concern, and low concentrations found from residue studies

(Memo; Pamela Hurley; 1/3/1992). The residues to be regulated are lambda-cyhalothrin and its epimer R157836.

860.1300 Nature of the Residue - Livestock

Studies of lambda-cyhalothrin metabolism in ruminants and poultry have been reviewed. Lambda-cyhalothrin is the major component of the residue in animals, except in kidney and liver, where, in addition to the plant metabolites, 3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2-hydroxymethyl-2-methylcyclopropane-carboxylic acid (OH-CPA) and 4-hydroxy-3-phenoxybenzoic acid (4'-OH-3PBAcid) may be present in significant quantities. A residue transfer study, in which cows were fed dietary levels of 8, 25, or 80 ppm lambda-cyhalothrin, demonstrated that, at <8 ppm, OH-CPA levels in tissue would not exceed 0.01 ppm (PPs#2F4109, 2F4114, 7F3560, and 1F3992; M. Flood; 8/31/1992). As with plants, HED has determined that the residues to be regulated are lambda-cyhalothrin and its epimer R157836. The animal metabolites do not need to appear in the tolerance expression.

860.1340 Residue Analytical Methods

Adequate GC/ECD methods are available for enforcing tolerances for lambda-cyhalothrin residues in plant and animal commodities. ICI Method 81 (PRAM 81) is available for determining residues of lambda-cyhalothrin and its epimer in plant matrices, while ICI Method 86 (PRAM 86) is available for determining residues of lambda-cyhalothrin and its epimer in animal matrices. Both methods have been validated by EPA as adequate enforcement methods.

For Method PRAM81, residues of lambda-cyhalothrin and R157836 are extracted with acetone/hexane (1:1, v/v), and cleaned using liquid-liquid chromatography to remove lipids, followed by Florisil column chromatography. Residues are then determined by GC/ECD; the method LOQ is 0.01 ppm for both analytes.

For Method PRAM86, residues are extracted from milk or animal tissues with 50% acetone/hexane. The aqueous fraction is removed, after which the residues are then dried over sodium sulfate, and cleaned up using a Florisil column. Residues are determined by GC/ECD; the method LOQ is 0.01 ppm for both analytes.

In the field trials submitted with the current petitions, residues of lambda-cyhalothrin and R157836 were determined using GC/ECD methods, which are more recent modifications of the current tolerance enforcement method for plant commodities. For the analysis of potatoes and cucurbit vegetables, residues were extracted with acetone/hexane (1:1, v/v) and sodium sulfate, filtered, and partitioned with aqueous sodium chloride. Residues in the resulting hexane fraction were then cleaned up using Florisil columns, and analyzed by GC/ECD using external standards. The validated LOQ is 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm.

For the analysis of grass commodities, residues were extracted with acetone/hexane (1:1, v/v), filtered, and cleaned up using a silica gel solid-phase extraction (SPE) cartridge. Residues were then analyzed by GC/ECD using external standards. For each grass matrix, the validated LOQ is 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, for a combined LOQ of 0.01 ppm.

Each of these GC/ECD methods was adequately validated in conjunction with the analysis of field trial samples using fortified control samples. Recoveries of lambda-cyhalothrin

averaged 89-96% (with standard deviations of 10-13%) from cucurbit vegetables, 85-93% (s.d. 14-17%) from grass commodities, and 90 (s.d. 10%) from potatoes. Recoveries of R157836 averaged 87-99% (s.d. 8-15%) from cucurbit vegetables, 80-95% (s.d. 11-18%) from grass commodities, and 91 (s.d. 11%) from potatoes. Apparent residues were less than the LOQ in most controls samples, and where apparent residues were above the LOQ in control samples, the residues were substantially less than the residues in the associated treated samples.

Conclusion. Adequate GC/ECD methods are available for enforcing the proposed and existing tolerances on plant and animal commodities, and the submitted residue data were determined using adequate GC/ECD methods derived from the existing tolerance enforcement method.

860.1360: Multiresidue Method

Data reflecting the recovery of lambda-cyhalothrin and its metabolite (PP 890) through FDA's multiresidue protocols have been submitted and forwarded to FDA (PPs#7F3560 and 7H5543; M. Flood; 9/19/1991). The FDA PESTDATA database (PAM Volume I, Appendix I, June 2005) indicates that cyhalothrin is completely recovered using Methods Section 302. However, no information is reported its recovery through Methods 303 and 304, nor on the recovery of PP 890 through any of the multiresidue method.

860.1380: Storage Stability

No new storage stability studies were submitted with these petitions. Previously reviewed storage stability data indicate that lambda-cyhalothrin and R157836 are stable at -18°C for intervals of up to 26 months in peach, pea, oilseed rape, wheat grain, sugar beet root, cottonseed, apple, cabbage, and potato (PPs#1F3952 and 1H5607; M. Flood; 9/19/1991). Residues were also shown to be stable at ≤ -15°C for intervals of up to 31 months in alfalfa, 24 months in lettuce (PP#5F4588; D219683; Linda Kutney; 8/26/1996), and 36 months in sorghum flour and starch, dry apple pomace, corn soapstock, and soybean refined oil (PP#7F3488; D193852; M. Flood; 5/14/1994).

In the field trials submitted with the current petitions, the maximum frozen storage durations were 2.9-3.6 months for muskmelons, cucumbers, and squash, 3 months for potatoes, and 8.5 months for grass forage, hay, straw, and seed screenings.

Conclusions. The available storage stability data support the storage conditions and durations for samples from the current field trials and processing studies.

860.1400 Water, Fish, and Irrigated Crops

The proposed use on wild rice is an aquatic use. However, no additional residue data are required under this guideline, as the impact of the use of lambda-cyhalothrin on rice was considered in conjunction with the earlier rice petition. The use directions for rice prohibit the release of flood water from rice fields within 7 days of application, and also prohibit the use of treated rice fields for the aquaculture of edible fish and crustaceans. These prohibitions also pertain to the proposed use on wild rice.

860.1460 Food Handling

This guideline is not relevant to the current petitions, as no new uses are being proposed for food/feed handling establishments.

860.1480 Meat, Milk, Poultry, and Eggs

The proposed use on grasses will have a substantial impact on the potential dietary exposure of livestock. Considering both established and proposed tolerances, TDBs for combined lambda-cyhalothrin residues were calculated to be 10.6 ppm for beef cattle, 10.4 ppm for dairy cattle, 0.9 ppm for swine, and 1.0 ppm for poultry (see Table 4, below). In addition to dietary exposure, beef cattle can also be exposed dermally through the use of impregnated ear tags or pour-on treatments containing lambda-cyhalothrin.

Table 4. Calculation of Theoretical Dietary Burdens of Lambda-Cyhalothrin Residues to Livestock.

Feedstuff	% Dry Matter[1]	% Diet[1]	Established or Recommended Tolerance (ppm)	Dietary Contribution (ppm)[2]
Beef and Dairy Cattle				
Grass forage	25	35	7.0	9.8
Alfalfa hay	89	5	6.0	0.34
Aspirated grain fractions	85	5 (Beef); 0 (Dairy)	2.0	0.12 (Beef); 0.0 (Dairy)
Rice grain	88	10	1.0	0.11
Field corn grain	88	30	0.05	0.02
Canola meal	88	15	1.0[3]	0.17
TOTAL BURDEN				**10.6 (Beef); 10.4 (Dairy)**
Poultry				
Alfalfa meal	89	10	6.0[3]	0.60
Canola meal	88	15	1.0[3]	0.15
Rice grain	88	20	1.0	0.20
Field corn grain	88	55	0.05	0.03
TOTAL BURDEN				**1.0**
Swine				
Alfalfa meal	89	10	6.0[3]	0.60
Canola meal	88	10	1.0[3]	0.10
Rice grain	88	20	1.0	0.20
Field corn grain	88	60	0.05	0.03
TOTAL BURDEN				**0.9**

1. Table 1 (OPPTS Residue Chemistry Test Guideline 860.1000).
2. Contribution = ([tolerance ÷ %dry matter] x %diet) for beef and dairy cattle; contribution = (tolerance x [%diet ÷ 100]) for poultry and swine.
3. Based on established tolerances of alfalfa hay and canola seeds.

An adequate dairy cattle feeding study is available reflecting dosing of three groups of cows (3 cows/group) with lambda-cyhalothrin at levels equivalent to 1.0, 5.0, and 25 ppm in the diet for periods of 28-30 days (PP#6F3318; M. Firestone; 1/22/1986). Based on the recalculated TDB, these dosing levels are equivalent to 0.1x, 0.5x, and 2.4x the TDB for cattle. Samples of milk were collected daily, and tissues samples were collected at study termination. Average

lambda-cyhalothrin residues in milk and tissues are summarized in Table 5, below. Based on the calculated TDB of 10.6 ppm for beef cattle, and 10.4 ppm for dairy cattle, the expected average residues from a worst-case dietary exposure would be 0.35 ppm in whole milk (reflecting 8.8 ppm in milk fat), 1.7 ppm in fat, 0.07 ppm in muscle, 0.03 ppm in liver, and 0.10 ppm in kidney.

Table 5. Average Residues in Milk and Tissues from Lambda-cyhalothrin Cattle Feeding Study.

Dose Group	Average Lambda-cyhalothrin Residues (ppm)				
	Milk	Fat	Muscle	Liver	Kidney
1.0 (0.1x)*	0.03	0.178	0.007	0.012	0.012
5.0 (0.5x)	0.08	0.946	0.037	0.008	0.042
25.0 (2.4x)	0.85	4.01	0.173	0.068	0.231

* Dose group level relative to calculated TDB is in parentheses

In order to estimate appropriate tolerance levels for ruminant tissues, the potential contribution from dermal exposure will also be considered, based on labeled uses for lambda-cyhalothrin on cattle. However, residues in milk from dermal dosing are not expected, as the use directions for dermal application products prohibit applications to lactating or dry dairy cows.

An adequate dermal study is available reflecting dosing of beef cattle at the labeled rate (PP#9F3770; M. Flood; 1/25/1990). In this study, five groups of mixed breed cattle (5 animals/group) weighing between 300 kg and 340 kg were dosed dermally with lambda-cyhalothrin (SABER® Pour-On Insecticide, 1% w/v) at intervals of 2 weeks; overall, four applications were made to the animals. One group of animals (Group A) was sacrificed within 6 hours of receiving the final dose, and the remaining groups (Groups B-E) were sacrificed at 3, 7, 14, or 28 days after the final dose. At slaughter, the entire liver, both kidneys (complete with perirenal fat), and samples of subcutaneous fat and quadriceps muscle were excised from each animal for analysis. Maximum residues of lambda-cyhalothrin in tissues were observed in animals from the 7-day sacrifice interval, and were 0.769 ppm in fat, 0.038 ppm in muscle, 0.055 ppm in kidneys, and 0.027 ppm in liver (see Table 6, below).

Considering potential residues from both oral (dietary burden) and dermal exposure to lambda-cyhalothrin, the maximum expected residues in cattle would be 0.35 ppm in whole milk (reflecting 8.8 ppm in milk fat), 2.5 ppm in fat, 0.11 ppm in muscle, 0.06 ppm in liver, and 0.15 ppm in kidney. The tolerances in cattle, goat, horse, and sheep commodities are currently established at 3.0 ppm in fat, 0.2 ppm in meat and meat-byproducts, and 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Based on the maximum expected residues, the tolerance should be increased to 10 ppm in milk fat. The current tolerances in the fat, meat, and meat-byproducts of cattle, goats, horses, and sheep are adequate.

Table 6. Residues in Tissues from Lambda-cyhalothrin Dermal Dosing Study.*

Dose Group	Sacrifice Interval (Days)	Lambda-cyhalothrin Residues (ppm)				
		Subcutaneous Fat	Perirenal Fat	Muscle	Kidney	Liver
A	0.25	0.080-0.304	0.182-0.483	<0.003-0.011	<0.003-0.040	<0.005-0.017
B	3	0.080-0.229	0.158-0.510	0.005-0.008	0.006-0.017	0.006-0.028
C	7	0.107-0.438	0.288-0.769	<0.003-0.038	0.025-0.055	<0.005-0.027

Table 6. Residues in Tissues from Lambda-cyhalothrin Dermal Dosing Study.*						
Dose Group	Sacrifice Interval (Days)	Lambda-cyhalothrin Residues (ppm)				
		Subcutaneous Fat	Perirenal Fat	Muscle	Kidney	Liver
D	14	0.016-0.299	0.049-0.568	<0.003-0.005	<0.003-0.008	<0.005-0.008
E	28	0.039-0.118	0.031-0.217	--	--	--

* Study was conducted at the maximum labeled use rate.

The maximum expected lambda-cyhalothrin residues in swine tissues are lower than in cattle, as the TDB for swine (0.9 ppm) is considerably lower than for cattle. Based on the calculated TDB for swine, and the results from the 1.0 ppm dose-group in the cattle feeding study, the maximum expected residues in hog commodities would be 0.16 ppm in fat, 0.006 ppm in meat, and 0.011 ppm in meat-byproducts. Therefore, the current tolerances in hog commodities could be lowered to 0.2 ppm in fat, 0.01 ppm in meat, and 0.02 ppm in meat-byproducts.

With regard to residues in poultry commodities, an adequate poultry feeding study is also available (PP#7F3488; S. Brooks; 8/13/1987) reflecting dosing of laying hens (10/group) with lambda-cyhalothrin at levels of 1, 5, and 25 ppm in their diet for 28 consecutive days. These dose levels are equivalent to 1x, 5x, and 25x the calculated TDB for poultry. Residues did not accumulate, and declined when feeding of the treated diet ceased. Average residues in tissues and eggs are shown in Table 7 (below); the residue levels in eggs are the mean plateau residues. Based on the calculated TDB for poultry, and the results from the 1.0 ppm dose-group, the maximum expected residues in poultry commodities would be 0.003 ppm in eggs, 0.022 ppm in fat, 0.002 ppm in meat, and 0.003 ppm in meat-byproducts. The current tolerances in poultry commodities are set at 0.01 ppm in eggs, meat, and meat-byproducts, and at 0.03 ppm in fat. Therefore, the current tolerances in poultry commodities are all adequate.

Table 7. Average Residues in Eggs and Tissues from Lambda-cyhalothrin Poultry Feeding Study.				
Dose group	Average Lambda-cyhalothrin Residues (ppm)			
	Eggs	Fat	Muscle	Liver
1.0 (1x)*	0.003	0.022	0.002	0.003
5.0 (5x)	0.010	0.062	0.003	0.003
25.0 (25x)	0.050	0.340	0.020	0.005

* Dose group level relative to calculated TDB is in parentheses.

Conclusions. For the current petitions, adequate cattle and poultry feeding studies are available reflecting the potential for dietary exposure of livestock to lambda-cyhalothrin residues. In addition, an adequate dermal application study is available on beef cattle reflecting direct dermal applications of lambda-cyhalothrin, which is a potential route of exposure for non-dairy cattle. Based on the recommended and existing tolerances in plant commodities, the calculated TDB for lambda-cyhalothrin residues are 10.6 ppm for beef cattle, 10.4 ppm for dairy cattle, 0.9 ppm for swine, and 1.0 ppm for poultry. Using these TDBs and the available livestock residue data, the maximum expected lambda-cyhalothrin residues in cattle commodities are 0.35 ppm in whole milk (reflecting 8.8 ppm in milk fat), 2.5 ppm in fat, 0.11 ppm in muscle, 0.06 ppm in

liver, and 0.15 ppm in kidney. The maximum expected residues in hog commodities would be 0.16 ppm in fat, 0.006 ppm in meat, and 0.011 ppm in meat-byproducts, while the maximum expected residues in poultry commodities would be 0.003 ppm in eggs, 0.022 ppm in fat, 0.002 ppm in meat, and 0.003 ppm in meat-byproducts. These residue levels indicate that the current tolerances in poultry commodities, as well as in the fat, meat, and meat by-products of cattle, goats, horses, and sheep, are all adequate. However, the tolerance should be increased in milk fat (from 5 ppm to 10 ppm). The data also indicate that the current tolerances in hog commodities could be lowered to 0.2 ppm in fat, 0.01 ppm in meat, and 0.02 ppm in meat-byproducts.

860.1500 Crop Field Trials

DER for MRID #46665304 (Potato)
DER for MRID #46665301 (Cantaloupe)
DER for MRID #46665302 (Cucumber)
DER for MRID #46665303 (Summer squash)
DER for MRID #46658301 (Grass)

Syngenta has submitted field trials supporting new uses for lambda-cyhalothrin (CS) on cucurbit vegetables, tuberous and corm vegetables, and grasses. The results from these studies are discussed below, and summarized in Table 8. In addition, IR-4 is proposing the expansion of existing uses on rice, wheat, and tree nuts to cover uses on wild rice, other small cereal grain (barley, buckwheat, oats, rye), and pistachios. The previously reviewed field trial data on rice, wheat, and tree nuts (almonds and pecans) are discussed below.

Table 8. Summary of Residue Data from Crop Field Trials with Lambda-Cyhalothrin.

Crop	Total Use Rate (lb ai/A)	End-use Product	PHI (Days)	Combined Residues (ppm) [1]						
				n	Min.	Max.	HAFT [2]	Median	Mean	Std. Dev.
Tuberous and Corm Vegetables (0.12 lb ai/A total application rate, 7-day PHI)										
Potato	0.117-0.124	1.0 lb ai/gal CS	7	32	<0.02	<0.02	0.02	0.010	0.010	NA
Cucurbit Vegetables (0.18 lb ai/A total application rate, 1-day PHI)										
Melon	0.176-0.182	1.0 lb ai/gal CS	1	12	<0.02	<0.03	0.030	0.013	0.016	0.007
			7	12	<0.02	<0.03	0.025	0.010	0.013	0.005
Cucumber	0.179-0.181	1.0 lb ai/gal CS	1	14	<0.02	<0.03	0.020	0.015	0.014	0.005
			7	14	<0.02	<0.02	0.020	0.010	0.011	0.002
Summer Squash	0.179-0.184	1.0 lb ai/gal CS	1	10	<0.02	<0.04	0.035	0.013	0.017	0.009
			7	10	<0.02	<0.02	0.020	0.010	0.010	0.000
Grass Forage, Fodder and Hay (0.03 lb ai/A per cutting, 0.09 lb ai/A per season, 1-day PHI for forage, 7-day PHI for hay, seed and straw)										
Grass Forage [3]	0.03	2.08 lb ai/gal CS	0-1	52	0.13	8.04	6.59	1.74	2.09	1.48
	0.06-0.07		0	48	1.07	5.82	4.71	2.65	2.82	1.20
	0.09-0.10		0-3	36	0.67	6.24	5.63	2.57	2.89	1.54
	Overall		**0-3**	**136**	**0.13**	**8.04**	**6.59**	**2.33**	**2.56**	**1.44**

Table 8. Summary of Residue Data from Crop Field Trials with Lambda-Cyhalothrin.										
Crop	Total Use Rate (lb ai/A)	End-use Product	PHI (Days)	Combined Residues (ppm)[1]						
				n	Min.	Max.	HAFT[2]	Median	Mean	Std. Dev.
Grass Hay[3]	0.03	2.08 lb ai/gal CS	6-10	26	0.50	3.84	3.64	1.33	1.50	0.82
	0.06-0.07		6-11	24	1.28	6.01	5.58	2.52	2.89	1.47
	0.09-0.10		5-8	18	<0.01	5.14	4.55	2.37	2.43	1.27
	Overall		**5-11**	**68**	**<0.01**	**6.01**	**5.58**	**1.84**	**2.24**	**1.33**
Grass Hay[3]	0.03	2.08 lb ai/gal CS	13-15	26	0.26	2.01	1.75	0.93	0.96	0.41
	0.06-0.07		12-17	24	0.29	4.04	3.25	1.38	1.46	0.88
	0.09-0.10		11-15	18	0.52	4.11	4.05	1.61	1.80	1.02
	Overall		**11-17**	**68**	**0.26**	**4.11**	**4.05**	**1.09**	**1.36**	**0.85**
Grass Straw	0.03	2.08 lb ai/gal CS	7-19	16	0.35	7.80	7.17	1.51	2.15	2.06
Grass Seed Screenings			7-19	16	0.80	3.23	3.22	1.83	1.86	0.71

1. The method LOQs are 0.01 ppm for each analyte in potatoes and cucurbits, for a combined LOQ of 0.02 ppm. The method LOQs for grass matrices are 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, for a combined LOQ of 0.01 ppm. For calculation of the median, mean, and standard deviation, ½LOQ was used for each analyte quantitated at less than the LOQ.
2. HAFT = Highest Average Field Trial.
3. For sampling of forage and hay, a single application was made at ~0.03 lb ai/A per cutting, allowing the fields to regrow between applications. Total application rates reflect the combined applications to each field at each cutting, but each cutting was treated at 0.03 lb ai/A.

Tuberous and Corm Vegetables (Subgroup 1C)

Potatoes. In 16 field trials conducted in growing zones 1, 2, 3, 5, 9, 10, and 11 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to potatoes as four broadcast foliar applications, during tuber development, at 0.029-0.031 lb ai/A per application, at RTIs of 7-10 days, for total rates of 0.117-0.124 lb ai/A (~1x the proposed rate). All applications were made using ground equipment at 8-10 or 10-60 gal/A, and did not include the use of any adjuvants. Single control, and duplicate treated samples of potato tubers were collected from each test at 7 DAT. Samples were stored at -17°C for up to 99 days prior to analysis, a duration supported by available storage stability data.

Potato tuber samples were analyzed for residues of lambda-cyhalothrin and R157836 using an adequate GC/ECD method derived from the current tolerance enforcement method. The method was validated in conjunction with the analysis of field trial samples. The validated LOQ is 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm; the LODs were not specified.

Following four applications at rates totaling 0.117-0.124 lb ai/A, residues of lambda-cyhalothrin and R157836 were each less than the LOQ in all 32 potato samples harvested at 7 DAT. Combined HAFT residues were 0.02 ppm, and average combined residues were 0.01 ppm.

Cucurbit Vegetables (Group 9)

Muskmelons. In six field trials conducted in growing zones 2, 5, 6, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to cantaloupes or honeydew melons as six broadcast foliar applications at 0.029-0.031 lb ai/A per application during fruit development, at

RTIs of 5-9 days, for total rates of 0.176-0.182 lb ai/A (~1x the proposed rate). All applications were made using ground equipment at 8-31 gal/A, and did not include the use of any adjuvants. Single control, and duplicate treated samples of whole melons were collected from each test at 1 and 7 DAT, while single subsamples of melon meat (pulp without rind and seeds) were collected from two tests at 1 and 7 DAT. Samples were stored at -18°C for up to 110 days prior to analysis, a duration supported by available storage stability data.

Melon samples were analyzed for residues of lambda-cyhalothrin and R157836 using an adequate GC/ECD method derived from the current tolerance enforcement method. The method was validated in conjunction with the analysis of field trial samples. The validated LOQ is 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm; the LODs were not specified.

Residues of lambda-cyhalothrin were <0.01-0.02 ppm in/on melons harvested at 1 DAT, with 6 of the 12 samples having residues less than the LOQ. Residues of lambda-cyhalothrin were also <0.01-0.02 ppm at 7 DAT, with 8 samples having residues less than the LOQ. At both sampling intervals, residues of R157836 were less than the LOQ in/on all samples, for combined residues of <0.02-<0.03 ppm at both intervals. Combined HAFT residues were 0.03 ppm at both intervals, while average combined residues were 0.016 ppm at 1 DAT, and 0.013 ppm at 7 DAT. Combined residues were <0.02 ppm in subsamples of melon pulp collected from two tests at both 1 and 7 DAT.

Cucumber. In seven field trials conducted in growing zones 2, 3, 5, 6, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to cucumbers as six broadcast foliar applications during fruit development at 0.029-0.031 lb ai/A per application, at RTIs of 5-9 days, for total rates of 0.179-0.181 lb ai/A (~1x the proposed rate). All applications were made using ground equipment at 8-10 or 10-60 gal/A, and did not include the use of any adjuvants. Single control, and duplicate treated samples of cucumbers were collected from each test at 1 and 7 DAT. Samples were stored at -18°C for up to 89 days prior to analysis, a duration supported by available storage stability data.

Cucumbers were analyzed for residues of lambda-cyhalothrin and R157836 using an adequate GC/ECD method derived from the current tolerance enforcement method. The method was validated in conjunction with the analysis of field trial samples. The validated LOQ is 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm; the LODs were not specified.

Residues of lambda-cyhalothrin were <0.01-0.02 ppm in/on cucumber samples at 1 DAT, with 6 of the 14 samples having residues less than the LOQ. By 7 DAT, residues of lambda-cyhalothrin were ≤0.01 ppm, with 11 samples having residues less than the LOQ. Residues of R157836 were less than the LOQ in/on all samples at both intervals, for combined residues of <0.02-<0.03 ppm at 1 DAT, and <0.02 ppm at 7 DAT. Combined HAFT residues were 0.02 ppm at both 1 and 7 DAT, while average combined residues were 0.014 ppm at 1 DAT, and 0.011 ppm at 7 DAT.

Summer Squash. In five field trials conducted in growing zones 1, 2, 3, 5, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to squash as six broadcast foliar applications at 0.029-0.031 lb ai/A per application during fruit development, at RTIs of 5-9 days, for total rates of 0.179-0.184 lb ai/A (~1x the proposed rate). All applications were made using ground equipment at 8-10 or 10-60 gal/A, and did not include the use of any adjuvants. Single

control, and duplicate treated samples of squash were collected from each test at 1 and 7 DAT. Samples were stored at -18°C for up to 98 days prior to analysis, a duration supported by available storage stability data.

Squash samples were analyzed for residues of lambda-cyhalothrin and R157836 using an adequate GC/ECD method derived from the current tolerance enforcement method. The method was validated in conjunction with the analysis of field trial samples. The validated LOQ is 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm; the LODs were not specified.

Residues of lambda-cyhalothrin were <0.01-0.03 ppm in/on squash samples at 1 DAT, with 5 of the 10 samples having residues less than the LOQ, and <0.01 ppm in/on all 10 samples by 7 DAT. Residues of R157836 were less than the LOQ in/on all samples at both intervals, for combined residues of <0.02-<0.04 ppm at 1 DAT, and <0.02 ppm at 7 DAT. Combined HAFT residues were 0.035 ppm at 1 DAT, and 0.02 ppm at 7 DAT, while average combined residues were 0.017 ppm at 1 DAT, and 0.010 ppm at 7 DAT.

Tree Nuts (Group 14)

To support the proposed use on pistachios, IR-4 cited the existing residue data on almonds and pecans that support the current 0.05 ppm tolerance for the tree nuts crop group (PP#0F6092; D262858; William Cutchin; 6/27/2002).

In five almond and five pecan field trials conducted throughout the US during 1998, lambda-cyhalothrin (1 lb ai/gal CS) was applied to both almonds and pecans as repeated foliar applications at 0.04 lb ai/A per application, for a total rate of 0.16 lb ai/A per season. In each trial, the initial application was made at dormancy to pre-bloom, and the remaining three applications were made beginning ~28 days prior to harvest at 5- to 8-day intervals. Duplicate treated samples of almond or pecan nutmeats were collected from each test, and analyzed using an adequate GC/ECD method. The method LOQ is 0.01 ppm for each analyte. Residues of lambda-cyhalothrin and R157836 were each <0.01 ppm in/on all samples of almond nutmeats (n = 10) and pecan (n = 10), for combined residues of <0.02 ppm.

As the proposed use directions for pistachios are identical to the existing use directions for other tree nuts, the almond and pecan residue data will support the use of the CS formulations of lambda-cyhalothrin on pistachios. The translation of the almond and pecan residue data to pistachios is appropriate because almond and pecan are the representative commodities of the tree nut crop group.

Cereal Grains and Forage, Fodder and Straw of Cereal Grains (Groups 16 and 17)

Wild Rice. To support the proposed use on wild rice, IR-4 cited the existing residue data supporting the current 1.0 ppm tolerance for rice grain (PPs#6F4769 and 6H4775; DP Numbers D228792 and D228931; Jose Morales; 5/28/1997).

In 16 field trials conducted during 1995 in growing zones 4, 6, and 10, lambda-cyhalothrin was applied to rice as four broadcast foliar sprays at 0.04 lbs. ai/A per application, for a total rate of 0.16 lb ai/A (~1.3x rate). The first two applications were made at 3-4 weeks and 5-6 weeks after crop emergence, and the last two applications were made at 26-29 days and 20-21 days prior to harvest. One, two, or three treated samples of rice grain were collected from each test, and analyzed using an adequate GC/ECD method, based on the current GC/ECD

enforcement method. The method LOQ is 0.01 ppm for each analyte. The field trial data were also supported by adequate storage stability data. For the 32 samples of rice grain harvested at 20-21 DAT, residues of lambda-cyhalothrin were 0.05-0.79 ppm, and residues of R157836 were <0.01-0.09 ppm, for combined residues of <0.06-0.88 ppm. The HAFT residues were 0.68 ppm for lambda-cyhalothrin, and 0.08 ppm for R157836, for combined HAFT residues of 0.75 ppm. Average residues were 0.30 ppm for lambda-cyhalothrin, and 0.03 ppm for R157836, for combined average residues of 0.33 ppm.

As the proposed use directions for wild rice are identical to the existing use directions for rice, which specifies a maximum use rate of 0.12 lb ai/A per season, the above rice grain residue data will support the use of the CS formulations of lambda-cyhalothrin on wild rice.

Barley, Buckwheat, Oats, and Rye. To support the proposed uses on these cereal grains, IR-4 cited the existing residue data for wheat commodities (PPs#7F3560 and 7H5543; M. Flood; 9/19/1991). The Agency has concluded that adequate wheat field trial data, reflecting a 1x application rate, are available to support the existing tolerances of 0.05 ppm in/on wheat grain, and 2.0 ppm in/on wheat forage, hay and straw. As the proposed use directions for barley, buckwheat, oats, and rye are identical to the existing use directions for wheat, the available residue data on wheat will be translated to these other small cereal grains to support the use of lambda-cyhalothrin (CS).

Grass Forage, Fodder and Hay (Group 17)

Grass. In 13 field trials conducted in growing zones 1, 4, 5, 6, 7, 8, 11, and 12 during 2003, lambda-cyhalothrin (2.08 lb ai/gal CS) was applied to a variety of grasses as a single broadcast foliar application per cutting. Each test site included two treatment regimes (Treatments #2 and #3) in which lambda-cyhalothrin (CS) was applied to grasses, at the 6-8" to boot stage, at rates of 0.030-0.034 lb ai/A per application, for a total of two (0.062-0.063 lb ai/A; 3 sites) or three (0.092-0.099 lb ai/A; 9 sites) applications. Forage and hay were cut following each application, and the fields were allowed to re-grow between applications. The RTIs were 14-60 days for applications to successive cuttings. At eight of the test sites, lambda-cyhalothrin (CS) was also applied to grass grown for seed as a single broadcast foliar application, at maturity, at a rate of 0.031-0.032 lb ai/A (Treatment #4). All applications were made using ground equipment at 2-20 gal/A, and did not include the use of any adjuvants.

Following each application in Treatments #2 and #3, single control, and duplicate treated samples of forage were cut and collected at 0-3 DAT, while single control, and duplicate treated samples of hay were cut at 5-11 DAT (Treatment #2) or 12-17 DAT (Treatment #3). For Treatment #4, single control, and duplicate samples of straw and seed screenings were collected at 7-19 DAT; following re-growth, samples of forage and hay were also collected at two cuttings (36-50 DAT and 51-64 DAT). For all treatments, samples of hay were allowed to dry in the field for 1-7 days prior to sampling. Samples of forage, hay, straw, and seed screenings were stored frozen for up to 8.5 months prior to analysis, a duration supported by available storage stability data.

Samples of grass forage, hay, straw, and seed screenings were analyzed for residues of lambda-cyhalothrin and R157836 using an adequate GC/ECD method (CCRL-MTH-023.

modified), which is derived from the current tolerance enforcement method. The validated LOQ for each grass matrix is 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, for a combined LOQ of 0.01 ppm. The LODs were not specified.

Regardless of treatment or sampling interval, lambda-cyhalothrin was the major component of the residue in all commodities, accounting for 88 (with standard deviation of 9%) of the combined residues in forage. 87 (s.d. 7%) of the combined residues in hay, 85 (s.d. 4%) of the combined residues in straw, and 89 (s.d. 4%) of the combined residues in seed screenings.

Following the single applications at the 6-8" to boot stages (Treatments #2 and #3), combined residues in/on forage harvested at 0-3 DAT were 0.13-8.04 ppm after the first application, 1.07-5.03 ppm after the second application, and 0.67-6.24 ppm after the third application. Average combined residues in/on forage following the first, second, and third applications were respectively 2.09, 2.82, and 2.89 ppm, while the overall average residues in/on all forage samples at ~0 DAT were 2.56 ppm. For hay harvested at 5-11 DAT (Treatment #2), combined residues were 0.50-3.84 ppm after the first application, 1.28-6.01 ppm after the second application, and <0.01-5.14 ppm after the third application. Average combined residues in/on hay at ~7 DAT following the first, second, and third applications were respectively 1.50, 2.89, and 2.43 ppm, while the average residues in/on all hay samples at ~7 DAT were 2.24 ppm. For hay harvested at 11-17 DAT (Treatment #3), combined residues were 0.26-2.01 ppm after the first application, 0.29-4.04 ppm after the second application, and 0.52-4.11 ppm after the third application. Average combined residues in/on hay at ~14 DAT following the first, second, and third applications were respectively 0.96, 1.46, and 1.80 ppm, while the average residues in/on all hay samples at ~14 DAT were 1.36 ppm.

The residue data on forage and hay from both Treatments #2 and #3 indicate that there is a trend toward slightly higher residues following repeated applications to separate cuttings. However, the maximum residues observed in any forage sample (8.04 ppm) occurred following the first application. A comparison of the residue data on hay from Treatments #2 and #3 also indicates that residues declined at longer post-treatment intervals, as average combined residues in/on hay were 2.24 ppm at ~7 DAT, and 1.36 ppm at ~14 DAT. In addition, residue data on hay from the single residue decline trial also showed that residues declined at increasing post-treatment intervals.

Following the single application to grasses grown for seed at 0.03 lb ai/A (Treatment #4), combined residues were 0.35-7.80 ppm in/on straw, and 0.80-3.23 ppm in/on seed screenings harvested at maturity, 7-19 DAT. Average combined residues were respectively 2.15 and 1.86 ppm in/on straw and seed screenings. Carryover of residues to subsequent cuttings of forage and hay was low. Average combined residues were 0.05 and 0.012 ppm in/on forage and hay, respectively, from the 1st regrowth (36-50 DAT), and 0.04 ppm in/on both forage and hay from the second regrowth (51-64 DAT).

Conclusions. The available field trial data on cucumbers, muskmelons, summer squash, potatoes, and grasses are adequate, and support the proposed use patterns for lambda-cyhalothrin (CS) on cucurbit vegetables, tuberous and corm vegetables, and grasses. The number and geographic distribution of the field trials are adequate, and the appropriate samples were collected at the proposed PHIs. In addition, the previously reviewed field trial data on rice will be translated to support an identical use on wild rice; the existing field trial data on almonds and

pecans will be translated to support an identical use on pistachios; and the existing wheat field trial data will be translated to support identical uses on barley, buckwheat, oats, and rye.

860.1520 Processed Food and Feed

DER for MRID #46665305 (Potato)

Potato. In a single field trial conducted in WA during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to potatoes as four broadcast foliar applications, during tuber development, at 0.15-0.16 lb ai/A per application, at RTIs of 7 days, for a total rate of 0.61 lb ai/A (~5x the proposed rate). Single bulk samples of control and treated tubers were harvested at 7 DAT, and processed into chips, flakes, and wet peel using simulated commercial procedures. Tuber samples were stored at -17°C for up to 89 days prior to analysis, a duration supported by available storage stability data.

Whole tubers were analyzed for residues of lambda-cyhalothrin and R157836 using an adequate GC/ECD method derived from the current tolerance enforcement method. The method was validated in conjunction with the analysis of field trial samples. The validated LOQ is 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm; the LODs were not specified.

Residues of lambda-cyhalothrin and R157836 were each <0.01 ppm in duplicate samples of potato tubers (RAC) treated at 5x the proposed use rate. Because residues were less than the LOQ in tubers from a 5x treatment, samples of the potato processed fractions were not analyzed. As the maximum theoretical concentration factor for potatoes is 5x, and residues in tubers were less than the LOQ at a 5x application rate, quantifiable residues are unlikely to occur in potato processed fractions from a 1x treatment.

Wheat. An adequate wheat grain processing study is available (PPs#7F3560 and 7H5443) indicating that lambda-cyhalothrin residues concentrate substantially in wheat bran (3x) and aspirated grain fractions (33x). Residues concentrated only slightly in middlings (1.1x) and shorts (1.3x), but were reduced in flour (0.66x). Based on these processing factors and the residue data for wheat grain, separate tolerances have been established in wheat bran at 0.2 ppm, and aspirated grain fractions at 2.0 ppm. The wheat grain processing study will be translated to support separate tolerances in bran from both barley and rye.

Conclusions. Processing data are not required for cucurbit vegetables or wild rice, and the available potato and wheat grain processing data are adequate. Separate tolerances are not required for potato processed fractions, as residues are unlikely to be detectable in processed potato commodities from applications at a 1x rate. Based on the available wheat grain processing study, separate tolerances are required in both barley bran and rye bran, each at 0.2 ppm.

860.1650 Submittal of Analytical Reference Standards

As of 7/18/2006, the analytical reference standards for lambda-cyhalothrin and its epimer are available at the EPA National Pesticide Standards Repository.

860.1850/1900: Confined and Field Accumulation in Rotational Crops

An adequate confined rotational crop study is available indicating that significant residues (greater than 0.01 ppm) will not be present in crops rotated 30 days after application of lambda-

cyhalothrin (EFED review; 4/6/1988). No additional rotational crop data are required, and no plant-back restrictions are required on the labels, based on the non-systemic nature of lambda-cyhalothrin and its half-life of 10-14 days (NV920006; D185478; George Herndon; 10/8/1992).

860.1550 Proposed Tolerances

HED has concluded that the residues of concern for purposes of risk assessment and the tolerance expression include lambda-cyhalothrin and its epimer R157836 (D220257; George Kramer; 2/9/1996). Tolerances are currently established for the combined residues of lambda-cyhalothrin and R157836 in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones [40CFR §180.438(a)(1)]. Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances are also established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

The tolerances proposed by Syngenta and IR-4 for the current petitions are listed in Table 9 (below), along with the Agency's recommended tolerance levels. As the majority of samples from the cucumber, melon, squash, and potato field trials had residues below the combined LOQ (0.02 ppm), the recommended tolerance levels were not determined using the Tolerance/MRL Harmonization Spreadsheet. Instead, the recommended tolerance levels are based on the maximum residue values. For cucurbit vegetables, the maximum combined residues at the proposed 1-day PHI were <0.03 ppm for muskmelons and cucumbers, and <0.04 ppm for summer squash; therefore, the requested 0.05 ppm tolerance will be adequate. For tuberous and corm vegetables, the maximum combined residues at the proposed 7-day PHI were less than the LOQ (<0.02 ppm) in/on all potato samples from the 1x field trials, and in/on the two samples from the 5x field trial. Considering the available potato residue data, and the current Mexican and Codex MRLs for potatoes (0.02 mg/kg), HED is recommending a tolerance of 0.02 ppm in tuberous and corm vegetables, in order to harmonize with international tolerances.

For determining the appropriate tolerance for the grass crop group, separate tolerances were calculated for each grass commodity (forage, hay, straw, and seed screenings) using the Tolerance/MRL Harmonization Spreadsheet. The residue datasets used for the tolerance calculations, and the supporting spreadsheet outputs are presented in Appendix II. The calculated tolerances were 7 ppm in forage, 7 ppm in hay from ~7 DAT, 4 ppm in hay from ~14 DAT, 10 ppm in straw, and 4.5 ppm in seed screenings. Tolerances are not needed on grass seed screenings nor straw, as these are not considered significant livestock feed items. Based on the residue data, HED recommends a tolerance of 7.0 ppm on "grass, forage, fodder, and hay, group 17." Although residues on fodder could be somewhat higher than 7 ppm, grass fodder is also not a significant feed item, and will not be included in the determination of the appropriate crop group tolerance. In the process of updating the crop groupings in the CFR, HED plans to delete the term "fodder" from the name of group 17 (personal communication from Bernard Schneider, 12/6/2006).

As the proposed uses on barley, buckwheat, oats, and rye are identical to the existing use on wheat, the available wheat field trial data and processing study will be translated to support

the same tolerance levels in equivalent commodities from these crops. Likewise, the existing pecan and almond field trial data will support an equivalent tolerance of 0.05 ppm in pistachios, and the existing rice grain field trial data will support an equivalent tolerance of 1.0 ppm in wild rice grain.

With regard to tolerances in animal commodities, the current petitions will substantially alter the potential exposure of livestock. Based on the recalculated TDBs for cattle (10.6 ppm for beef, 10.4 ppm for dairy), swine (0.9 ppm), and poultry (1.0 ppm), along with the available cattle and poultry residue studies, an increase of the tolerance level is required in milk fat. Current tolerance levels in the fat, meat, and meat-byproducts of cattle, goats, horses, and sheep are adequate. The existing tolerances in eggs, poultry meat, and poultry meat-byproducts are adequate, while the existing tolerances in hog commodities can be substantially lowered.

The Codex Alimentarius Commission, Mexico, and Canada have all established maximum residue limits (MRLs) for residues of lambda-cyhalothrin in/on a variety of raw agricultural commodities. Each of these regulatory bodies expresses residues in terms of only cyhalothrin; however, the US tolerance expression includes both lambda-cyhalothrin and its epimer R157836. A comparison of Codex, Canadian, and Mexican MRLs with the corresponding US tolerances is presented in Appendix I. For the crop uses currently under consideration, only potatoes have existing international tolerances, and the recommended US tolerance of 0.02 ppm will be in harmony with the existing 0.02 mg/kg MRLs for Codex and Mexico.

Table 9. Tolerance Summary for Lambda-Cyhalothrin.

Commodity	Established/Proposed Tolerance (ppm)	Recommended Tolerance (ppm)	Comments; *Correct Commodity Definition*
Barley, bran	0.2	0.2	Tolerances are based on the existing residue data and tolerances in similar wheat commodities.
Barley, grain	0.05	0.05	
Barley, hay	2.0	2.0	
Barley, straw	2.0	2.0	
Buckwheat, grain	0.05	0.05	
Cucurbit vegetables	0.05	0.05	*Vegetable, cucurbits, group 9*
Grass forage, fodder, and hay	9.0	7.0	A crop group tolerance is appropriate. *Grass forage, fodder, and hay, group 17*
Hog, fat	3.0	0.2	Based on a TDB of 0.9 ppm for swine, the maximum expected residues are 0.16 ppm in hog fat, 0.006 ppm in hog meat, and 0.011 ppm in hog meat-byproducts.
Hog, meat	0.2	0.01	
Hog, meat-byproducts	0.2	0.02	
Milk, fat	5.0	10	Based on a TDB of 10.4 ppm for dairy cattle, the maximum expected residues in milk are 0.35 ppm, equivalent to 8.8 ppm in milk fat.

Table 9. Tolerance Summary for Lambda-Cyhalothrin.

Commodity	Established/Proposed Tolerance (ppm)	Recommended Tolerance (ppm)	Comments; *Correct Commodity Definition*
Oat, grain	0.05	0.05	Tolerances are based on the existing residue data and tolerances in similar wheat commodities.
Oat, forage	2.0	2.0	
Oat, hay	2.0	2.0	
Oat, straw	2.0	2.0	
Pistachio	0.05	0.05	Tolerance is based on existing almond and pecan residue data, and the tolerance in the tree nut group.
Rice, wild, grain	1.0	1.0	Tolerance is based on the existing tolerance and residue data in rice.
Rye, bran	None	0.2	Tolerances are based on the existing residue data and tolerances in similar wheat commodities.
Rye, grain	0.05	0.05	
Rye, forage	2.0	2.0	
Rye, straw	2.0	2.0	
Tuberous and corm vegetables	0.05	0.02	Combined residues were <0.02 ppm in/on all potato samples from all field trials conducted at 1x rate, and from the field trial conducted at a 5x rate. *Vegetable, tuberous and corm, subgroup 1C*

REFERENCES:

NV920006; D185478; George Herndon; 10/8/1992.

PP#'s 7F3488 (Lambda-Cyhalothrin in/on Soybeans); 7F3560/7H5543 (Wheat, Sweet Corn, Sunflowers); 1F3952/1H5607 (Broccoli, Cabbage, Tomatoes); 1F3985 (Head Lettuce), 1F3992 (Grain Sorghum); 2F4100 (Dry Bulb Onions, Garlic); 2F4109 (Field, Pop, Seed Corn); 2F4114 (Peanuts). Responses to Various CBTS Reviews. Storage Stability in Raw and Processed Commodities.; D193852, D193853, D193856, D193867, D193872, D193868, D193869, D193870, D193871, D193873, D195192, D195189, D197574, D197575, D197578, D197579, D197580, D197581, D197583, D197689, D200994, D200995, D200996; M. Flood; 5/16/1994.

Cyhalothrin - Plant Metabolism Data Requirements for Support of New Uses.; D220257; George Kramer; 2/9/1996.

PP#6F4769/6H4775. Lambda-Cyhalothrin (Karate®) in/on Rice. Evaluation of Residue Data and Analytical Methodology.; D228792, D228931; Jose Morales, C. Lewis, and Sanyvette Williams-Foy; 5/28/1997.

PP#0F6092. Request for the Use of Lambda-cyhalothrin in/on Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco including Apple and Peach Cooking Studies. Evaluation of Analytical Method and Magnitude of the Residue Data.; D262858, D276160; William Cutchin; 6/2/2002.

PP#0F6092. Request for the Use of Lambda-cyhalothrin in/on Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.; D284860; Kit Farwell; 8/15/2002.

ATTACHMENTS:

Appendix I - International Residue Limit Status sheet.
Appendix II - Tolerance Assessment Calculations.

APPENDIX I - International Residue Limits.

INTERNATIONAL RESIDUE LIMIT STATUS

Chemical Name: 1 to 1 mixture of (*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropane carboxylate **and** (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropane carboxylate	**Common Name:** Lambda-cyhalothrin	**X Proposed tolerances** Reevaluated tolerance Other	**Date:** 10/10/2006

Codex Status (Maximum Residue Limits)	**U. S. Tolerances**
No Codex proposal step 6 or above No Codex proposal step 6 or above for the crops requested	**Petition Number:** 5F6994, 3E6593, 6E7077 **DP Numbers:** 313315, 324219, 330542 **Other Identifier:** PC Code 128897
Residue definition (step 8/CXL): Cyhalothrin	**Reviewer/Branch:** William T. Drew/RAB2
	Residue definition: Tolerances are currently expressed as the combined residues of lambda-cyhalothrin and its epimer R157836.

Crops	MRL (mg/kg)	Crops	Tolerance (ppm)
Cabbage, head	0.2	Barley, bran	0.2
Cotton seed	0.02	Barley, grain	0.05
Cotton seed oil, crude	0.02	Barley, hay	2.0
Cotton seed oil, edible	0.1	Barley, straw	2.0
Pome fruits	0.2	Buckwheat, grain	0.05
Potato	0.02	Grass, forage, fodder, and hay, group 17	10
		Oat, grain	0.05
		Oat, forage	2.0
		Oat, hay	2.0
		Oat, straw	2.0
		Pistachio	0.05
		Rice, wild, grain	1.0
		Rye, bran	0.2
		Rye, grain	0.05
		Rye, forage	2.0
		Rye, straw	2.0
		Vegetable, cucurbit, group 9	0.05
		Vegetable, tuberous and corm, subgroup 1C	0.05

Limits for Canada		**Limits for Mexico**	
No Limits X No Limits for the crops requested		No Limits No Limits for the crops requested	
Residue definition: Cyhalothrin-lambda		Residue definition: Lambda-cyhalothrin	
Crops	**MRL (mg/kg)**	**Crops**	**MRL (ppm)**
Head Lettuce	2	Garlic	0.1
Milk	1	Alfalfa	5
Broccoli, cabbage	0.4	Cotton	0.05
Sunflower oil	0.3	Rice	1
Meat of cattle, goats, hogs, horses, and sheep	0.2	Broccoli	0.4
Sunflower seed	0.2	Sugar cane	0.03
Corn flour	0.15	Onion	0.1
Leeks	0.15	Pepper	0.2
Tomatoes	0.1	Cabbage	0.4
Corn	0.05	Beans	0.1
		Tomato	0.1
		Corn	0.05
		Potato	0.02
		Sorghum	0.03
		Soybean	0.01
		Green tomato	0.1
		Wheat	0.05
Notes/Special Instructions:			

APPENDIX II - Tolerance Assessment Calculations.

The Agency's *Guidance for Setting Pesticide Tolerances Based on Field Trial Data* was utilized for determining appropriate tolerance level for the grass forage, fodder, and hay crop group (group 17) because the combined residues of lambda-cyhalothrin and R157836 were readily quantifiable (above the LOQ) in/on forage, hay, straw, and seed screenings.

The datasets used to determine the crop group tolerance consisted of field trial data representing applications of the appropriate formulations at ~1x the proposed maximum use rates. As specified by the *Guidance for Setting Pesticide Tolerances Based on Field Trial Data* SOP, the field trial application rates were within 25% of the maximum label application rate, and the PHIs were consistent with the appropriate stage of maturity, and the proposed PHI for each commodity

To determine the appropriate tolerance for the grass crop group, the residue values for forage, hay, straw, and seed screenings (Tables II-1 through II-3) were used to calculate separate possible tolerances for each commodity. The datasets for each commodity were entered into the tolerance spreadsheet, and visual inspection of the lognormal probability plots indicates that the datasets for hay, straw, and seed screenings are reasonably lognormal (Figure II-3, -5, -7, -9); however, the data set for grass forage does not appear to be lognormal (Figure II-1). The results from the approximate Shapiro-Francia test statistic confirmed that the assumption of lognormality should not be rejected for straw, seed screenings, and hay harvested at ~14 DAT. However, the Shapiro-Francia test statistic indicated that the assumption of lognormality should be rejected for forage and hay (~7 DAT). The calculated tolerances were 7 ppm in forage, 7 ppm in hay from ~7 DAT, 4 ppm in hay from ~14 DAT, 10 ppm in straw, and 4.5 ppm in seed screenings (Figures II-2, -4, -6, -8, -10). Tolerances are not needed on grass seed screenings and straw as these are not considered significant livestock feed items. Although the calculated tolerance in straw (10 ppm) is somewhat disparate from the calculated tolerances in forage and hay (7 ppm), a crop group tolerance is still appropriate for group 17, as grass straw/fodder is not a significant feed item, and will not be included in the determination of the appropriate crop group tolerance. Based on the residue data, HED recommends a tolerance of 7.0 ppm on "grass, forage, fodder, and hay, group 17."

Table II-1. Combined Residues of Lambda-Cyhalothrin and R157836 on Grass Forage using a CS Formulation.				
Regulator:	**EPA**			
Chemical:	**Lambda-cyhalothrin**			
Crop:	**Grass forage**			
PHI:	**0-3 days**			
App. Rate:	**0.03 lb ai/A per cutting**			
Submitter:	**Syngenta**			
MRID Citation:	**MRID 46658301**			
	Combined Residues			
	2.43	1.83	2.63	2.29
	3.87	2.64	3.02	2.21
	0.77	2.23	1.27	1.65
	1.24	2.20	1.35	2.30
	2.36	2.86	2.58	3.51
	2.34	2.44	2.12	3.48
	1.83	1.30	1.71	1.30
	1.50	2.83	1.19	2.61
	5.14	3.80	8.04	4.88
	3.04	3.18	1.16	3.13
	2.65	1.19	3.98	1.07
	3.14	1.61	2.41	1.61
	1.57	1.41	1.13	2.06
	2.23	2.65	2.13	2.33
	0.29	1.70	1.12	1.91
	0.41	1.32	1.03	1.21
	0.74	2.30	1.77	0.67
	1.23	4.90	2.26	3.60
	2.24	3.40	1.21	4.62
	2.14	5.63	1.30	5.63
	2.99	2.50	5.09	3.10
	5.29	2.70	3.75	3.54
	0.13	1.27	0.15	2.04
	0.53	1.38	1.01	2.33
	1.09	3.85	1.08	3.22
	1.49	2.63	1.59	3.53
	5.03	5.53	4.38	4.61
	2.90	4.82	5.82	6.24
	3.48	1.29	3.38	1.53
	2.94	1.13	3.04	1.44
	2.99	2.15	4.30	2.82
	3.51	2.38	3.73	2.49
	4.61	1.28	4.16	1.13
	2.40	1.06	5.78	1.36

Figure II-1. Lognormal probability plot of lambda-cyhalothrin field trial data for grass forage following a broadcast foliar application at 0.03 lb ai/A per cutting.

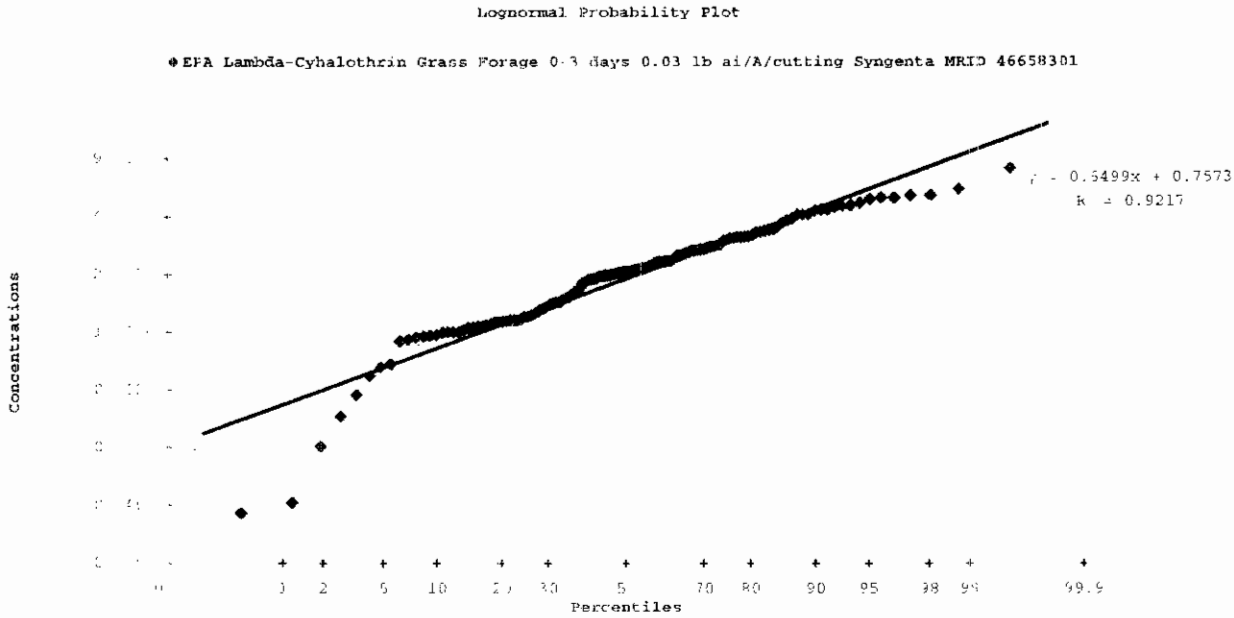


Figure II-2. Tolerance spreadsheet summary of lambda-cyhalothrin field trial data for grass forage following a broadcast foliar application of lambda-cyhalothrin (CS).

	Regulator: EPA Chemical: Lambda-Cyhalothrin Crop: Grass Forage PHI: 0-3 days App. Rate: 0.03 lb ai/A/cutting Submitter: Syngenta MRID Citation: MRID 46658301 n: 136 min: 0.12 max: 5.04 median: 1.33 average: 1.56		
	95th Percentile	**99th Percentile**	**99.9th Percentile**
EU Method I Normal	5.0 (6.0)	6.0 (7.0)	8.0 (--)
EU Method I Log Normal	7.0 **(8.0)**	**11** (13)	17 (--)
EU Method II Distribution-Free	7.0		
California Method μ + 3σ	**7.0**		
UPLMedian95th	11		
Approximate Shapiro-Francia Normality Test	0.927 p value <= 0.01: Reject lognormality assumption		

Table II-2. Combined Residues of Lambda-Cyhalothrin and R157836 on Grass Hay using a CS Formulation.				
Regulator:	**EPA**			
Chemical:	**Lambda-cyhalothrin**			
Crop:	**Grass hay**		**Grass Hay**	
PHI:	**5-11 days**		**11-17 days**	
App. Rate:	**0.03 lb ai/A per cutting**		**0.03 lb ai/A per cutting**	
Submitter:	**Syngenta**		**Syngenta**	
MRID Citation:	**MRID 46658301**		**MRID 46658301**	
	Combined Residues		**Combined Residues**	
	3.09	1.50	0.64	0.90
	1.72	1.92	0.51	0.54
	1.16	1.38	1.07	1.08
	1.54	0.50	0.63	0.96
	1.84	1.63	1.32	1.07
	1.05	1.44	0.26	1.10
	0.61	1.56	0.83	0.89
	1.09	1.16	1.02	1.03
	3.84	3.43	1.33	1.85
	1.28	1.84	0.58	0.51
	1.05	1.10	0.83	1.15
	0.93	0.52	0.82	0.81
	0.96	0.88	1.48	2.01
	2.72	3.19	2.82	3.29
	4.03	6.01	1.34	1.46
	5.52	5.63	2.32	0.81
	1.56	1.35	0.64	0.91
	2.95	5.79	2.30	1.66
	2.26	2.47	1.66	1.65
	2.33	1.55	0.78	0.77
	2.26	2.66	1.50	1.42
	1.28	2.56	1.08	0.97
	2.04	1.82	0.29	0.35
	3.18	3.07	4.04	2.46
	1.58	1.57	0.79	0.78
	0.69	0.96	0.65	0.57
	2.43	1.81	0.89	1.46
	2.26	2.45	1.65	1.66
	3.43	3.12	2.72	2.28
	3.44	3.89	1.29	0.52
	1.56	1.59	3.99	4.11
	3.95	5.14	1.55	2.39
	2.66	2.39	1.56	2.06
Values at ½LOQ are in bold.				

Figure II-3. **Lognormal probability plot of lambda-cyhalothrin field trial data for grass hay harvested ~7 days following a broadcast foliar application at 0.03 lb ai/A per cutting.**

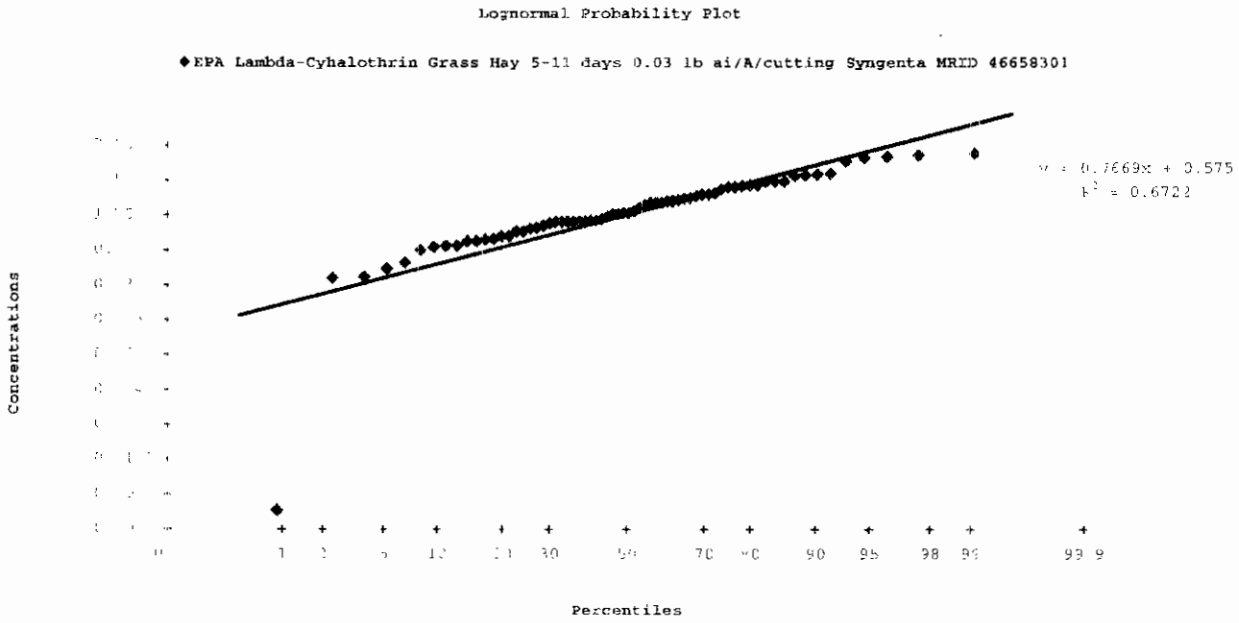


Figure II-4. **Tolerance spreadsheet summary of lambda-cyhalothrin field trial data for grass hay following a broadcast foliar application of lambda-cyhalothrin (CS).**

Regulator:	EPA
Chemical:	Lambda-Cyhalothrin
Crop:	Grass hay
PHI:	5 11 days
App. Rate:	0.03 lb ai/A/cutting
Submitter:	Syngenta
MRID Citation:	MRID 46658301
n:	68
min:	0.01
max:	6.01
median:	1.84
average:	2.14

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	4.5 (5.3)	6.0 (6.0)	7.0 (--)
EU Method I Log Normal	9.0 (12)	16 (25)	35 (--)
EU Method II Distribution-Free		7.0	
California Method μ + 3σ		**7.0**	
UPLMedian95th		10	
Approximate Shapiro-Francia Normality Test		0.6722 p-value <= 0.01: Reject lognormality assumption	

Figure 11-5. **Lognormal probability plot of lambda-cyhalothrin field trial data for grass hay harvested ~14 days following a broadcast foliar application at 0.03 lb ai/A per cutting.**

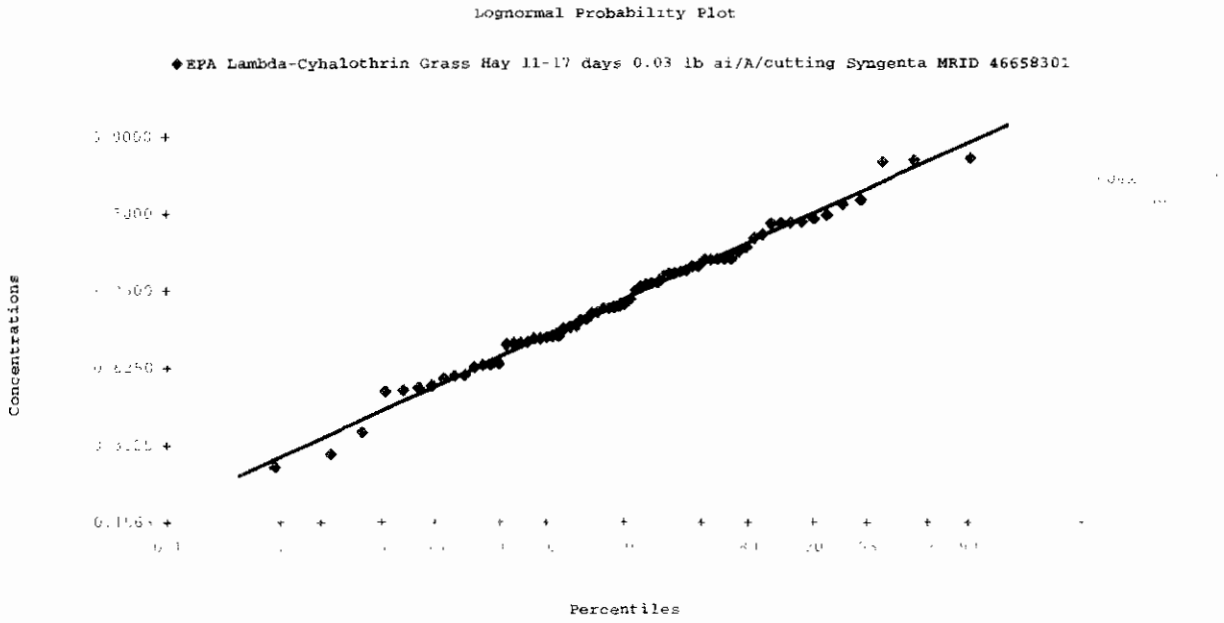


Figure 11-6. **Tolerance spreadsheet summary of lambda-cyhalothrin field trial data for grass hay following a broadcast foliar application of lambda-cyhalothrin (CS).**

Regulator:	EPA
Chemical:	Lambda-Cyhalothrin
Crop:	Grass Hay
PHI:	~17 days
App. Rate:	0.03 lb ai/A/cutting
Submitter:	Syngenta
MRID Citation:	MRID 46658301
n:	68
min:	0.26
max:	5.11
median;	1.09
average:	1.36

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	3.0 (3.5)	3.5 (4.0)	4.0 (--)
EU Method I Log Normal	3.5 **(4.0)**	**5.0** (7.0)	8.0 (--)
EU Method II Distribution-Free			
California Method μ + 3σ		**4.0**	
UPLMedian95th		**6.0**	
Approximate Shapiro-Francia Normality Test	p value 0.05	0.9904 do not reject lognormality assumption	

Table II-3. Combined Residues of Lambda-Cyhalothrin and R157836 on Grass Straw and Seed Screenings using CS Formulation.		
Regulator:	**EPA**	
Chemical:	**Lambda-cyhalothrin**	
Crop:	**Grass Straw**	**Grass Seed Screenings**
PHI:	**7-19 days**	**7-19 days**
App. Rate:	**0.03 lb ai/A per cutting**	**0.03 lb ai/A per cutting**
Submitter:	**Syngenta**	**Syngenta**
MRID Citation:	**MRID 46658301**	**MRID 46658301**
	Combined Residues	**Combined Residues**
	1.61	2.22
	0.55	2.50
	1.98	1.12
	7.80	1.85
	2.50	3.23
	0.98	0.80
	1.25	1.43
	1.16	1.63
	1.43	2.21
	0.35	1.84
	2.31	1.52
	6.54	1.82
	2.31	3.21
	1.01	0.91
	1.58	1.32
	1.07	2.07

Figure II-7. Lognormal probability plot of lambda-cyhalothrin field trial data for grass straw following a broadcast foliar application at 0.03 lb ai/A per cutting.

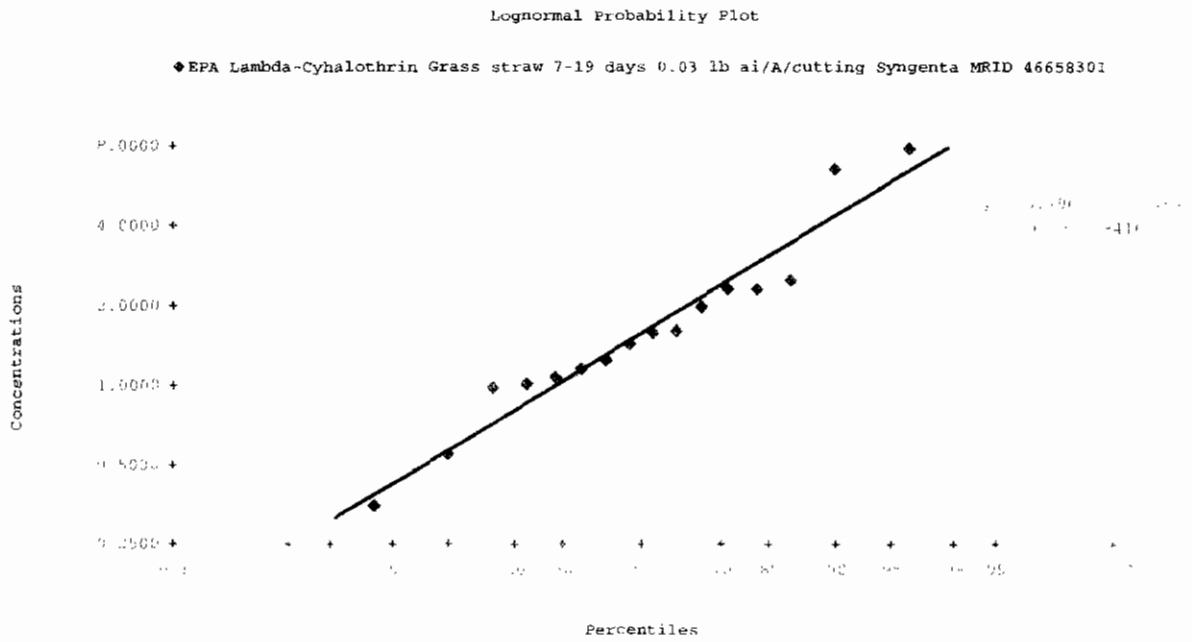


Figure II-8. Tolerance spreadsheet summary of lambda-cyhalothrin field trial data for grass straw following a broadcast foliar application of lambda-cyhalothrin (CS).

Regulator:	EPA
Chemical:	Lambda-Cyhalothrin
Crop:	Grass straw
PHI:	7 day
App. Rate:	[illegible]
Submitter:	Syngenta
MRID Citation:	42 [illegible] 46658301
n:	30
min:	[illegible]
max:	80
median:	[illegible]
average:	[illegible]

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	6.0 (8.4)	7.0 (10)	9.0 (--)
EU Method I Log Normal	6.0 (12)	10 (25)	18 ( )
EU Method II Distribution-Free		5.0	
California Method $\mu + 3\sigma$		9.0	
UPLMedian95th		10	
Approximate Shapiro-Francia Normality Test		0.9416 p value [illegible] rejected log(no) normality assumption	

Figure II-9. Lognormal probability plot of lambda-cyhalothrin field trial data for grass seed screenings forage following a broadcast foliar application at 0.03 lb ai/A per cutting.

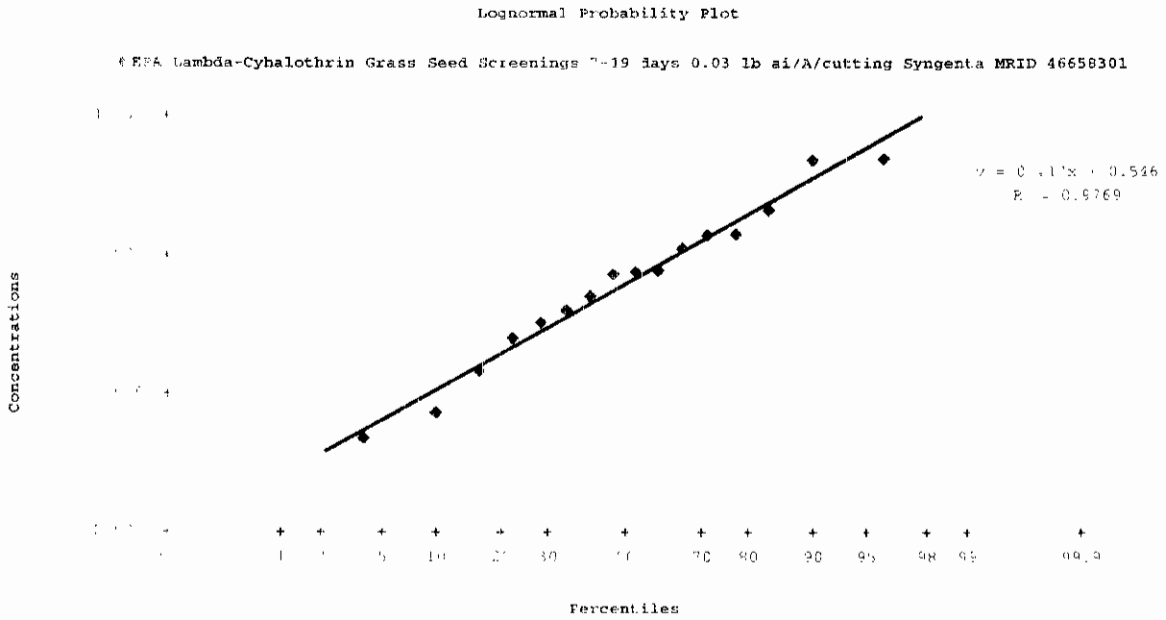


Figure II-10. Tolerance spreadsheet summary of lambda-cyhalothrin field trial data for grass seed screenings following a broadcast foliar application of lambda-cyhalothrin (CS).

Regulator:	EPA
Chemical:	Lambda-Cyhalothrin
Crop:	Grass Seed Screenings
PHI:	7-19 days
App. Rate:	.03 lb ai/A/cutting
Submitter:	Syngenta
MRID Citation:	MRID 46658301
n:	36
min:	0.87
max:	3.23
median:	1.83
average:	1.86

	95th Percentile	99th Percentile	99.9th Percentile
EU Method I Normal	3.5 (4.0)	4.0 (4.5)	4.5 (--)
EU Method I Log Normal	3.5 (5.0)	**4.5** (7.0)	6.0 (--)
EU Method II Distribution-Free	4.5		
California Method $\mu + 3\sigma$	**4.0**		
UPLMedian95th	13		
Approximate Shapiro-Francia Normality Test	0.9769 p-value > 0.05 ; do not reject lognormality assumption		

Lambda-Cyhalothrin/128897/Syngenta Crop Protection, Inc.
Non-guideline Study
Market Basket Survey - Residues in Beef Fat

Primary Evaluator	Sheila Piper Sheila Piper, Chemist, HED/CEB	Date: 8-NOV-2006
Peer Reviewer	Dennis McNeilly, Chemist, HED/RAB2	Date: 9-NOV-2006
Approved by	R. Loranger Richard Loranger, Senior Scientist, HED/RAB2	Date: 14-DEC-2006

This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B, Durham, NC 27713; submitted 08/18/2006). The DER has been reviewed by the Health Effects Division (HED) and revised to reflect current Office of Pesticide Programs (OPP) policies.

STUDY REPORT:

46686001 Heard, N. (2004) Syngenta Market Basket Survey for Lambda-Cyhalothrin in Beef Fat: Final Report Amendement. Project Number: 1576-02. Unpublished study prepared by Syngenta Crop Protection, Inc. 267 p.

EXECUTIVE SUMMARY:

The current tolerance for total lambda-cyhalothrin residues in beef fat is 3 ppm. In order to provide a more refined estimate of the dietary exposure of consumers in the U.S. to lambda-cyhalothrin residues in single serving samples of beef fat at the retail level, Syngenta Crop Protection conducted a market basket survey on beef fat. The study design and procedures were discussed with HED personnel prior to study initiation.

During the fall of 2002, a total of 29 Syngenta personnel located throughout the U.S. served as "shoppers", with each shopper purchasing 4 separately packaged samples of beef during two separate shopping phases (≥2 weeks apart), for a total of 8 samples per shopper or 232 total samples. The purchased samples were beef cuts containing large amounts of visible fat, and were readily identifiable as being from a single animal (e.g. steaks or roasts). Each shopper purchased samples from 1-8 retail groceries in their respective region, and samples were obtained from a total of 26 states, with each state contributing 4-19 samples. A sample of fat (free of meat) was cut from each beef sample, separately packaged, frozen, and shipped to the analytical laboratory, where samples were stored at -20°C until analysis. Samples were stored frozen for up to 32 days prior to analysis, an interval that is supported by the available storage stability data.

Residues in beef fat of lambda-cyhalothrin and its epimer, R157836, were determined using a GC method with electron capture detection (ECD), and the method was adequately validated prior to and in conjunction with the analysis of survey samples. For this method, residues are extracted from beef fat with acetonitrile, centrifuged, filtered and initially cleaned up using a C_{18}

SPE cartridge. Residues are then redissolved in hexane, further purified using a silica gel SPE column, and finally analyzed by GC/ECD using an external standard, containing a mixture of lambda-cyhalothrin (34.4%) and R157836 (65.6%). The primary analytical method used a DB-17 column, and residues were confirmed using an alternate column, RTX 200. The lower limit of method validation (LLMV) was conducted at 10 ppb with the mixed standard, which is equivalent to 3.44 ppb for lambda-cyhalothrin and 6.56 ppb for R157836. Based on concurrent recoveries at the LLMV (n=64), the limits of quantitation (LOQ) and detection (LOD) were calculated to be 3 and 1 ppb, respectively, for lambda-cyhalothrin and 6 and 2 ppb for R157836.

The data indicate that there was a low incidence of quantifiable residues of lambda-cyhalothrin and R157836 in beef fat. Of the 232 samples, lambda-cyhalothrin was non-detectable (< 1 ppb) in 216 samples (93.1%), detectable but non-quantifiable in 11 samples (4.7%), and quantifiable (≥3 ppb) in only 5 samples (2.2%). Quantifiable residues of lambda-cyhalothrin were found at 3.0-17.2 ppb, and were confirmed by a secondary analysis. Overall median residues of lambda-cyhalothrin were calculated to be 0.5 ppb (½LOD), and average residues were 0.7 ± 1.2 ppb. Residues of R157836 were detected in only one sample at the LOD (2 ppb), and this sample was the same sample that had the highest residues of lambda-cyhalothrin. Median and average residues of R157836 were each calculated to be 1.0 ppb (½LOD), and total combined residues of lambda-cyhalothrin and R157836 ranged from ND-19.2 ppb, and averaged 1.7 ± 1.4 ppb.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS:

Under the conditions and parameters used in the study, the market basket residue data on beef fat are classified as scientifically acceptable. The acceptability of this study for regulatory purposes is addressed in the forthcoming U.S. EPA Residue Chemistry Summary Document DP Barcode D324223.

COMPLIANCE:

Signed and dated Good Laboratory Practice (GLP), Quality Assurance and Data Confidentiality statements were provided. No deviations were reported which would have an impact on the validity of the study.

A. BACKGROUND INFORMATION

Lambda-cyhalothrin is a synthetic pyrethroid insecticide/acaricide used to control a wide range of pests in/on food and feed crops, on livestock, and in and around building and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops [40 CFR §180.438(a)(1)]. Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk), including a 3.0 ppm tolerance for residues in fat of livestock.

TABLE A.1. Lambda-Cyhalothrin Nomenclature.

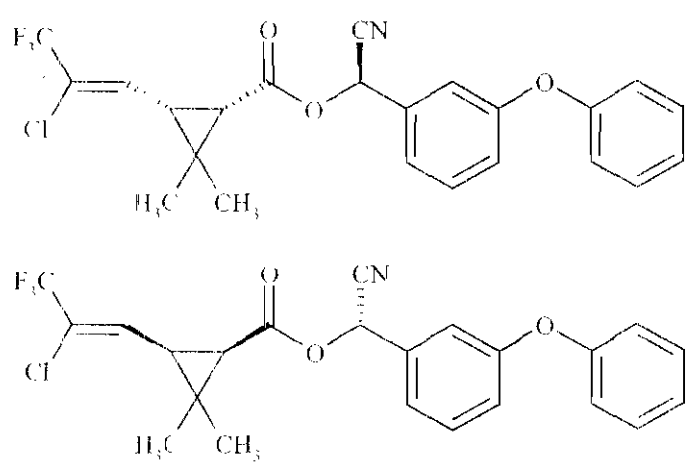
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common name	Lambda-Cyhalothrin
Company experimental name	ICIA0321
IUPAC name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS registry number	91465-08-6
End-use products (EP)	Karate ® Insecticide (EPA Reg. No. 100-1097) Warrior ® Insecticide (EPA Reg. No. 100-1112)

TABLE A.2. Physicochemical Properties of the Lambda-Cyhalothrin.

Parameter	Value	Reference
Melting point/range	49.2 ° C	DP Barcode D284860 [1]
pH	NA	
Density	NA	
Water solubility (mg/L at 20°C)	0.005 at pH 6.5	
Solvent solubility (g/L)	NA	
Vapor pressure	1.5 x 10-9 mm Hg at 20°C	
Dissociation constant, pK_a	NA	
Octanol/water partition coefficient, Log(K_{OW})	7.00	
UV/visible absorption spectrum	NA	

[1] DP Barcode: D284860, K. Farwell, 8/15/02
NA = not available.

B. EXPERIMENTAL DESIGN

Based on the maximum potential dietary exposure of cattle to lambda-cyhalothrin treated crops, currently estimated residues in beef fat are a significant component in the dietary exposure assessment for lambda-cyhalothrin. Therefore, Syngenta conducted a market basket survey to provide a more refined estimate of the dietary exposure of consumers to lambda-cyhalothrin residues in single serving samples of beef fat.

The study used a simplified sampling design based on the assumptions that (i) residues in beef fat are not likely to exhibit seasonal variations as beef cattle typically consume a diet of stored and blended feed items the would not exhibit a seasonality of residues, and that (ii) residues in beef fat are not expected to differ widely between different areas as beef cattle or their products are transported extensively both prior to and after slaughter. Considering the expected residues in beef fat, a tolerance interval approach, as recommended by the Agency, was used to determine the minimum number of samples required for the survey. Using the following equation, $n \geq \ln(1-C)/\ln P$, and selecting the 99.5% confidence interval (C) around the 97.5th percentile (P), a minimum of 210 samples was determined to be required for the survey.

The study author noted that the study assumptions and design were discussed with and agreed to by the Agency, prior to study initiation (Teleconference between N. Heard of Syngenta and D. Miller and R. Loranger of HED/OPP/EPA; 6/6/2002)

B.1. Sample Collection Information

A total of 29 Syngenta employees located throughout the contiguous U.S. were utilized to serve as "shoppers" to collect the beef samples. The shoppers were instructed to buy cuts of beef containing as much fat as possible, such as rib eye, T-bone, porterhouse steaks or rib roasts. The cuts of beef were to be separately packaged from single animals, and no processed or ground beef samples were to be collected. A total of eight samples were to be purchased by each shopper on at least two different dates, approximately 2 weeks apart, with four samples being purchased at each time. Samples were also to be purchased from as many different local retail grocery stores as possible (actual stores are identified in Table C.3).

During the fall of 2002, each shopper purchased the appropriate types and numbers of beef samples, for a total of 232 samples (29 shoppers x 2 shopping dates x 4 samples per date = 232 samples). Samples were collected in 26 states (AL, AR, AZ, CA, CO, FL, KS, ID, IL, IN, LA, MD, MI, MN, MS, NC, ND, NE, NH, NY, OH, SD, TN, TX, WA and WI), with each state contributing for 4-19 samples.

B.2. Sample Handling and Preparation

After purchase, the fat was cut from each sample of raw beef, making sure that only fat was collected and cleaning the knife and cutting surface between samples. Each fat sample was then separately double-bagged in Ziplock ™ bags and placed in the home freezer with four blue ice packs until frozen solid (at least 48 hours). The hard frozen fat samples were then packed with

the blue ice into a Styrofoam™ lined box and shipped via FedEx overnight to the analytical laboratory (Dietary Safety Department, Syngenta Crop Protection, Greensboro, NC), where samples were stored at -20°C until analysis.

B.3. Analytical Methodology

Residues of lambda-cyhalothrin and R157836 were determined using a method titled "Analytical Method for the Determination of Lambda-Cyhalothrin and R157836 in Beef Fat by Gas Chromatography with Election Capture Detection". This GC/ECD method was specifically developed for the analysis of samples from this study.

For this method, residues are extracted from homogenized 10g samples of beef fat with acetonitrile by shaking in a warm water bath (45-50°C) for 1 hour. Residues are centrifuged, filtered, and initially cleaned up by elution through a C_{18} SPE cartridge. Residues are then concentrated to dryness, redissolved in hexane, and further purified using a silica gel SPE column eluted with hexane:diethyl ether (90:10). Residues are re-concentrated, dissolved in hexane and analyzed by GC/ECD using external standards. Both analytes were determined from a single injection. The primary or main method used at DB-17 column for analysis, and selected samples were also analyzed by a confirmatory method using a RTX 200 column for analysis. The retention times for lambda-cyhalothrin and R157836 are 9.52 and 9.75 min, respectively, for the primary method, and 8.8 and 9.1 min for the confirmatory method. A mixed standard containing both lambda-cyhalothrin (34.4%) and R157836 (65.6%) was used for comparison. The LLMV was 10 ppb for total residues, which is equivalent to 3.44 ppb for lambda-cyhalothrin and 6.56 ppb for R157836.

The above method was validation prior to the analysis of survey samples and in conjunction with the analysis of survey samples. For the initial method validation, "control" samples of beef fat were fortified with the mixed standard at 10 and 50 ppb, which is equivalent to 3.44 and 17.2 ppb of lambda-cyhalothrin and 6.56 and 32.8 ppb of R157836. For the concurrent validation, control samples were fortified with the mixed standard at 10 ppb.

C. RESULTS AND DISCUSSION

A total of 29 Syngenta personnel located throughout the U.S. served as "shoppers", with each shopper purchasing 4 separately packaged samples of beef during two separate shopping phases (≥2 weeks apart) during the fall of 2002, for a total of 8 samples per shopper and 232 total samples. The beef samples purchased were cuts containing large amounts of visible fat, and were readily identifiable as being from a single animal (e.g. steaks or roasts). Each shopper purchased samples from 1-8 retail groceries in their respective region, and samples were obtained from a total of 26 states, with each state contributing 4-19 samples. A sample of fat (free of meat) was cut from each beef sample, separately packaged, frozen, and shipped to the analytical laboratory.

Both the primary and confirmatory GC/ECD methods used to analyze beef fat samples were adequately validated prior to and in conjunction with the analysis of survey samples. Method

validation recoveries for lambda-cyhalothrin using both the primary and confirmatory analyses averaged 88-109% (±2-11%) at fortification levels of 3.44 and 17.2 ppb (Table C.1), and method validation recoveries for R157836 using both analyses averaged 85-111% (±1-7%) at fortification levels of 6.56 and 32.8 ppb. Concurrent method recoveries for the primary method averaged 96 ± 12% for lambda-cyhalothrin fortified at 3.44 ppb and 102 ± 13% for R157836 fortified at 6.56 ppb. Concurrent method recoveries for the confirmatory method averaged 113 ± 17% for lambda-cyhalothrin fortified at 3.44 ppb and 98 ± 7% for R157836 fortified at 6.56 ppb. Apparent residues in the control beef fat samples were <LLMV. Adequate sample calculations, data spreadsheets, and sample chromatograms were provided.

The statistically calculated LOQs and LODs for both analytes were determined using the recoveries from the 64 control samples fortified at the LLMV (3.44 or 6.56 ppb) and analyzed concurrently with the survey samples. The LOQs and LODs were calculated using a one-tailed t-statistic at the 99% confidence interval ($LOD = t_{0.99} \cdot \sigma$; $LOQ = 3 \cdot LOD$). The calculated LOQ and LOD for the primary method were respectively 3 and 1 ppb for lambda-cyhalothrin and 6 and 2 ppb for R157836 in beef fat.

Samples of beef fat were stored frozen for a maximum of 32 days prior to extraction for analysis (Table C.2). Residues of lambda-cyhalothrin have been demonstrated to be stable under freezer storage conditions in beef fat, muscle and liver for up to 2.1 months (MRID 40027912).

The residue data for lambda-cyhalothrin and R157836 are reported in Table C.3, and samples are identified by the region (city/state) and retail store where they were collected. The data indicate a low incidence of quantifiable residues of both lambda-cyhalothrin and R157836 in beef fat. Of the 232 samples, lambda-cyhalothrin was non-detectable (<1 ppb) in 216 samples (93.1%), detectable but non-quantifiable in 11 samples (4.7%), and quantifiable (≥3 ppb) in only 5 samples (2.2%). Residues in these 5 samples were 3.0, 3.0, 3.5, 7.5, 17.2 ppb. The secondary analysis of each of these samples confirmed the presence of lambda-cyhalothrin. Median residues of lambda-cyhalothrin were 0.5 ppb (½LOD), and average residues were 0.7 ± 1.2 ppb (Table C.4). For the epimer R157836, residues were non-detectable (<2 ppb) in 231 samples and were detected at 2 ppb in only one sample, which was the same sample that had the highest residues of lambda-cyhalothrin. Median and average residues of R157836 were each 1.0 ppb (½LOD). Combined residues of lambda-cyhalothrin and R157836 ranged from <3-19.2 ppb, and averaged 1.7 ± 1.4 ppb.

Occurrences of quantifiable residues of lambda-cyhalothrin were below established combined tolerance of 3.0 ppm, with the maximum total residue level (19.2 ppb) accounting for 0.6% of the current tolerance.

TABLE C.1. Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Beef Fat.

Matrix	Methods [1]	Analyte	Spike level (ppb) [2]	Sample size (n)	Recoveries (%)	Mean SD (%)
Method Validation Recoveries						
Beef fat	Primary Analytical Method	λ-cyhalothrin	3.44	6	76, 86, 98, 102, 105, 102	95 ± 11
			17.2	3	107, 109, 110	109 ± 2
		R157836	6.56	6	83, 92, 97, 103, 96, 95	94 ±7
			32.8	3	110, 110, 112	111 ± 1
Beef fat	Confirmatory Analytical Method	λ-cyhalothrin	3.44	6	78, 86, 90, 86, 98, 89	88 ± 7
			17.2	3	90, 91, 96	92 ± 4
		R157836	6.56	6	81, 91, 85, 85, 85, 80	85 ± 4
			32.8	3	94, 95, 99	96 ± 3
Concurrent Method Recoveries						
Beef fat	Primary Analytical Method	λ-cyhalothrin	3.44	64	94, 104, 83, 105, 91, 89, , 95, 97, 94, 93, 111, 115, 82, 92, 95, 89, 72, 91, 101, 109, 72, 80, 82, 89, 122, 104, 96, 88, 95, 104, 93, 95, 81, 89, 92, 99, 96, 96, 81, 90, 101, 92, 112, 102, 87, 94, 74, 104, 98, 101, 111, 105, 95, 112, 71, 97, 99, 112, 94, 108, 115, 110, 102, 108	96 ± 12
		R157836	6.56	64	90, 95, 74, 109, 106, 98, 108, 110, 109, 110, 109, 110, 109, 120, 109, 111, 109, 114, 108, 108, 118, 118, 104, 110, 118, 103, 101, 89, 104, 114, 98, 104, 69, 82, 96, 103, 97, 95, 92, 77, 89, 103, 112, 113, 91, 98, 92, 99, 106, 109, 114, 108, 92, 115, 57, 89, 91, 113, 80, 108, 109, 103, 110, 102	102 ± 13
Beef fat	Confirmatory Analytical Method	λ-cyhalothrin	3.44	12	126, 111, 105, 106, 129, 159, 87 93, 89, 124, 119, 107	113 ± 17
		R157836	6.56	12	103, 93, 93, 88, 93, 104, 98, 102, 95, 114, 99, 95	98 ± 7

[1] Both Methods used GC/ECD for determination of residues; however, the primary method used a DB-17 column and the confirmatory method used a RTX 200 column

[2] A mixed standard containing both λ-cyhalothrin and R157836 at a ratio of 34.4:65.6 was used for fortification at a combined level of 13 or 50 ppb.

TABLE C.2. Summary of Storage Conditions.

Matrix	Storage Temperature (°C)	Actual Storage Duration (days)	Interval of Demonstrated Storage Stability (months)
Beef fat	-20	32	2.1 [1]

[1] MRID 40027912: Sapiets, A. (1985) PP321: Storage Stability in Frozen Animal Tissues: Laboratory Project ID: M3959B. Unpublished study prepared by ICI Americas Inc., Jealott's Hill Research Station. 11 p.

TABLE C.3. Residues of Lambda-Cyhalothrin and R157836 in Single Servings of Beef Fat Collected during 2002 from Commercial Groceries Throughout the U.S.

Sampling Location (City, State, ID#)	Store ID	Cut of Beef	Residues (ppb) [1]		
			λ-Cyhalothrin	R157836	Combined Residues [2]
Enterprise and Hartford, AL Callaway and Mexico Beach, FL AL-BF	Winn Dixie	Rib-eye	ND	ND	1.5
	Food World	NY Strip	ND	ND	1.5
	Wal-Mart	Rib-Eye	ND	ND	1.5
	Tate's Grocery	T-bone	ND	ND	1.5
	Winn Dixie	T-bone	ND	ND	1.5
	Wal-Mart	Porterhouse	ND	ND	1.5
	Food World	Rib-eye	ND	ND	1.5
	Gulf Foods	Porter House	ND	ND	1.5
Search, AR AR-BF	Kroger	T-bone	ND	ND	1.5
	Country mart	T-bone	(1.0) [3]	ND	2.5
	Food King	T-bone	ND	ND	1.5
	Sexton Foods	T-bone	ND	ND	1.5
	Food King	T-bone	ND	ND	1.5
	Wal-Mart	Porterhouse	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Sexton Foods	T-bone	ND	ND	1.5
Yuma, AZ AZ-BF	Valley Meat Co.	Rib-eye	ND	ND	1.5
	Albertson's	NY strip	ND	ND	1.5
	Fry's	Top Sirloin	ND	ND	1.5
	IGA	T-bone	ND	ND	1.5
	Valley Meat Co	Top Sirloin	ND	ND	1.5
	IGA	Rump roast	ND	ND	1.5
	Fry's	Rib-eye	ND	ND	1.5
	Albertson's	Cross rib roast	ND	ND	1.5
Woodland and Davis, CA CA-BF	Nugget	Rib-Eye	ND	ND	1.5
	Nugget	Rib-Eye	ND	ND	1.5
	Nugget	Rib-Eye	ND	ND	1.5
	Albertson's	Rib-Eye	ND	ND	1.5
	Safeway	Rib-Eye	ND	ND	1.5
	Safeway	Rib-Eye	ND	ND	1.5
	Albertson's	Rib-Eye	ND	ND	1.5
	Nugget	Rib-Eye	ND	ND	1.5
Greely, CO CO-BF	Toody's	Rib-Eye	ND	ND	1.5
	King Supper's	Rib-Eye	ND	ND	1.5
	Wal-Mart	T-bone	ND	ND	1.5
	Safeway	T-bone	ND	ND	1.5
	Safeway	T-bone	ND	ND	1.5
	Wal-Mart	T-bone	ND	ND	1.5
	King Supper's	Rib-Eye	ND	ND	1.5
	Toody's	T-bone	ND	ND	1.5
Lakeland, FL FL-BF	Winn Dixie	T-bone	ND	ND	1.5
	Winn Dixie	T-bone	ND	ND	1.5
	Publix	Rib-Eye	ND	ND	1.5
	Publix	Sirloin	(1.4)	ND	2.5
	Winn Dixie	Bottom round roast	ND	ND	1.5
	Winn Dixie	Bottom round roast	ND	ND	1.5
	Winn Dixie	Bottom round steak	ND	ND	1.5
	Winn Dixie	Bottom round steak	ND	ND	1.5

TABLE C.3. Residues of Lambda-Cyhalothrin and R157836 in Single Servings of Beef Fat Collected during 2002 from Commercial Groceries Throughout the U.S.

Sampling Location (City, State, ID#)	Store ID	Cut of Beef	Residues (ppb) [1]		
			λ-Cyhalothrin	R157836	Combined Residues [2]
Oak Ridge and Greensboro, NC GA-BF	Lowe's Foods	Sirloin	ND	ND	1.5
	Lowe's Foods	Sirloin	ND	ND	1.5
	Lowe's Foods	Sirloin	ND	ND	1.5
	Lowe's Foods	Sirloin	ND	ND	1.5
	Fresh market	Rib-eye	ND	ND	1.5
	Fresh market	Rib-eye	ND	ND	1.5
	Fresh market	Rib-eye	ND	ND	1.5
	Fresh market	Rib-eye	ND	ND	1.5
Star, Meridian and Caldwell, ID ID-BF	Star Merc.	Rib-eye	(1.6)	ND	2.5
	Greenfield Custom Meat	Chuck roast	17.2, 16.8 [4]	(2.0, 2.0)	19.2
	Paul's Market	Bottom round	ND	ND	1.5
	Paul's market	New York strip	ND	ND	1.5
	Star Merc.	Top sirloin	ND	ND	1.5
	Fred Meyer	Beef chuck roast	7.5, (1.6)	ND	8.5
	Paul's Market	Cross rib chuck	ND	ND	1.5
	Paul's market	Rib-eye	ND	ND	1.5
Monticello and Champaign, IL IL-BF	Bill & Sandy's IGA	Rib-eye	ND	ND	1.5
	Jerry's IGA	New York Strip	ND	ND	1.5
	Schnuck's	Rib-eye	ND	ND	1.5
	Schnuck's	NY Strip	ND	ND	1.5
	Meijer	Rib-eye	ND	ND	1.5
	Schnuck's	Rib-eye	ND	ND	1.5
	Country Market	Rib-eye	ND	ND	1.5
	Bill & Sandy's IGA	Rib-eye	ND	ND	1.5
Covington, Danville and Lafayette, IN IN-BF	IGA	Top sirloin	ND	ND	1.5
	Wal-Mart	Loin strip steak	ND	ND	1.5
	Sav-A-Lot	Bottom round	ND	ND	1.5
	Country market	Chuck-eye round	ND	ND	1.5
	Super Target	Chuck steak	ND	ND	1.5
	Payless	Sirloin	ND	ND	1.5
	Marsh	NY strip	ND	ND	1.5
	D+R fruit &Meat market	Rib-eye	ND	ND	1.5
Larned and Great Bend, KS KS-BF	Dillon's	T-bone	ND	ND	1.5
	Dillon's	T-bone	ND	ND	1.5
	Butcher block	KC strip	ND	ND	1.5
	Butcher block	KC strip	ND	ND	1.5
	Food-4-less	KC strip	ND	ND	1.5
	Dillon's	T-bone	ND	ND	1.5
	Dillon's	T-bone	ND	ND	1.5
	Butcher block	T-bone	ND	ND	1.5
Marion IL KY-BF	Sam's	Rib-eye	ND	ND	1.5
	Kroger	Rib-eye	ND	ND	1.5
	IGA	Rib-eye	ND	ND	1.5
	Small's Market	Round steak	ND	ND	1.5
	Kroger	Rib-eye	ND	ND	1.5
	Smal's market	T-bone	ND	ND	1.5
	IGA	NY strip	ND	ND	1.5
	IGA	Arm roast	ND	ND	1.5

TABLE C.3. Residues of Lambda-Cyhalothrin and R157836 in Single Servings of Beef Fat Collected during 2002 from Commercial Groceries Throughout the U.S.

Sampling Location (City, State, ID#)	Store ID	Cut of Beef	Residues (ppb) [1]		
			λ-Cyhalothrin	R157836	Combined Residues [2]
Ruston and West Monroe, LA LA-BF	Super 1 foods	T-bone	ND	ND	1.5
	Super Kmart	T-bone	ND	ND	1.5
	Brookshire's	T-bone	3.5, 6.2	ND	4.5
	Super-1 foods	T-bone	ND	ND	1.5
	Super-1 foods	T-bone	ND	ND	1.5
	Brookshire's #4	T-bone	ND	ND	1.5
	Super Kmart	T-bone	ND	ND	1.5
	Super 1 Foods	T-bone	ND	ND	1.5
Lansing and St. Johns, MI MI-BF	Meijer	Rib-eye	(1.5)	ND	2.5
	Farmer Jack	NY strip	(1.9)	ND	2.5
	L&L food center	English roast	ND	ND	1.5
	Kroger	Bottom round roast	ND	ND	1.5
	Meijer	Chuck-eye	ND	ND	1.5
	FarmerJack	Top round	ND	ND	1.5
	Kroger	Rib-eye	ND	ND	1.5
	L&L food center	Loin T-bone	ND	ND	1.5
Hector, Hutchinson and Redwood Falls, MN MN-BF	Hector Meat Processor	T-bone	ND	ND	1.5
	Econo Foods	T-bone	ND	ND	1.5
	Cash Wide Foods	T-bone	ND	ND	1.5
	Wal-Mart	Porterhouse	ND	ND	1.5
	Wal-Mart	T-bone	ND	ND	1.5
	Cash Wise Foods	T-bone	ND	ND	1.5
	Hector Meat Processor	T-bone	ND	ND	1.5
	Terstee G's	T-bone	ND	ND	1.5
Shawnee and Lenexa, KS MO-BF	Hy-vee's foods	Rib-eye	ND	ND	1.5
	Hen house	KC strip	ND	ND	1.5
	Super target	KC strip	ND	ND	1.5
	Hy-vee foods	T-bone	ND	ND	1.5
	Target	KC strip	ND	ND	1.5
	Hy-vee	T-bone	ND	ND	1.5
	Hy-vee	KC strip	ND	ND	1.5
	Hen house	Rib-eye	ND	ND	1.5
Greenville, MS MS-BF	Kroger	T-bone	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
Cary and Apex, NC NC-BF	Harris-Teeter	T-bone	ND	ND	1.5
	Whole Foods	Rib-eye	ND	ND	1.5
	Kroger	Rib-eye	ND	ND	1.5
	The Fresh market	Rib-eye	ND	ND	1.5
	Harris-Teeter	Rib-eye	ND	ND	1.5
	Lowe's Foods	Round Roast	ND	ND	1.5
	Winn Dixie	Rib-eye	ND	ND	1.5
	Lowe's Foods	T-bone	ND	ND	1.5

TABLE C.3. Residues of Lambda-Cyhalothrin and R157836 in Single Servings of Beef Fat Collected during 2002 from Commercial Groceries Throughout the U.S.

Sampling Location (City, State, ID #)	Store ID	Cut of Beef	Residues (ppb) [1]		
			λ-Cyhalothrin	R157836	Combined Residues [2]
West Fargo and Fargo, ND ND-BF	Sun Mart	Rib-eye	(2.5), 4.3	ND	2.5
	Sun Mart	Rib-eye	(1.7), 3.1	ND	2.5
	Sun Mart	Rib-eye	ND	ND	1.5
	Sun Mart	Rib-eye	ND	ND	1.5
	Sun Mart	Rib-eye	ND	ND	1.5
	Hornbacher's	Rib-eye	ND	ND	1.5
	Cash wise	T-bone	ND	ND	1.5
	Hornbacher's	Porterhouse	ND	ND	1.5
York, NE NE-BF	Bag'N Save	Boneless rump roast	ND	ND	1.5
	Bag'N save	Rib steak,	ND	ND	1.5
	Sun Mart	Rib-eye	ND	ND	1.5
	Grand Central	Beef loin NY steak	ND	ND	1.5
	Sun Mart	Rib-eye	ND	ND	1.5
	Bag'N Save	T-bone	ND	ND	1.5
	Bag'N Save	Top round	ND	ND	1.5
	Grand Central	Beef loin	ND	ND	1.5
Manchester, Bedford and Merrimack, NH NH-BF	Shop & Save Grocery	T-bone	ND	ND	1.5
	Vista Foods	Boneless rib-eye	ND	ND	1.5
	Shaws Grocery	Rib steak	(1.9)	ND	2.5
	Hannaford Grocery	Rib roast	ND	ND	1.5
	Shaws Grocery	Chuck roast	3.0, 4.4	ND	4.0
	Vista foods	Sirloin	ND	ND	1.5
	Sam's Wholesale	T-bone	ND	ND	1.5
	Hannaford Grocery	Rib-eye	ND	ND	1.5
Webster, Ontario and Geneva, NY NY-BF	Wegman's	Rib-eye	ND	ND	1.5
	Wegman's	Rib-eye	ND	ND	1.5
	Wegman's	Strip steak	ND	ND	1.5
	Wegman's	Strip steak	ND	ND	1.5
	Wegman's	Rib-eye	ND	ND	1.5
	Wegman's	Rib-eye	3.0, 3.3	ND	4.0
	Top's	Porterhouse	(2.9), 3.9	ND	2.5
	BJ's	Porterhouse	ND	ND	1.5
Hillard and Columbus, OH OH-BF	Kroger	Porterhouse	ND	ND	1.5
	Kroger	T-bone	ND	ND	1.5
	Kroger	Rib-eye	ND	ND	1.5
	Kroger	Loin steak	ND	ND	1.5
	Meijer	Rib-eye	(2.1)	ND	2.5
	Giant Eagle	T-bone	ND	ND	1.5
	Big Bear	Porterhouse	ND	ND	1.5
	Kroger	Rib-eye	ND	ND	1.5
Stevensville, MD PA-BF	PJ's Butcher Shop	NY strip	ND	ND	1.5
	PJ's Butcher Shop	Sirloin	ND	ND	1.5
	PJ's Butcher Shop	Rib-eye	ND	ND	1.5
	PJ's Butcher Shop	Rib roast	ND	ND	1.5
	PJ's Butcher Shop	Top round	ND	ND	1.5
	PJ's Butcher Shop	T-bone	ND	ND	1.5
	PJ's Butcher Shop	Boneless chuck roast	ND	ND	1.5
	PJ's Butcher Shop	Sirloin butt steak	ND	ND	1.5

TABLE C.3. Residues of Lambda-Cyhalothrin and R157836 in Single Servings of Beef Fat Collected during 2002 from Commercial Groceries Throughout the U.S.

Sampling Location (City, State, ID#)	Store ID	Cut of Beef	Residues (ppb) [1]		
			λ-Cyhalothrin	R157836	Combined Residues [2]
Sioux Falls and Brandon, SD SD-BF	Hy-vee	Rib-eye	ND	ND	1.5
	Randall foods	Rib-eye	ND	ND	1.5
	Econo foods	T-bone	ND	ND	1.5
	Sunshine foods	T-bone	ND	ND	1.5
	Sunshine foods	T-bone	ND	ND	1.5
	Hy-vee foods	T-bone	ND	ND	1.5
	Jubilee foods	T-bone	(1.9) [4]	ND	2.5
	Hy-vee foods	T-bone	ND	ND	1.5
Jackson, TN TN-BF	Kroger	T-bone	ND	ND	1.5
	Wal-Mart	T-bone	ND	ND	1.5
	Lathams	Rib-eye	ND	ND	1.5
	Highland park Grocery	Rib-eye	ND	ND	1.5
	Kroger	Rib-eye	ND	ND	1.5
	Wal-Mart	T-bone	ND	ND	1.5
	Highland Park Grocer	Rib-eye	ND	ND	1.5
	Latham's	Rib-eye	ND	ND	1.5
Hewitt, Robinson and Waco, TX TX-BF	IGA	Shoulder roast	ND	ND	1.5
	Fitzpatricks Meat market	Rib-eye	ND	ND	1.5
	HEB	Rib-eye	ND	ND	1.5
	Albertsons	Rump roast	ND	ND	1.5
	HEB	Rib-eye	ND	ND	1.5
	Wal-Mart	Rib-eye	ND	ND	1.5
	Albertsons	Pot roast	ND	ND	1.5
	Brookshire Bros	Rib-eye	ND	ND	1.5
Yakima, WA WA-BF	Safeway	Rib-eye	ND	ND	1.5
	Safeway	Rib-eye	ND	ND	1.5
	Safeway	Rib-eye	ND	ND	1.5
	Safeway	Rib-eye	ND	ND	1.5
	Safeway	Loin T-bone	ND	ND	1.5
	Wrap Thriftway	Rib-eye	ND	ND	1.5
	Rosaur's	Rib-eye	ND	ND	1.5
	Fred Meyer	Loin T-bone	ND	ND	1.5
Madison, WI WI-BF	Brennan's	Rib-eye	ND	ND	1.5
	Brennan's	Rib-eye	ND	ND	1.5
	Brennan's	Rib-eye	ND	ND	1.5
	Brennan's	Rib-eye	ND	ND	1.5
	Brennan's	Rib-eye	ND	ND	1.5
	Brennan's	Rib-eye	ND	ND	1.5
	Brennan's	Rib-eye	ND	ND	1.5
	Brennan's	Rib-eye	ND	ND	1.5

[1] For the primary analytical method, the statistically calculated LOQs for parent and R157836 are 3 and 6 ppb, respectively, and LODs are 1 and 2 ppb. The LOQ and LOD for combined residues are 9 and 3 ppb.

[2] Combined residues were calculated using actual residues for values ≥LOQ, ½LOQ for values between the LOQ and LOD and ½LOD for non-detectable residues.

[3] Where two values are reported, the second value is from analysis using the confirmatory method. Only the values from the primary method were used to calculate combined residues.

[4] Values between the LOQ and LOD are listed in parentheses.

TABLE C.4 Summary of Lambda-Cyhalothrin and R157836 Residues in Single Servings of Beef Fat Collected from Commercial Groceries Throughout the U.S.

Commodity	Analyte	Residue Levels (ppb) [1]					
		n	Min. [2]	Max.	Median	Mean	Std. Dev.
Beef Fat	λ-cyhalothrin	232	<1.0	17.2	0.5	0.7	1.2
	R157836		<2.0	2.0 [3]	1.0	1.0	0.1
	Combined Resides		<3.0	19.2	1.5	1.7	1.4

[1] The statistically calculated LOQs for parent and R157836 are 3 and 6 ppb, respectively, and the LODs are 1 and 2 ppb. The LOQ and LOD for combined residues are 9 and 3 ppb. For calculation of mean, median and standard deviation, residue values between the LOQ and LOD were estimated to be ½LOQ, and residue values <LOD were estimated to be ½LOD.

[2] Minimum values were all <LOD.

[3] Maximum value for R157836 was above the LOD, but <LOQ.

D. CONCLUSION

The study design and procedures used to collect and analyze the samples of beef fat were adequate, and a sufficient number of samples were collected to statistically represent lambda-cyhalothrin residues in single servings of beef fat available to U.S. consumers at the retail level. The residue data indicate that residues of lambda-cyhalothrin and R157836 in beef fat are low, with total residues being <20 ppb.

E. REFERENCES

DP Barcode: D284860
Subject: PP#0F6092. Request for the Use of Lambda-cyhalothrin in/on Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.
From: K. Farwell
To: W. Sproat
Date: 8/15/02
MRID(s): None

F. DOCUMENT TRACKING

RDI: S.Piper 11/8/06; D.McNeilly 11/9/06; R. Loranger 12/14/06
Petition Number(s): NA
DP Barcode(s): D324223
PC Code: 128897

Lambda-Cyhalothrin/100-1112 & 100-1097/PC Code 128897/Syngenta Crop Protection/100
DACO 7.4.1/7.4.2/OPPTS 860.1500/OECD IIA 6.3.1, 6.3.2, 6.3.3 and IIIA 8.3.1, 8.3.2, 8.3.3
Crop Field Trial – Grasses (Forage, Hay, Straw, and Seed Screenings)

Primary Evaluator: William T. Drew, Chemist, HED/RAB2 — Date: 12/27/2006

Approved by: Richard A. Loranger, Branch Senior Scientist, HED/RAB2 — Date: 12/27/2006

This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B; Durham, NC 27713). It has been reviewed by HED, and revised to reflect current OPP policy.

STUDY REPORTS

MRID #46658301. Kent Ediger (2004) *Lambda-Cyhalothrin - Magnitude of the Residues In or On Crop Group 17: Grass Forage, Fodder and Hay.* Lab Study ID Number: 25-02. Unpublished study prepared by the Dietary Safety Department of Syngenta Crop Protection. 692 pages. {OPPTS Residue Chemistry Test Guideline 860.1500}

EXECUTIVE SUMMARY

Syngenta Crop Protection submitted crop field trials supporting the use on grasses of lambda-cyhalothrin formulated as a capsule suspension (CS) having 2.08 pounds of active ingredient per gallon (lb ai/gal). In 13 field trials conducted in growing zones 1, 4, 5, 6, 7, 8, 11, and 12 during 2003, lambda-cyhalothrin (2.08 lb ai/gal CS) was applied to a variety of grasses as a single broadcast foliar application per cutting. Each trial site (except one in SD, where only one application was made, at the rate of 0.031 lb ai/A) included two treatments (#2 and #3) in which lambda-cyhalothrin (2.08 lb ai/gal CS) was applied to grasses (at the 6-8" to boot stage) at rates of 0.030-0.034 pounds of ai per acre (lb ai/A) per application, for a total of two (0.062-0.063 lb ai/A; 3 sites) or three (0.092-0.099 lb ai/A, 9 sites) applications. Forage and hay were cut following each application, and the fields were allowed to regrow between applications. The re-treatment intervals (RTIs) were 14-60 days for applications to successive cuttings. At eight of the trial sites, lambda-cyhalothrin (2.08 lb ai/gal CS) was also applied to grass grown for seed as a single broadcast foliar application (at maturity) at rates of 0.031-0.032 lb ai/A (Treatment #4). All applications were made using ground equipment in spray volumes of 2-20 gallons per acre (GPA), and did not include the use of any adjuvants.

Following each application in Treatments #2 and #3, single control and duplicate treated samples of forage were cut and collected at 0-3 days after treatment (DAT), and single control and duplicate treated samples of hay were cut at 5-11 DAT (Treatment #2) or 12-17 DAT (Treatment #3). For Treatment #4, single control and duplicate samples of straw and seed screenings were collected at 7-19 DAT, and following regrowth, samples of forage and hay were also collected at two cuttings (36-50 DAT and 51-64 DAT). For all treatments, samples of hay were allowed to dry in the field for 1-7 days prior to sampling. Samples of forage, hay, straw,

and seed screenings were stored frozen for up to 8.5 months prior to analysis, a duration supported by available storage stability data.

Samples of grass forage, hay, straw, and seed screenings were analyzed for residues of lambda-cyhalothrin and its epimer (R157836) using a gas chromatograph with electron capture detection (GC/ECD) method (CCRL-MTH-023, modified), which is derived from the current tolerance enforcement method. For this method, residues were extracted with acetone/hexane (1:1, v/v), filtered, and cleaned up using a silica gel solid-phase extraction (SPE) cartridge. Residues were then analyzed by GC/ECD using external standards. For each matrix, the validated limit of quantitation (LOQ) is 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, resulting in a combined LOQ of 0.01 ppm. The limits of detection (LODs) were not specified.

Regardless of treatment or sampling interval, lambda-cyhalothrin was the major component of the residue in all commodities, accounting for 88 ± 9% of the combined residues in forage, 87 ± 7% of the combined residues in hay, 85 ± 4% of the combined residues in straw, and 89 ± 4% of the combined residues in seed screenings.

Following the single applications at the 6-8" to boot stages (Treatments #2 and #3), combined residues in forage harvested at 0-3 DAT were 0.13-8.04 ppm after the first application, 1.07-5.03 ppm after the second application, and 0.67-6.24 ppm after the third application. Average combined residues in forage following the first, second and third applications were respectively 2.09, 2.82, and 2.89 ppm, while the overall average residues in all forage samples at ~0 DAT were 2.56 ppm. For hay harvested at 5-11 DAT (Treatment #2), combined residues were 0.50-3.84 ppm after the first application, 1.28-6.01 ppm after the second application, and <0.01-5.14 ppm after the third application. Average combined residues in hay at ~7 DAT following the first, second, and third applications were respectively 1.50, 2.89, and 2.43 ppm, while the average residues in all hay samples at ~7 DAT were 2.24 ppm. For hay harvested at 11-17 DAT (Treatment #3), combined residues were 0.26-2.01 ppm after the first application, 0.29-4.04 ppm after the second application, and 0.52-4.11 ppm after the third application. Average combined residues in hay at ~14 DAT following the first, second, and third applications were respectively 0.96, 1.46, and 1.80 ppm, while the average residues in all hay samples at ~14 DAT were 1.36 ppm.

The residue data on forage and hay from both Treatments #2 and #3 indicate that there is a trend toward slightly higher residues following repeated applications to separate cuttings. However, the maximum residues observed in any forage sample (8.04 ppm) occurred following the first application. A comparison of the residue data on hay from Treatments #2 and #3 indicates that residues declined at longer post-treatment intervals (PTIs), as average combined residues in hay were 2.24 ppm at ~7 DAT, and 1.36 ppm at ~14 DAT. In addition, residue data on hay from the single residue decline trial also showed that residues declined at increasing PTIs.

Following the single application to grasses grown for seed at 0.03 lb ai/A (Treatment #4), combined residues were 0.35-7.80 ppm in straw, and 0.80-3.23 ppm in seed screenings harvested at maturity, 7-19 DAT. Average combined residues were respectively 2.15 and 1.86 ppm in straw and seed screenings. Carryover of residues to subsequent cuttings of forage and hay was

low. Average combined residues were 0.05 and 0.012 ppm in forage and hay, respectively, from the 1st regrowth (36-50 DAT), and 0.04 ppm in both forage and hay from the second regrowth (51-64 DAT).

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS

Under the conditions and parameters used in the study, the grass field trial residue data are classified as scientifically acceptable. The acceptability of this study for regulatory purposes is addressed in the US EPA Residue Chemistry Summary Document (DP #324219).

COMPLIANCE

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No deviations from regulatory requirements were reported which would have an impact on the validity of the study.

A. BACKGROUND INFORMATION

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food/feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones (40CFR §180.438[a][1]). Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances have also been established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection has submitted a petition (PP#5F6994) supporting the use of 1.0 and 2.08 lb ai/gal CS formulations of lambda-cyhalothrin on grasses (grass forage, fodder, and hay, Group 17).

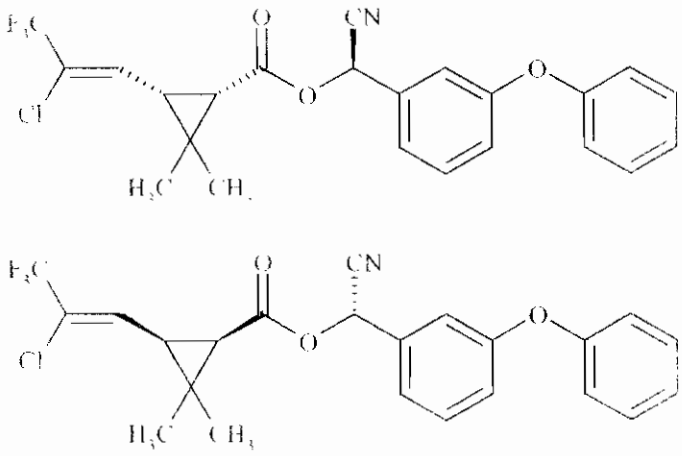
Table A.1 Lambda-Cyhalothrin Nomenclature.	
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common Name	Lambda-Cyhalothrin
Company Experimental Name	ICIA0321
Molecular Formula	$C_{23}H_{19}ClF_3NO_3$
Molecular Weight	449.9
IUPAC Name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Registry Number	91465-08-6
End-use Products (EP)	1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™; EPA Registration #100-1112) 2.08 lb ai/gal CS (Karate® Insecticide with Zeon Technology™; EPA Registration #100-1097)

Table A.2 Physicochemical Properties of Lambda-Cyhalothrin.		
Parameter	**Value**	**Reference**
Melting Point/Range (°C)	49.2	D284860[1]
pH	NA[2]	
Density (g/cm^3 at 25°C)	1.33	
Water Solubility (mg/L at 20°C, pH 6.5)	0.005	
Solvent Solubility (g/L)	NA	
Vapor Pressure (mm Hg at 20°C)	1.5×10^{-9}	
Dissociation Constant (pK$_a$ at 20°C)	>9	
Octanol/water Partition Coefficient (Log[K$_{OW}$])	7.00	
UV/visible Absorption Spectrum	NA	

1. Kit Farwell, 8/15/2002
2. NA -- Not Available

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

Fourteen grass field trials were conducted in growing zones 1, 4, 5, 6, 7, 8, 10, 11, and 12 during 2003. However, the supporting field trial data (use rates, dates of application, harvest intervals, etc.) were not provided for the trial site in CA (zone 10); therefore, the residue data associated with this trial are not discussed further in this report.

Each trial site consisted of a control plot, and two or three treated plots (see Table B.1.2, below). Treatments #2 and #3 were used to represent repeated applications to pasture and rangeland grasses, while Treatment #4 was used to represent a single application to grasses grown for seed. For Treatments #2 and #3, lambda-cyhalothrin (2.08 lb ai/gal CS) was initially applied as a broadcast foliar application to grass (from the 6-8" stage to the boot stage) at a target rate of 14.2 g ai/A (0.031 lb ai/A). Samples of forage were to be collected immediately following application (0 DAT) for both treatments, while samples of hay were to be cut at 7 DAT for Treatment #2, and 14 DAT for Treatment #3. Following regrowth, a second application was made at a target rate of 0.03 lb ai/A; samples of forage (0 DAT) and hay (7 or 14 DAT) were again collected. Where possible, the grass was again allowed to regrow, and a third application was made at a target rate of 0.03 lb ai/A; forage and hays samples were again collected at the same intervals. For Treatment #4 (8 trials), a single broadcast foliar application of lambda-cyhalothrin (2.08 lb ai/gal CS) was applied to grass at a target rate of 0.03 lb ai/A, approximately 7 days prior to harvest of mature seed.

Average monthly temperatures and rainfall during the trials were reported for each site, along with historical averages. Irrigation was used to supplement rainfall as necessary, and information was also provided on the maintenance pesticides and fertilizers used at each site. No anomalous weather conditions were reported.

TABLE B.1.1 Trial Site Conditions.

Location (City, State; Year) [Trial Identification]	Soil Characteristics			
	Type	%OM	pH	CEC (meq/g)
Montpelier, VA; 2003 [EB-IR-003-03]	Sandy Loam	NR*	NR	NR
York, NE; 2003 [NB-IR-002-03]	Silty Clay Loam	NR	NR	NR
Corsica, SD; 2003 [NC-IR-001-03]	Loam	NR	NR	NR
Kirksville, MO; 2003 [ND-IR-001-03]	Loam	NR	NR	NR
Roseau, MN; 2003 [NN-IR-003-03]	Loam	NR	NR	NR
Leland, MS; 2003 [S3-IR-002-03]	Silty Clay Loam	NR	NR	NR
East Bernard, TX; 2003 [SA-IR-003-03]	Clay	NR	NR	NR
Plainview, TX; 2003 [SC-IR-002-03]	Clay Loam	NR	NR	NR
Moses Lake, WA; 2003 [WF-IR-009-03]	Silt Loam	NR	NR	NR
Raft River, ID; 2003 [WG-IR-007-03]	Loam	NR	NR	NR
Hillsboro, OR; 2003 [WG-IR-008-03]	Silt Loam	NR	NR	NR
Cornelius, OR; 2003 [WG-IR-009-03]	Silt Loam	NR	NR	NR
Cornelius, OR; 2003 [WG-IR-010-03]	Silt Loam	NR	NR	NR

* NR - Not Reported.

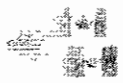


TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) Trial ID	EP [1]	Treatment #	Application Information [2]				
			Method; Timing	Spray Volume (GPA) [3]	Single Rate (lb ai/A)	RTI [4] (Days)	Total Rate (lb ai/A)
Montpelier, VA; 2003 EB-IR-003-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 41.	9	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 41.		0.032	36	0.064
			3. Broadcast foliar application to regrowth at BBCH 41.		0.032	27	0.096
		3	1. Broadcast foliar application at BBCH 41.	9	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 40.		0.033	36	0.065
			3. Broadcast foliar application to regrowth at BBCH 41.		0.032	27	0.097
York, NE; 2003 NB-IR-002-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 32.	20	0.031	--	0.031
			2. Broadcast foliar application to regrowth at BBCH 15.		0.032	41	0.063
			3. Broadcast foliar application to regrowth at BBCH 15.		0.032	41	0.095
		3	1. Broadcast foliar application at BBCH 32.	2	0.031	--	0.031
			2. Broadcast foliar application to regrowth at BBCH 15.		0.032	41	0.063
			3. Broadcast foliar application to regrowth at BBCH 15.		0.032	41	0.095
		4	Broadcast foliar application to mature grass (BBCH 87)	20	0.031	NA [5]	0.031
Corsica, SD; 2003 NC-IR-001-03	2.08 lb ai/gal CS	2	Broadcast foliar application at BBCH 32.	19	0.031	NA	0.031
		3	Broadcast foliar application at BBCH 32.	19	0.031	NA	0.031

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) Trial ID	EP [1]	Treatment #	Application Information [2]				
			Method; Timing	Spray Volume (GPA) [3]	Single Rate (lb ai/A)	RTI [4] (Days)	Total Rate (lb ai/A)
Kirksville, MO; 2003 ND-IR-001-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 37.	12-16	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 17.		0.032	37	0.064
			3. Broadcast foliar application to regrowth at BBCH 19.		0.032	56	0.096
		3	1. Broadcast foliar application at BBCH 37.	12-16	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 17.		0.032	37	0.064
			3. Broadcast foliar application to regrowth at BBCH 19.		0.031	56	0.095
		4	Broadcast foliar application to mature grass (BBCH 85-89).	17	0.032	NA	0.032
Roseau, MN 2003 NN-IR-003-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 51.	13-15	0.031	-	0.031
			2. Broadcast foliar application to regrowth at BBCH 50.		0.031	46	0.062
		3	1. Broadcast foliar application at BBCH 51.	13-15	0.031	--	0.031
			2. Broadcast foliar application to regrowth at BBCH 50.		0.031	46	0.062
		4	Broadcast foliar application to mature grass (BBCH 63).	13	0.032	NA	0.032
Leland, MS; 2003 S3-IR-002-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 63.	2.2	0.031	--	0.031
			2. Broadcast foliar application to regrowth at BBCH 65.		0.031	31	0.062
			3. Broadcast foliar application to regrowth at BBCH 63.		0.031	33	0.093
		3	1. Broadcast foliar application at BBCH 63.	2.2	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 65.		0.031	31	0.063
			3. Broadcast foliar application to regrowth at BBCH 63.		0.032	33	0.095

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) Trial ID	EP [1]	Treatment #	Application Information [2]				
			Method; Timing	Spray Volume (GPA) [3]	Single Rate (lb ai/A)	RTI [4] (Days)	Total Rate (lb ai/A)
East Bernard, TX; 2003 SA-IR-003-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 63.	12-15	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 65.		0.034	54	0.064
			3. Broadcast foliar application to regrowth at BBCH 63.		0.032	59	0.098
		3	1. Broadcast foliar application at BBCH 63.	12-14	0.034	-	0.034
			2. Broadcast foliar application to regrowth at BBCH 65.		0.034	53	0.068
			3. Broadcast foliar application to regrowth at BBCH 63.		0.031	60	0.099
Plainview, TX; 2003 SC-IR-002-03	2.08 lb ai/gal CS	2	1. Broadcast Foliar application at boot stage.	1.9-2.1	0.032	-	0.032
			2. Broadcast Foliar application to regrowth at height of 6-8".		0.030	59	0.062
		3	1. Broadcast Foliar application at boot stage.	2.0	0.031		0.031
			2. Broadcast Foliar application to regrowth at height of 6-8".		0.032	59	0.063
Moses Lake, WA; 2003 WF-IR-009-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at mid-boot (BBCH43).	18-19	0.031		0.031
			2. Broadcast foliar application to regrowth at 12-14" (BBCH41).		0.031	33	0.062
		3	1. Broadcast foliar application at mid-boot (BCHH43).	19	0.031	-	0.031
			2. Broadcast foliar application to regrowth at 12-14" (BBCH 41).		0.031	33	0.062
		4	Single broadcast foliar application 7 days before cutting of mature grass (BBCH 89).	18	0.031	NA	0.031

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) Trial ID	EP[1]	Treatment #	Application Information[2]				
			Method; Timing	Spray Volume (GPA)[3]	Single Rate (lb ai/A)	RTI[4] (Days)	Total Rate (lb ai/A)
Raft River, ID 2003 WG-IR-007-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application during vegetative stage.	10	0.031	--	0.031
			2. Broadcast foliar application to regrowth during vegetative stage.		0.031	37	0.062
			3. Broadcast foliar application to regrowth during vegetative stage.		0.031	48	0.093
		3	1. Broadcast foliar application during vegetative stage.	10	0.032	--	0.032
			2. Broadcast foliar application to regrowth during vegetative stage.		0.032	37	0.064
			3. Broadcast foliar application to regrowth during vegetative stage.		0.032	48	0.096
		4	Broadcast foliar application to mature grass.	10	0.031	NA	0.031
Hillsboro, OR 2003 WG-IR-008-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 40.	20	0.030	--	0.030
			2. Broadcast foliar application to regrowth at BBCH 19.		0.032	14	0.062
			3. Broadcast foliar application to regrowth at BBCH 44.		0.031	14	0.093
		3	1. Broadcast foliar application at BBCH 40.	20	0.031	--	0.031
			2. Broadcast foliar application to regrowth at BBCH 19.		0.031	21	0.062
			3. Broadcast foliar application to regrowth at BBCH 49.		0.032	21	0.093
		4	Broadcast foliar application to mature grass (BBCH 98).	20	0.031	NA	0.031
Cornelius, OR 2003 WG-IR-009-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 43.	20	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 19.		0.030	14	0.062
			3. Broadcast foliar application to regrowth at BBCH 19.		0.030	14	0.092
		3	1. Broadcast foliar application at BBCH 40.	20	0.032	--	0.032
			2. Broadcast foliar application to regrowth at BBCH 19.		0.030	21	0.062
			3. Broadcast foliar application to regrowth at BBCH 29.		0.031	21	0.093
		4	Broadcast foliar application to mature grass (BBCH 93).	20	0.032	NA	0.032

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) Trial ID	EP [1]	Treatment #	Application Information [2]				
			Method; Timing	Spray Volume (GPA) [3]	Single Rate (lb ai/A)	RTI [4] (Days)	Total Rate (lb ai/A)
Cornelius, OR; 2003 WG-IR-010-03	2.08 lb ai/gal CS	2	1. Broadcast foliar application at BBCH 43.	20	0.032	-	0.032
			2. Broadcast foliar application to regrowth at BBCH 19.		0.031	14	0.063
			3. Broadcast foliar application to regrowth at BBCH 44.		0.031	14	0.094
		3	1. Broadcast foliar application at BBCH 41.	20	0.032		0.032
			2. Broadcast foliar application to regrowth at BBCH 19.		0.032	21	0.064
			3. Broadcast foliar application to regrowth at BBCH 29.		0.031	21	0.095
		4	Broadcast foliar application to mature grass (BBCH 93).	20	0.031	NA	0.031

1. The 2.08 lb ai/gal capsule suspension (CS) formulation is equivalent to a microencapsulated formulation.
2. None of the field trials included the use of any tank-mix/spray adjuvants.
3. GPA = Gallons Per Acre.
4. RTI = Re-Treatment Interval
5. NA = Not Applicable.

TABLE B.1.3 Trial Numbers and Geographical Locations.

NAFTA Growing Zones	Grasses		
	Submitted	Requested [1]	
		Canada	U.S.
1	1	--	--
2	--	--	--
3	--	--	--
4	1	--	--
5	3	--	
6	1	--	-
7	1	--	--
8	1	--	--
9	--	--	
10	1 [2]	--	-
11	2	--	--
12	3	--	-
Total	**13**	**--**	**12** [3]

1. Table 5 from OPPTS Residue Chemistry Test Guideline 860.1500 does not identify the required distribution of field trials for grass, but rather states that grass trials are to be from "all areas across the country."
2. Another trial in CA (Region 10) wasn't reviewed as no field trial info (use rates, dates, PTIs, etc.) were reported.
3. Number of grass field trials required for crop group tolerance on grass forage, fodder, and hay, Group 17.

B.2. Sample Handling and Preparation

For Treatments #2 and #3, single control and duplicate treated samples of forage were cut and sampled following each application at 0-3 DAT, while single control and duplicate treated samples of hay were cut at 5-11 DAT (Treatment #2) or 12-17 DAT (Treatment #3). For Treatment #4, single control and duplicate samples of mature straw and seed screenings were collected at 7-19 DAT following the single application. Following regrowth, single control and duplicate treated samples of forage and hay were also collected from two subsequent untreated cuttings (36-50 DAT and 51-64 DAT). For all treatments, samples of forage, straw, and seed screening were frozen following harvest; samples of hay were allowed to dry in the field for 1-7 days prior to sampling. Details regarding sample storage at the field sites were not provided, but the report stated that all samples were frozen after collection, and transported frozen to the analytical laboratory (Syngenta Crop Protection in Greensboro, NC) where samples were stored frozen until extraction for analysis.

B.3. Analytical Methodology

Samples of grass forage, hay, straw, and seed screenings were analyzed for residues of lambda-cyhalothrin and R157836 using a GC/ECD method, which is a modified version of Method CCRL-MTH-023, *Analytical Method For the Determination of Lambda-Cyhalothrin and R157836 in Pasture grasses/Forage*. Method CCRL-MTH-023 is based on the current tolerance enforcement method (PRAM 81). In the current study, the major modifications to Method CCRL-MTH-023 included omitting the liquid/liquid partitioning step, and replacing the Florisil cleanup with a silica SPE cleanup step.

For the modified method, residues of lambda-cyhalothrin and R157836 were extracted from grass matrices using acetone/hexane (1:1, v/v), filtered, and an aliquot of the resulting organic extract was concentrated to dryness. Residues were re-dissolved in hexane, and loaded onto a silica gel SPE cartridge. The cartridge was then washed with hexane/ether (19:1, v/v), the residues were eluted with hexane/ether (9:1, v/v), and concentrated to dryness. Residues of both analytes were then determined by a single injection using GC/ECD with external standards. The validated LOQs for each grass matrix were 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836. The LODs were not reported.

C. RESULTS AND DISCUSSION

In 13 field trials conducted in growing zones 1, 4, 5, 6, 7, 8, 11, and 12 during 2003, lambda-cyhalothrin (2.08 lb ai/gal CS) was applied to a variety of grasses as a single broadcast foliar application per cutting. Each trial site (except one in SD, where only one application was made, at the rate of 0.031 lb ai/A) included two treatments (#2 and #3) in which lambda-cyhalothrin (2.08 lb ai/gal CS) was applied to grasses (at the 6-8" to boot stage), at rates of 0.030-0.034 lb ai/A per application, for a total of two (0.062-0.063 lb ai/A; 3 sites) or three (0.092-0.099 lb ai/A; 9 sites) applications. Following each application, forage was cut at ~0 DAT, and hay was cut at ~7 DAT (Treatment #2) or ~14 DAT (Treatment #3), and the grass was

allowed to regrow between applications. The RTIs were 14-60 days for applications to successive cuttings. At eight of the trial sites, lambda-cyhalothrin (2.08 lb ai/gal CS) was also applied to grass (at maturity) as a single broadcast foliar application at rates of 0.031-0.032 lb ai/A (Treatment #4). All applications were made using ground equipment in spray volumes of 2-20 GPA, and did not include the use of any adjuvants.

Following each application in Treatments #2 and #3, single control and duplicate treated samples of forage were cut and collected at 0-3 DAT, while single control and duplicate treated samples of hay were cut at 5-11 DAT (Treatment #2) or 12-17 DAT (Treatment #3). For Treatment #4, single control and duplicate samples of straw and seed screenings were collected at 7-19 DAT; samples of forage and hay were also collected from two untreated cuttings (36-50 DAT and 51-64 DAT) after regrowth of the grass. For all treatments, samples of hay were allowed to dry in the field for 1-7 days prior to sampling.

The GC/ECD method (CCRL-MTH-023, modified) used to determine residues of lambda-cyhalothrin and R157836 in grass matrices was adequately validated in conjunction with the analysis of field trial samples. For lambda-cyhalothrin, overall concurrent recoveries averaged 93% (with standard deviation of 16%) from forage fortified at 0.003-0.69 ppm, 89% (std. dev. 16%) from hay fortified at 0.003-3.4 ppm, 85% (std. dev. 14%) from straw fortified at 0.003-3.4 ppm, and 91% (std. dev. 17%) from seed screenings fortified at 0.003-0.69 ppm (see Table C.1, below). For R157836, overall concurrent recoveries averaged 93% (std. dev. 15%) from forage fortified at 0.007-1.3 ppm, 95% (std. dev. 18%) from hay fortified at 0.007-6.6 ppm, 80% (std. dev. 11%) from straw fortified at 0.007-6.6 ppm, and 85% (std. dev. 16%) from seed screenings fortified at 0.007-1.3 ppm. The majority of control samples for each grass matrix had residues <LOQ for each analyte. Although apparent residues above the LOQ were detected for both parent and R157836 in selected control samples, these residue levels are not expected to adversely impact the residue data because residue levels in these control samples were substantially lower than in the associated treated samples. Adequate sample calculations and example chromatograms were provided.

Samples were stored frozen for durations of up to 8.5 months prior to extraction (see Table C.2, below). Adequate storage stability data have been previously reviewed (PP#1F3952/1H5607; M. Flood; 9/19/1991) indicating that lambda-cyhalothrin and R157836 are stable at -18°C for intervals of up to 26 months in peaches, peas, rapeseed, wheat grain, sugar beet roots, cottonseed, apples, cabbage, and potatoes. As residues have been shown to be stable on a wide variety of frozen plant matrices, these data will support the sample storage conditions and durations for the current grass study.

TABLE C.1	Summary of Concurrent Validation Recoveries of Lambda-Cyhalothrin and R157836 from Grass Matrices.				
Matrix	**Analyte**	**Spike Level (ppm)**	**Samples (n)**	**Recoveries (%)**	**Mean [Std. Dev.] (%)**
Forage	Lambda-Cyhalothrin	0.003	28	87, 127, 119, 73, 86, 85, 105, 100, 92, 81, 102, 119, 111, 74, 90, 90, 117, 129, 114, 91, 113, 87, 108, 91, 83, 87, 118, 73	98 [17]
		0.017	46	74, 125, 94, 67, 75, 66, 99, 114, 84, 72, 98, 138, 87, 61, 94, 98, 106	91 [16]
		0.034	26	86, 83, 92, 100, 117, 103, 127, 65, 74, 95, 71, 110, 88, 88, 102, 100, 114, 115, 136, 97, 95, 98, 75, 97, 74, 90, 87, 84, 89, 84, 85, 65, 83, 105, 106, 89, 70, 83, 80, 91, 82, 89, 101, 61, 77, 103	91 [18]
		0.17	24	104, 74, 112, 80, 110, 109, 79, 91, 129, 85, 96, 80, 115, 94, 88, 87, 94, 106, 98, 103, 89, 83, 85, 91, 85, 86, 94, 87, 79, 83, 97, 89, 78	94 [14]
		0.34	21	95, 75, 96, 101, 89, 62, 88, 90, 101, 130, 70, 112, 93, 111, 98, 99, 77, 91, 86, 90, 96	93 [15]
		0.69	19	66, 126, 92, 98, 84, 76, 100, 93, 75, 129, 65, 91, 114, 100, 77, 91, 84, 100, 73	91 [18]
		Overall	**164**	**61-138**	**93 [16]**
Hay	Lambda-Cyhalothrin	0.003	26	92, 71, 85, 116, 129, 78, 137, 87, 113, 65, 87, 96, 96, 95, 110, 92, 134, 70, 107, 102, 88, 95, 73, 77, 66, 104	95 [20]
		0.017	38	95, 70, 97, 85, 77, 96, 86, 69, 109, 98, 122, 65, 80, 80, 94, 117, 63, 89, 88, 77, 118, 77, 76, 71, 108, 66, 66, 101, 90, 81, 110, 81, 107, 74, 79	89 [16]
		0.034	35	63, 68, 121, 86, 115, 76, 96, 96, 115, 62, 91, 83, 88, 75, 95, 90, 65, 96, 101, 89, 109, 86, 101, 99, 60, 76, 111, 70, 84, 116, 87, 84, 99, 86, 82, 75, 90, 95	87 [16]
		0.17	33	82, 65, 75, 96, 112, 80, 85, 88, 70, 68, 92, 85, 82, 74, 74, 100, 108, 92, 75, 119, 92, 92, 75, 94, 102, 94, 93, 73, 98, 73, 88, 94, 105	88 [13]
		0.34	22	103, 89, 84, 103, 92, 81, 66, 76, 81, 84, 95, 85, 74, 93, 65, 77, 80, 86, 89, 99, 81, 78	85 [10]
		0.69	10	68, 97, 86, 84, 90, 88, 95, 84, 83, 73	85 [9]
		3.4	12	83, 122, 114, 106, 128, 105, 86, 84, 80, 93, 66, 68	95 [20]
		Overall	**176**	**60-137**	**89 [16]**

TABLE C.1	Summary of Concurrent Validation Recoveries of Lambda-Cyhalothrin and R157836 from Grass Matrices.				
Matrix	**Analyte**	**Spike Level (ppm)**	**Samples (n)**	**Recoveries (%)**	**Mean [Std. Dev.] (%)**
Straw	Lambda-Cyhalothrin	0.69	3	69, 90, 81	80 [11]
		0.17	3	84, 81, 81	82 [2]
		3.4	2	108, 72	90
		0.017	3	108, 82, 85	92 [14]
		0.034	2	70, 81	76 [8]
		0.003	2	116, 84	100
		0.34	1	74	NA*
		Overall	**16**	**69-116**	**85 [14]**
Seed Screenings	Lambda-Cyhalothrin	0.003	3	137, 81, 127	115 [30]
		0.017	4	95, 101, 90, 85	93 [7]
		0.69	2	71, 79	75 [6]
		0.034	5	104, 69, 83, 93, 73	84 [14]
		0.34	5	97, 76, 87, 88, 79	85 [8]
		0.17	2	102, 100	101 [1]
		Overall	**21**	**69-137**	**91 [17]**
Forage	R157836	0.007	23	114, 103, 80, 78, 96, 102, 101, 112, 124, 64, 72, 123, 82, 128, 73, 73, 100, 80, 118, 85, 101, 91, 113	96 [19]
		0.033	26	73, 121, 100, 96, 69, 100, 102, 100, 65, 79, 106, 138, 94, 109, 83, 98, 102, 89, 117, 118, 85, 74, 83, 87, 71, 95	94 [18]
		0.066	42	91, 105, 101, 98, 104, 74, 109, 89, 98, 77, 123, 92, 84, 99, 98, 117, 103, 79, 107, 89, 98, 78, 98, 83, 84, 89, 94, 82, 71, 61, 88, 98, 113, 84, 70, 93, 79, 91, 64, 90, 68, 100	91 [14]
		0.33	27	105, 99, 118, 93, 110, 104, 113, 84, 95, 109, 94, 97, 91, 110, 127, 98, 88, 89, 85, 104, 99, 80, 78, 91, 104, 90, 79	98 [12]
		0.65	1	98	NA
		0.66	20	75, 68, 100, 103, 90, 88, 104, 86, 69, 110, 91, 114, 98, 89, 78, 90, 93, 86, 92, 63	89 [14]
		1.3	18	69, 111, 100, 85, 83, 73, 102, 94, 76, 120, 90, 120, 98, 64, 89, 85, 94, 80	91 [16]
		Overall	**157**	**61-138**	**93 [15]**

TABLE C.1 Summary of Concurrent Validation Recoveries of Lambda-Cyhalothrin and R157836 from Grass Matrices.

Matrix	Analyte	Spike Level (ppm)	Samples (n)	Recoveries (%)	Mean [Std. Dev.] (%)
Hay	R157836	0.007	21	86, 64, 70, 94, 92, 94, 71, 94, 72, 86, 87, 89, 67, 85, 65, 98, 82, 75, 107, 85, 114	85 [14]
		0.033	34	89, 75, 95, 83, 82, 80, 98, 65, 70, 100, 91, 111, 74, 136, 75, 63, 91, 88, 127, 119, 65, 71, 76, 90, 123, 121, 96, 87, 82, 101, 77, 88, 66, 60	89 [20]
		0.066	41	79, 82, 81, 123, 96, 136, 72, 90, 101, 93, 65, 88, 80, 125, 62, 75, 100, 67, 99, 93, 87, 111, 86, 87, 103, 63, 81, 100, 77, 84, 93, 120, 77, 82, 96, 103, 105, 78, 76, 72, 83	90 [17]
		0.33	31	70, 81, 96, 99, 83, 88, 95, 88, 74, 65, 67, 82, 82, 74, 78, 99, 99, 94, 73, 91, 95, 97, 74, 98, 90, 69, 101, 75, 76, 78, 104	85 [12]
		0.66	23	94, 89, 86, 95, 108, 88, 71, 78, 75, 91, 81, 96, 87, 79, 85, 70, 86, 65, 89, 97, 79, 63, 76	84 [11]
		1.3	9	86, 93, 83, 85, 89, 89, 90, 83, 74	86 [6]
		6.6	12	84, 120, 105, 118, 100, 88, 86, 77, 93, 62, 118, 88	95 [18]
		Overall	**171**	**60-136**	**87 [15]**
Straw	R157836	1.3	3	66, 89, 85	80 [12]
		0.033	4	87, 103, 85, 76	86 [11]
		6.6	2	88, 63	76
		0.33	2	83, 85	84
		0.066	2	67, 66	87
		0.007	1	73	NA
		0.66	1	78	NA
		Overall	**15**	**63-103**	**80 [11]**
Seed Screenings	R157836	0.007	2	117, 90	104
		0.033	4	110, 95, 84, 78	92 [14]
		1.3	2	77, 75	76
		0.066	5	113, 68, 88, 64, 69	80 [20]
		0.66	5	90, 79, 88, 88, 78	85 [6]
		0.33	1	61	NA
		Overall	**19**	**61-117**	**85 [16]**

* NA = Not Applicable.

TABLE C.2 Summary of Storage Conditions.

Crop [Matrix]	Storage Temperature (°C)	Actual Storage Duration (Months)[1]	Interval of Demonstrated Storage Stability (Months)[2]
Grass [Forage, Hay, Straw, Seed Screenings]	<-18	8.5	26

1. Storage duration from harvest to analysis.
2. PP#1F3952/1H5607; M. Flood; 9/19/1991.

Regardless of treatment or sampling interval, lambda-cyhalothrin was the major component of the residue in all commodities, accounting for 88 ± 9% of the combined residues in forage, 87 ± 7% of the combined residues in hay, 85 ± 4% of the combined residues in straw, and 89 ± 4% of the combined residues in seed screenings.

For Treatment #2, combined residues in forage harvested at 0-3 DAT were 0.13-8.04 ppm after the first application, 1.07-5.03 ppm after the second application, and 0.67-5.53 ppm after the third application (see Table C.3, below). Combined residues in hay harvested at 5-11 DAT were 0.50-3.84 ppm after the first application, 1.28-6.01 ppm after the second application, and <0.01-5.14 ppm after the third application. Average combined residues following the first, second and third applications were respectively 2.15, 2.81, and 2.63 ppm in forage, and 1.50, 2.89, and 2.43 ppm in hay (see Table C.4.1, below).

For Treatment #3, combined residues in forage harvested at 0-1 DAT were 0.41-5.29 ppm after the first application, 1.21-5.82 ppm after the second application, and 1.06-6.24 ppm after the third application (see Table C.3, below). Combined residues in hay harvested at 11-17 DAT were 0.26-2.01 ppm after the first application, 0.29-4.04 ppm after the second application, and 0.52-4.11 ppm after the third application. Average combined residues following the first, second and third applications were respectively 2.03, 2.83, and 3.16 ppm in forage, and 0.96, 1.46, and 1.80 ppm in hay (see Table C.4.1, below).

The residue data on forage and hay from both Treatments #2 and #3 indicate that there is a trend toward slightly higher residues following repeated applications to separate cuttings (see Figure C.3, below). For forage harvested at ~0 DAT from both treatments, average combined residues were lowest following the first application (2.09 ppm), but were similar following the second and third applications (2.82 and 2.89 ppm). However, the maximum residues observed in any forage sample (8.04 ppm) occurred following the first application. For hay from ~7 DAT (Treatment #2), average combined residues were also lowest following the first application (1.50 ppm), and were similar for the second and third applications (2.89 and 2.43 ppm). For hay from ~14 DAT (Treatment #3), average combined residues were again lowest after the first application (0.96 ppm), and then increased at both the second and third applications (1.46 and 1.80 ppm).

Comparison of the residue data on hay from Treatments #2 and #3 also indicates that residues declined at longer PTIs. When the data are pooled for all three applications, average combined residues in hay were 2.24 ppm at ~7 DAT and 1.36 ppm at ~14 DAT (see Table C.4.1, below). In addition, residue data on hay from the single residue decline trial showed that

residues declined at increasing PTIs (MO trial, Table C.3, below). Average combined residues in hay declined rapidly from 0 DAT (14.4 ppm) to 3 DAT (2.25 ppm), and then declined more gradually to 1.58 ppm by 11 DAT.

Following the single application to grasses grown for seed at 0.03 lb ai/A (Treatment #4), combined residues at 7-19 DAT were 0.35-7.80 ppm in straw, and 0.80-3.23 ppm in seed screenings (see Table C.3, below). Average combined residues were respectively 2.15 and 1.86 ppm in straw and seed screenings (see Table C.4.2, below). Carryover of residues to subsequent cuttings of forage and hay was low. Average combined residues were respectively 0.05 and 0.012 ppm in forage and hay from the 1st regrowth (36-50 DAT), and 0.04 ppm in both forage and hay from the second regrowth (51-64 DAT).

Common cultural practices were used to maintain plants; the weather conditions, maintenance chemicals, and fertilizer used in the study did not have a notable impact on the residue data.

TABLE C.3 Residue Data from Grass Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) Trial ID	Zone	Grass Type (Variety)	Treatment #	Application #	Total Rate (lb ai/A)	Commodity	PHI [1] (Days)	Residues (ppm) [2]		
								Lambda-cyhalothrin	R157636	Combined [3]
Montpelier, VA; 2003 EB-IR-003-03	2	Orchard Grass (unknown)	2	1	0.03	Forage	0	2.2, 2.4	0.23, 0.23	2.43, 2.63
						Hay	6	2.9, 1.4	0.19, 0.098	3.09, 1.50
				2	0.06	Forage	0	4.7, 4.1	0.33, 0.28	5.03, 4.38
						Hay	7	3.6, 5.1	0.43, 0.91	4.03, 6.01
				3	0.10	Forage	0	2.1, 0.6	0.20, 0.066	2.30, 0.67
						Hay	7	<0.003 [4], 1.5 [4]	<0.007 [4], 0.31 [4]	0.01, 1.81
			3	1	0.03	Forage	0	3.5, 2.7	0.37, 0.32	3.87, 3.02
						Hay	15	0.72, 0.71	0.10, 0.10	0.82, 0.81
				2	0.06	Forage	0	2.7, 5.5	0.20, 0.32	2.90, 5.82
						Hay	12	2.2, 1.9	0.62, 0.39	2.82 2.29
				3	0.10	Forage	0	4.5, 3.3	0.40, 0.30	4.90, 3.60
						Hay	14	1.4, 1.4	0.25 [4], 0.26 [4]	1.65, 1.66
York, NE; 2003 NB-IR-002-03	5	Smooth Bromegrass (Lincoln)	2	1	0.03	Forage	0	0.72 [4], 1.2 [4]	0.048 [4], 0.074 [4]	0.77, 1.27
						Hay	7	1.0, 1.2	0.16, 0.18	1.16, 1.38
				2	0.06	Forage	0	3.2, 3.1	0.28, 0.28	3.48, 3.38
						Hay	6	2.4, 2.7	0.32, 0.49	2.72, 3.19
				3	0.09	Forage	0	2.9, 4.0	0.50, 0.62	3.40, 4.62
						Hay	7	1.8, 2.0	0.46, 0.45	2.26, 2.45
			3	1	0.03	Forage	0	1.1, 1.2	0.14, 0.15	1.24, 1.35
						Hay	14	0.45, 0.49	0.062, 0.045	0.51, 0.54
				2	0.06	Forage	0	2.7, 2.8	0.24, 0.24	2.94, 3.04
						Hay	14	1.2, 1.3	0.14, 0.16	1.34, 1.46
				3	0.09	Forage	0	5.2, 5.0	0.43, 0.63	5.63, 5.63
						Hay	13	0.72, 1.2	0.17 [4], 0.26 [4]	0.89, 1.46
			4	1	0.03	Straw	9	2.2, 2.1	0.30, 0.21	2.50, 2.31
						Seed Screenings	7	2.1, 2.1	0.12, 0.11	2.22, 2.21
						Forage (1st regrowth)	36	0.005, 0.007	<0.007, <0.007	0.01, 0.01
						Hay (1st regrowth)	36	0.024 [4], 0.019 [4]	<0.007, <0.007	0.03, 0.03

TABLE C.3 Residue Data from Grass Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) Trial ID	Zone	Grass Type (Variety)	Treat-ment #	Appli-cation #	Total Rate (lb ai/A)	Commodity	PHI [1] (Days)	Residues (ppm) [2]		
								Lambda-cyhalothrin	R157636	Combined [3]
						Forage (2nd regrowth)	51	0.005, 0.004	<0.007, <0.007	0.01, 0.01
						Hay (2nd regrowth)	51	0.004, 0.003	<0.007, <0.007	0.01, 0.01
Corsica, SD; 2003 NC-IR-001-03	5	Bromegrass (unknown)	2	1	0.03	Forage	0	2.2, 2.4	0.16, 0.18	2.36, 2.58
						Hay	7	1.4, 0.46	0.14, 0.043	1.54, 0.50
			3	1	0.03	Forage	1	2.2, 2.0	0.14, 0.12	2.34, 2.12
						Hay	14	0.98, 1.0	0.089, 0.080	1.07, 1.08
Kirksville, MO; 2003 ND-IR-001-03	5	Fescue (Kentucky 31)	2	1	0.03	Forage	0	1.6, 1.5	0.23, 0.21	1.83, 1.71
						Hay	6	1.5, 1.7	0.22 [4], 0.22 [4]	1.72, 1.92
				2	0.06	Forage	0	2.2, 3.2	0.79, 1.1	2.99, 4.30
						Hay	0	12, 13	1.8 [4], 1.9 [4]	13.8, 14.9
						Hay	3	1.9, 2.2	0.19, 0.21	2.09, 2.41
						Hay	5	2.0, 1.2	0.083, 0.25	2.08, 1.45
						Hay	8	0.95, 0.99	0.16, 0.15	1.11, 1.14
						Hay	11	1.4, 1.4	0.18, 0.17	1.58, 1.57
				3	0.10	Forage	3	1.5, 1.8	1.0, 1.3	2.50, 3.10
						Hay	7	2.7, 3.0	0.73, 0.12	3.43, 3.12
			3	1	0.03	Forage	0	1.3, 1.0	0.20, 0.19	1.50, 1.19
						Hay	14	0.57, 0.87	0.062, 0.091	0.63, 0.96
				2	0.06	Forage	0	3.0, 3.1	0.51, 0.63	3.51, 3.73
						Hay	17	0.69, 0.69	0.096, 0.089	0.79, 0.78
				3	0.09	Forage	0	2.3, 3.1	0.40, 0.44	2.70, 3.54
						Hay	15	0.99, 1.3	0.57, 0.76	1.56, 2.06
			4	1	0.03	Straw	8	6.8, 5.7	1.0, 0.84	7.80, 6.54
						Seed Screenings	8	2.7, 2.7	0.53, 0.51	3.23, 3.21
						Forage (1st regrowth)	39	0.15, 0.078	0.042, 0.033	0.19, 0.11
						Hay (1st regrowth)	41	0.96, 0.24	0.11, 0.023	1.07, 0.26
						Forage (2nd regrowth)	54	0.15, 0.23	0.040 [4], 0.048 [4]	0.19, 0.28
						Hay (2nd regrowth)	54	0.094, 0.067	0.013, <0.007	0.11, 0.07

TABLE C.3 Residue Data from Grass Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) Trial ID	Zone	Grass Type (Variety)	Treat-ment #	Appli-cation #	Total Rate (lb ai/A)	Commodity	PHI [1] (Days)	Residues (ppm) [2]		
								Lambda-cyhalothrin	R157636	Combined [3]
Roseau, MN: 2003 NN-IR-003-03	5	(Bluegrass) Park	2	1	0.03	Forage	0	4.6 [4], 7.2	0.54 [4], 0.84 [4]	5.14, 8.04
						Hay	7	1.7, 1.5	0.14 [4], 0.13 [4]	1.84, 1.63
				2	0.06	Forage	0	4.1, 3.7	0.51, 0.46	4.61, 4.16
						Hay	7	5.1, 5.2	0.42, 0.43	5.52, 5.63
			3	1	0.03	Forage	0	3.0, 0.74	0.043, 0.42	3.04, 1.16
						Hay	14	1.2, 0.98	0.12 [4], 0.087 [4]	1.32, 1.07
				2	0.06	Forage	0	2.2, 5.3	0.20, 0.48	2.40, 5.78
						Hay	14	2.1, 0.77	0.22, 0.043	2.32, 0.81
			4	1	0.03	Straw	7	1.4, 1.3	0.21, 0.13	1.61, 1.43
						Seed Screenings	7	2.2, 1.6	0.30, 0.24	2.5, 1.84
						Forage (1st regrowth)	39	0.005, 0.003	<0.007, <0.007	0.01, 0.01
						Hay (1st regrowth)	39	0.018, 0.010	<0.007, <0.007	0.02, 0.01
						Forage (2nd regrowth)	53	0.009, 0.009	<0.007, <0.007	0.01, 0.01
						Hay (2nd regrowth)	53	0.070, 0.014	0.13, <0.007	0.20, 0.02
Leland, MS: 2003 S3-IR-002-03	4	Bermuda (unknown)	2	1	0.03	Forage	0	2.4, 3.6	0.25, 0.38	2.65, 3.98
						Hay	10	0.80, 0.74	0.16, 0.14	0.96, 0.88
				2	0.06	Forage	0	1.6, 2.0	0.23, 0.29	1.83, 2.29
						Hay	8	2.7, 2.6	0.48, 0.47	3.18, 3.07
				3	0.09	Forage	0	1.1, 1.8	0.17, 0.24	1.27, 2.04
						Hay	8	2.1, 1.9	0.24, 0.25	2.34, 2.15
			3	1	0.03	Forage	0	2.9, 2.0	0.24, 0.41	3.14, 2.41
						Hay	15	1.3, 1.8	0.18, 0.21	1.48, 2.01
				2	0.06	Forage	0	2.4, 2.0	0.24, 0.21	2.64, 2.21
						Hay	15	3.9, 2.3	0.14, 0.16	4.04, 2.46
				3	0.09	Forage	0	1.2, 2.1	0.18, 0.23	1.38, 2.33
						Hay	15	1.6, 1.1	0.18, 0.15	1.78, 1.25
East Bernard, TX: 2003	6	Pasture Grass	2	1	0.03	Forage	0	1.4, 1.0	0.17, 0.13	1.57, 1.13
						Hay	7	0.94, 1.3	0.11, 0.14	1.05, 1.44

TABLE C.3 Residue Data from Grass Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) Trial ID	Zone	Grass Type (Variety)	Treat-ment #	Appli-cation #	Total Rate (lb ai/A)	Commodity	PHI [1] (Days)	Residues (ppm) [2]		
								Lambda-cyhalothrin	R157636	Combined [3]
SA-IR-003-03		(Jiggs)		2	0.07	Forage	0	2.0, 1.4	0.23, 0.25	2.23, 1.65
						Hay	7	1.4, 1.2	0.16, 0.15	1.56, 1.35
				3	0.10	Forage	0	3.5, 2.9	0.35, 0.32	3.85, 3.22
						Hay	5	0.61, 0.88	0.076, 0.078	0.69, 0.96
			3	1	0.03	Forage	0	2.0, 1.9	0.23, 0.23	2.23, 2.13
						Hay	13	0.54, 0.72	0.099, 0.18	0.64, 0.90
				2	0.07	Forage	0	1.2, 1.2	1.0, 1.1	2.20, 2.30
						Hay	14	0.56, 0.80	0.081, 0.11	0.64, 0.91
				3	0.10	Forage	0	2.4, 3.1	0.23, 0.43	2.63, 3.53
						Hay	11	0.58, 0.51	0.067, 0.059	0.65, 0.57
Plainview, TX; 2003 SC-IR 002-03	8	Bermuda Grass (Cimmaron)	2	1	0.03	Forage	0	0.26, 1.0	0.025, 0.12	0.29, 1.12
						Hay	7	0.52, 1.3	0.088, 0.26 [4]	0.61, 1.56
				2	0.06	Forage	0	2.7, 3.3	0.16, 0.21	2.86, 3.51
						Hay	7	2.5, 5.0	0.45, 0.79	2.95, 5.79
			3	1	0.03	Forage	0	0.37, 0.87	0.040, 0.16 [4]	0.41, 1.03
						Hay	14	0.23, 0.98	0.027, 0.12	0.26, 1.10
				2	0.06	Forage	0	2.2, 3.1	0.24, 0.38	2.44, 3.48
						Hay	14	2.1, 1.5	0.20, 0.11	2.30, 1.66
Moses Lake, WA; 2003 WF-IR-009-03	11	Bluegrass (Blue Chip)	2	1	0.03	Forage	0	0.66, 0.77	0.083, 1.0	0.74, 1.77
						Hay	7	1.0, 1.0	0.090, 0.16	1.09, 1.16
				2	0.06	Forage	0	1.1, 1.1	0.20 [4], 0.20 [4]	1.30, 1.30
						Hay	7	1.8, 2.0	0.46, 0.47	2.26, 2.47
			3	1	0.03	Forage	0	1.1, 2.0	0.13, 0.26	1.23, 2.26
						Hay	14	0.71, 0.50	0.12, 0.088	0.83, 0.59
				2	0.06	Forage	0	2.5, 2.3	0.33, 0.31	2.83, 2.61
						Hay	14	1.4, 1.4	0.26, 0.25	1.66, 1.65
			4	1	0.03	Straw	7	0.48, 0.31	0.071, 0.039	0.55, 0.35
						Seed Screenings	7	0.96, 1.3	0.16, 0.22	1.12, 1.52

TABLE C.3 Residue Data from Grass Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) Trial ID	Zone	Grass Type (Variety)	Treat-ment #	Appli-cation #	Total Rate (lb ai/A)	Commodity	PHI [1] (Days)	Residues (ppm) [2]		
								Lambda-cyhalothrin	R157636	Combined [3]
						Forage (1st regrowth)	39	0.018, 0.036	0.008, 0.011	0.03, 0.05
						Hay (1st regrowth)	39	0.047, 0.039	0.021, 0.019	0.07, 0.06
						Forage (2nd regrowth)	53	0.010, 0.007	0.015, 0.015	0.03, 0.02
						Hay (2nd regrowth)	53	0.018, 0.018	0.007, <0.007	0.03, 0.03
Raft River, ID: 2003 WG-IR-007-03	11	Kentucky Bluegrass (mixed)	2	1	0.03	Forage	0	2.1, 1.1	0.14, 0.11	2.24, 1.21
						Hay	7	3.3, 3.0	0.54, 0.43	3.84, 3.43
				2	0.06	Forage	0	3.4, 4.4	0.40, 0.48	3.80, 4.88
						Hay	7	2.0, 1.3	0.33, 0.25	2.33, 1.55
				3	0.09	Forage	0	5.2, 4.4	0.33, 0.21	5.53, 4.61
						Hay	7	2.9, 3.3	0.54, 0.59	3.44, 3.89
			3	1	0.03	Forage	0	2.1, 1.1 [4]	0.039, 0.20	2.14, 1.3
						Hay	14	0.71, 0.72	0.31 [4], 0.31 [4]	1.02, 1.03
				2	0.06	Forage	0	2.9, 2.9	0.28, 0.23	3.18, 3.13
						Hay	14	0.63, 0.61	0.15, 0.16	0.78, 0.77
				3	0.10	Forage	0	4.3, 5.6	0.52, 0.64	4.82, 6.24
						Hay	14	2.1, 1.8	0.62, 0.48	2.72, 2.28
			4	1	0.03	Straw	7	1.6, 1.9	0.38, 0.41	1.98, 2.31
						Seed Screenings	7	1.6, 1.9	0.25, 0.22	1.85, 1.82
						Forage (1st regrowth)	37	0.11, 0.031	0.024, 0.010	0.13, 0.04
						Hay (1st regrowth)	37	0.071, 0.017	0.051, 0.016	0.12, 0.03
						Forage (2nd regrowth)	52	0.018, 0.010	<0.007, <0.007	0.03, 0.02
						Hay (2nd regrowth)	52	0.028, 0.027	0.008, 0.013	0.04, 0.04
Hillsboro, OR. 2003 WG-IR-008-03	12	Rye Grass (Pentium)	2	1	0.03	Forage	0	2.6, 4.5	0.39, 0.59	2.99, 5.09
						Hay	7	1.1, 1.6	0.18, 0.24	1.28, 1.84
				2	0.06	Forage	0	1.1, 1.0	0.091, 0.074	1.19, 1.07
						Hay	7	2.1, 2.5	0.16, 0.16	2.26, 2.66
				3	0.09	Forage	0	1.1, 1.3	0.19, 0.23	1.29, 1.53
						Hay	7	1.4, 1.4	0.16, 0.19	1.56, 1.59

TABLE C.3 Residue Data from Grass Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) Trial ID	Zone	Grass Type (Variety)	Treatment #	Application #	Total Rate (lb ai/A)	Commodity	PHI [1] (Days)	Residues (ppm) [2]		
								Lambda-cyhalothrin	R157636	Combined [3]
			3	1	0.03	Forage	0	5.0, 3.5	0.29, 0.25	5.29, 3.75
						Hay	14	1.2, 1.7	0.13, 0.15	1.33, 1.85
				2	0.06	Forage	0	1.4, 1.4	0.21, 0.21	1.61, 1.61
						Hay	14	1.4, 1.3	0.098, 0.12	1.50, 1.42
				3	0.09	Forage	0	1.0, 1.3	0.13, 0.14	1.13, 1.44
						Hay	14	1.2, 0.5	0.092, 0.024	1.29, 0.52
			4	1	0.03	Straw	18	1.0, 1.4	0.25, 0.18	1.25, 1.58
						Seed Screenings	18	1.3, 1.2	0.13, 0.12	1.43, 1.32
						Forage (1st regrowth)	48	0.025 [4], 0.023 [4]	<0.007, <0.007	0.03, 0.03
						Hay (1st regrowth)	48	0.036, 0.069	<0.007, 0.009	0.04, 0.08
						Forage (2nd regrowth)	63	0.013, 0.021	<0.007, <0.007	0.02, 0.03
						Hay (2nd regrowth)	63	0.052 [4], 0.042 [4]	0.009, 0.007	0.06, 0.05
Cornelius, OR, 2003 WG-IR-009-03	12	Orchard Grass (Hallmark)	2	1	0.03	Forage	0	0.075, 0.091	0.053, 0.054	0.13, 0.15
						Hay	7	0.95, 1.0	0.099, 0.10	1.05, 1.10
				2	0.06	Forage	0	1.3, 1.9	0.11, 0.16	1.41, 2.06
						Hay	7	1.1, 2.3	0.18, 0.26	1.28, 2.56
				3	0.09	Forage	0	1.8, 2.3	0.35, 0.52	2.15, 2.82
						Hay	7	3.6, 4.7	0.35, 0.44	3.95, 5.14
			3	1	0.03	Forage	0	0.50, 0.96	0.031, 0.051	0.53, 1.01
						Hay	14	0.53, 0.45	0.054, 0.056	0.58, 0.51
				2	0.06	Forage	0	2.5, 2.2	0.15, 0.13	2.65, 2.33
						Hay	14	1.0, 0.87	0.083, 0.098	1.08, 0.97
				3	0.09	Forage	0	2.2, 2.3	0.18, 0.19	2.38, 2.49
						Hay	14	3.6, 3.7	0.39, 0.41	3.99, 4.11
			4	1	0.03	Straw	15	0.80, 0.83	0.18, 0.18	0.98, 1.01
						Seed Screenings	15	0.69, 0.80	0.11, 0.11	0.8, 0.91
						Forage (1st regrowth)	45	0.11, 0.09	<0.007, 0.008	0.12, 0.10
						Hay (1st regrowth)	45	0.022, 0.019	<0.007, <0.007	0.03, 0.03

TABLE C.3 Residue Data from Grass Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) Trial ID	Zone	Grass Type (Variety)	Treat-ment #	Appli-cation #	Total Rate (lb ai/A)	Commodity	PHI [1] (Days)	Residues (ppm) [2]		
								Lambda-cyhalothrin	R157636	Combined [3]
						Forage (2nd regrowth)	60	0.009, 0.006	0.023, 0.013	0.03, 0.02
						Hay (2nd regrowth)	60	0.009, 0.022	0.007, 0.008	0.02, 0.03
Cornelius, OR; 2003 WG-IR-010-03	12	Tall Fescue (Rebel Exceed)	2	1	0.03	Forage	0	1.0, 1.0	0.086, 0.082	1.09, 1.08
						Hay	7	0.86, 0.49	0.074, 0.025	0.93, 0.52
				2	0.06	Forage	0	1.6, 1.8	0.10, 0.11	1.70, 1.91
						Hay	7	1.8, 1.6	0.24, 0.22	2.04, 1.82
				3	0.09	Forage	0	1.1, 0.96	0.18, 0.17	1.28, 1.13
						Hay	7	2.4, 2.2	0.26, 0.19	2.66, 2.39
			3	1	0.03	Forage	0	1.4, 1.5	0.087, 0.088	1.49, 1.59
						Hay	14	0.68, 0.95	0.15, 0.20	0.83, 1.15
				2	0.06	Forage	0	1.2, 1.1	0.12, 0.11	1.32, 1.21
						Hay	14	0.27, 0.32	0.019, 0.030	0.29, 0.35
				3	0.09	Forage	0	0.94, 1.2	0.12, 0.16	1.06, 1.36
						Hay	14	1.3, 2.0	0.25, 0.39	1.55, 2.39
			4	1	0.03	Straw	19	0.90, 0.85	0.26, 0.22	1.16, 1.07
						Seed Screenings	19	1.5, 1.9	0.13, 0.17	1.63, 2.07
						Forage (1st regrowth)	50	0.007, 0.006	<0.007, <0.007	0.01, 0.01
						Hay (1st regrowth)	50	0.026 [4], 0.029 [4]	<0.007, <0.007	0.03, 0.04
						Forage (2nd regrowth)	64	<0.003, 0.004	<0.007, <0.007	0.01, 0.01
						Hay (2nd regrowth)	64	0.007, 0.009	<0.007, <0.007	0.01, 0.02

1. PHI = Pre-Harvest Interval.
2. For each grass commodity, the method LOQ is 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, for a combined LOQ of 0.01 ppm
3. Combined residues were calculated by summing lambda-cyhalothrin and R157836 residues. For samples with values <LOQ, the LOQ was used for calculating the combined residues.
4. Average of two analyses of the same sample.

TABLE C.4.1 Summary of Residue Data from Grass Field Trials with Lambda-Cyhalothrin (Grasses Grown for Forage and Hay).

Treatment #	Application #	Total Rate (lb ai/A)	Commodity [1]	PHI (Days)	Combined Residue Levels (ppm) [2]						
					n	Min.	Max.	HAFT [3]	Median	Mean	Std. Dev.
Residues Following Each Application											
2		0.03	Forage	0	26	0.13	8.04	6.59	1.74	2.15	1.78
			Hay	6-10	26	0.50	3.84	3.64	1.33	1.50	0.82
		0.06-0.07	Forage	0	24	1.07	5.03	4.71	2.58	2.81	1.30
			Hay	6-11	24	1.28	6.01	5.58	2.52	2.89	1.47
		0.09-0.10	Forage	0-3	18	0.67	5.53	5.07	2.40	2.63	1.38
			Hay	5-8	18	<0.01	5.14	4.55	2.37	2.43	1.27
3		0.03	Forage	0-1	26	0.41	5.29	4.52	1.85	2.03	1.13
			Hay	13-15	26	0.26	2.01	1.75	0.93	0.96	0.41
		0.06-0.07	Forage	0	24	1.21	5.82	4.36	2.65	2.83	1.13
			Hay	12-17	24	0.29	4.04	3.25	1.38	1.46	0.88
		0.09-0.10	Forage	0	18	1.06	6.24	5.63	2.67	3.16	1.68
			Hay	11-15	18	0.52	4.11	4.05	1.61	1.80	1.02
Pooled Residue Data for All Applications											
2 & 3	1-3	0.03/Application	Forage	0-3	136	0.13	8.04	6.59	2.33	2.56	1.44
			Hay	5-11	68	<0.01	6.01	5.58	1.84	2.24	1.33
			Hay	11-17	68	0.26	4.11	4.05	1.09	1.36	0.85

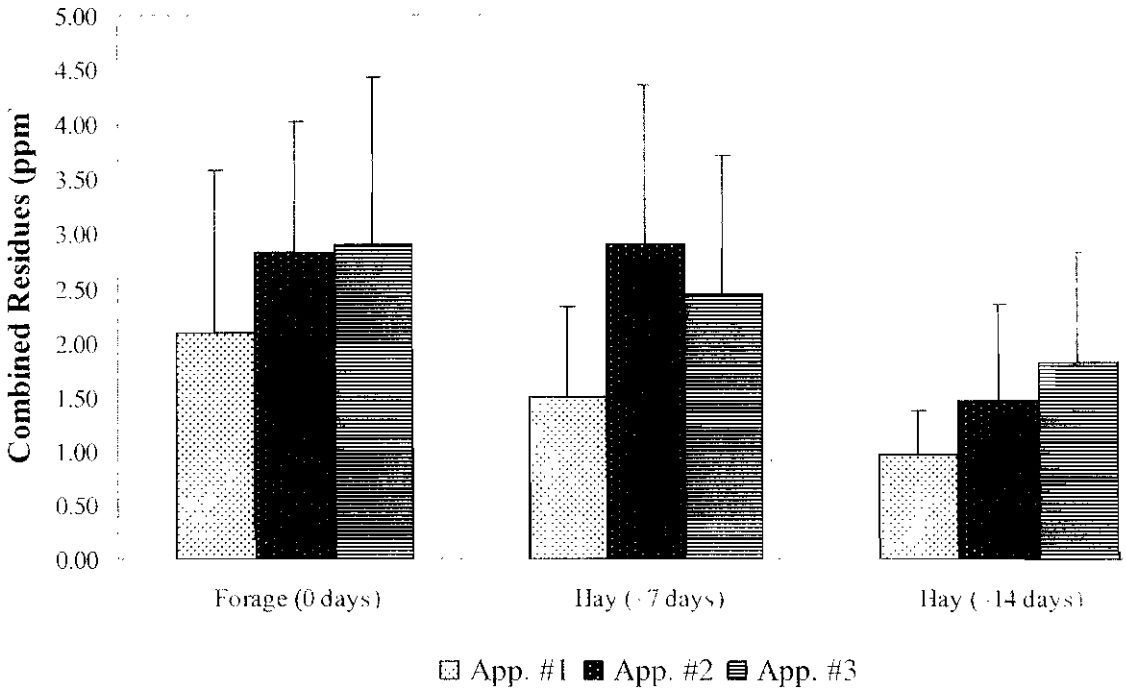
1. Following each application, forage was cut at ~0 DAT, and hay was cut at ~7 or ~14 DAT.
2. For each grass commodity, the method LOQ is 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, for a combined LOQ of 0.01 ppm. For calculation of the median, mean, and standard deviation, ½LOQ (0.0015 or 0.0035 ppm) was used for each analyte below the LOQ.
3. HAFT = Highest Average Field Trial.

TABLE C.4.2 Summary of Residue Data from Grass Field Trials with Lambda-Cyhalothrin (Grasses Grown for Seed).

Treatment #	Total Rate (lb ai/A)	Commodity [1]	PHI (Days)	Combined Residue Levels (ppm) [2]						
				n	Min.	Max.	HAFT [3]	Median	Mean	Std. Dev.
4	1.03	Straw	7-19	16	0.35	7.80	7.17	1.51	2.15	2.06
		Seed Screenings	7-19	16	0.80	3.23	3.22	1.83	1.86	0.71
		Forage (1st regrowth)	36-50	16	<0.01	0.19	0.15	0.03	0.05	0.06
		Hay (1st regrowth)	36-50	16	0.01	1.07	0.67	0.03	0.12	0.26
		Forage (2nd regrowth)	51-64	16	<0.01	0.28	0.23	0.02	0.04	0.08
		Hay (2nd regrowth)	51-64	16	<0.01	0.20	0.11	0.03	0.04	0.05

1. Following harvest of mature seeds, treated plots were allowed to regrow, and were cut twice for forage and hay.
2. For each grass commodity, the method LOQ is 0.003 ppm for lambda-cyhalothrin, and 0.007 ppm for R157836, for a combined LOQ of 0.01 ppm. For calculation of the median, mean, and standard deviation, ½LOQ (0.0015 or 0.0035 ppm) was used for each analyte below the LOQ.
3. HAFT = Highest Average Field Trial.

Figure C.3. Average Combined Residues (± Standard Deviation) in Forage and Hay Following Repeated Applications of Lambda-Cyhalothrin at ~0.03 lb ai/A per cutting.



D. CONCLUSION

The grass field trial data are adequate, and support the use of a single broadcast foliar application of lambda-cyhalothrin (2.08 lb ai/gal CS) to grass from the 6-8" stage until crop maturity at a rate of 0.03 lb ai/A. The data also support the use of a single application per cutting, up to a total of 3 applications (total rate of 0.09 lb ai/A) per season. The data support PHIs of 0 days for forage, 7 days for mature grass grown for seed, and 7 to 14 days for hay.

E. REFERENCES

PP#0F6092. Request for the Use of Lambda-cyhalothrin in Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.; D284860; Kit Farwell; 8/15/2002.

F. DOCUMENT TRACKING

RDI: W.T. Drew (12/27/2006)
Petition Number: 5F6994
DP Barcode: D324219
PC Code: 128897

Lambda-Cyhalothrin/100-1112/PC Code 128897/Syngenta Crop Protection/100
DACO 7.4.1/7.4.2/OPPTS 860.1500/OECD IIA 6.3.1, 6.3.2, 6.3.3 and IIIA 8.3.1, 8.3.2, 8.3.3
Crop Field Trial/Residue Decline – Cucumber (Fruit)

Primary Evaluator: William T. Drew, Chemist, HED/RAB2 — Date: 12/27/2006

Approved by: R. Loranger — Date: 12/27/2006
Richard A. Loranger, Branch Senior Scientist, HED/RAB2

This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B; Durham, NC 27713). It has been reviewed by HED, and revised to reflect current OPP policy.

STUDY REPORTS

MRID #46665302. Dave Schwab, Carol Anderson, Jason Niekamp (2001) *Lambda-Cyhalothrin: Residue Levels on Cucumber from Trials Conducted in the United States During 2000.* Lab Study ID Numbers: 45940 (ABC); RR 00-077B, WINO 30823, LCYH-00-MR-03 (Zeneca); 1426-01 (Syngenta). Unpublished study prepared by Analytical Bio-Chemistry Laboratories and Syngenta Crop Protection. 134 pages. {OPPTS Residue Chemistry Test Guideline 860.1500}

EXECUTIVE SUMMARY

Syngenta Crop Protection submitted crop field trials supporting the use on cucumbers of lambda-cyhalothrin, formulated as a capsule suspension (CS) having 1 pound of active ingredient per gallon (lb ai/gal). In seven field trials conducted in growing zones 2, 3, 5, 6, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to cucumbers as six broadcast foliar applications at rates of 0.029-0.031 pounds of ai per acre (lb ai/A) per application during fruit development, at re-treatment intervals (RTIs) of 5-9 days, for total application rates of 0.179-0.181 lb ai/A. All applications were made using ground equipment in spray volumes of either 8-10 or 10-60 gallons per acre (GPA), and did not include the use of any adjuvants. Single control and duplicate treated samples of cucumbers were collected from each trial at 1 and 7 days after the last treatment (DAT). Samples were stored at -18°C for up to 89 days prior to analysis, a duration supported by available storage stability data.

Cucumbers were analyzed for residues of lambda-cyhalothrin and its epimer (R157836) using a gas chromatograph with electron capture detection (GC/ECD) method derived from the current tolerance enforcement method. For this method, residues were extracted with acetone/hexane (1:1, v/v) and sodium sulfate, filtered, and partitioned with aqueous sodium chloride. Residues in the hexane fraction were then cleaned up using Florisil columns, and analyzed by GC/ECD using external standards. The validated limits of quantitation (LOQs) are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. The limits of detection (LODs) were not specified.

Residues of lambda-cyhalothrin were <0.01-0.02 ppm in cucumber samples at 1 DAT, with 6 of the 14 samples having residues <LOQ. By 7 DAT, residues of lambda-cyhalothrin

were ≤0.01 ppm, with 11 samples having residues <LOQ. Residues of R157836 were <LOQ in all samples at both intervals, for combined residues of < 0.02-<0.03 ppm at 1 DAT, and <0.02 ppm at 7 DAT. Combined HAFT residues were 0.02 ppm at both 1 and 7 DAT, while average combined residues were 0.014 ppm at 1 DAT and 0.011 ppm at 7 DAT.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS

Although details of climatic conditions for each trial site were not provided in the study, the cucumber field trial residue data are classified as scientifically acceptable. The acceptability of this study for regulatory purposes is addressed in the US EPA Residue Chemistry Summary Document (DP #313315).

COMPLIANCE

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No deviations from regulatory requirements were reported which would have an impact on the validity of the study.

A. BACKGROUND INFORMATION

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food/feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones (40CFR §180.438[a][1]). Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances have also been established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection has submitted a petition (PP#5F6994) supporting the use of a 1 lb ai/gal CS formulation of lambda-cyhalothrin on cucurbit vegetables, Group 9.

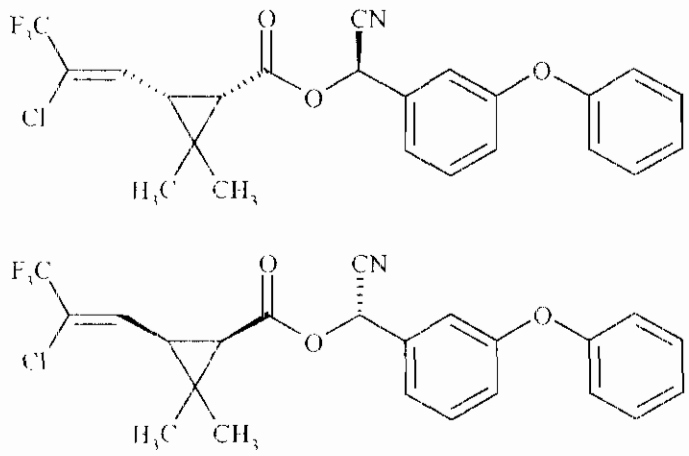
Table A.1 Lambda-Cyhalothrin Nomenclature.	
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common Name	Lambda-Cyhalothrin
Company Experimental Name	ICIA0321
Molecular Formula	$C_{23}H_{19}ClF_3NO_3$
Molecular Weight	449.9
IUPAC Name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Registry Number	91465-08-6
End-use Products (EP)	1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™; EPA Registration #100-1112)

Table A.2 Physicochemical Properties of Lambda-Cyhalothrin.		
Parameter	**Value**	**Reference**
Melting Point/Range (°C)	49.2	D284860[1]
pH	NA[2]	
Density (g/cm^3 at 25°C)	1.33	
Water Solubility (mg/L at 20°C, pH 6.5)	0.005	
Solvent Solubility (g/L)	NA	
Vapor Pressure (mm Hg at 20°C)	1.5×10^{-9}	
Dissociation Constant (pK_a at 20°C)	>9	
Octanol/water Partition Coefficient (Log[K_{OW}])	7.00	
UV/visible Absorption Spectrum	NA	

1. Kit Farwell, 8/15/2002.
2. NA = Not Available.

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

Seven cucumber field trials were conducted in growing zones 2, 3, 5, 6, and 10 during 2000 (see Table B.1.1, below). During each field trial, temperatures and rainfall were reportedly within normal parameters; however, no detailed information on climatic conditions was provided for any of the field sites. The study only indicated that crops were grown under typical climatic conditions, with supplemental irrigation provided as needed. At each site, lambda-cyhalothrin (1 lb ai/gal CS) was applied as six broadcast foliar applications at a target rate of 0.03 lb ai/A per application, beginning ~30-40 days prior to normal crop maturity (see Table B.1.2, below).

TABLE B.1.1 Trial Site Conditions.

Location (City, State; Year) [Trial ID]	Soil Characteristics			
	Type	%OM	pH	CEC (meq/g)
Suffolk, VA; 2000 [302]	Sandy Loam	NR*	NR	NR
Chula, GA; 2000 [303]	Loamy Sand	NR	NR	NR
Oviedo, FL; 2000 [304]	Sand	NR	NR	NR
Columbia, MO; 2000 [305]	Silt loam	NR	NR	NR
Carlyle, IL; 2000 [306]	Silt Loam	NR	NR	NR
East Bernard, TX; 2000 [307]	Sandy Loam	NR	NR	NR
Madera, CA; 2000 [308]	Loamy Sand	NR	NR	NR

* NR – Not Reported.

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) [Trial ID]	End-Use Product	Application Information [1]					Tank Mix Adjuvants
		Timing	Spray Volume (GPA) [2]	Single Rate (lb ai/A)	RTI [3] (Days)	Total Rate (lb ai/A)	
Suffolk, VA; 2000 [302]	1.0 lb ai/gal CS	From blooming to maturity.	8-10	0.30-0.31	5-9	0.181	None
Chula, GA; 2000 [303]	1.0 lb ai/gal CS	From 1 true leaf to mature fruit.	10-60	0.30	6-7	0.180	None
Oviedo, FL; 2000 [304]	1.0 lb ai/gal CS	From 1 bloom to mature fruit.	10-60	0.30-031	5-7	0.181	None
Columbia, MO; 2000 [305]	1.0 lb ai/gal CS	From flowering to 7-day PHI.	10-60	0.29-0.31	6-7	0.180	None
Carlyle, IL; 2000 [306]	1.0 lb ai/gal CS	From first bloom to reproductive.	10-60	0.30	6-7	0.180	None
East Bernard, TX; 2000 [307]	1.0 lb ai/gal CS	From blooming to fruiting.	8-10	0.29-0.31	5-6	0.179	None
Madera, CA; 2000 [308]	1.0 lb ai/gal CS	From 4-5 true leaves to mature fruit.	8-10	0.30-0.31	5-7	0.181	None

1. All treatments consisted of 6 broadcast foliar applications which were made using ground equipment.
2. GPA – Gallons Per Acre. Spray volumes for specific trials were not reported.
3. RTI – Re-Treatment Interval.

TABLE B.1.3 Trial Numbers and Geographical Locations.

NAFTA Growing Zones	Cucumbers		
	Submitted	Requested	
		Canada	U.S.
1	--	--	--
2	2	--	2
3	1	--	1
4	--	--	--
5	2	--	2
6	1	--	1
7	--	--	--
8	--	--	--
9	--	--	--
10	1	--	--
11	--	--	--
12	--	--	--
Total	**7**	**--**	**6***

* Number of cucumber field trials required for crop group tolerance on cucurbit vegetables, Group 9

B.2. Sample Handling and Preparation

Single control and duplicate treated samples of cucumber (weighing at least 2.5 lb per sample) were collected from each trial site at two post-treatment intervals, 1 and 7 DAT. Samples of cucumbers were placed in freezers within 2 hours of collection, and were shipped by freezer truck to the analytical laboratory (ABC Laboratories in Columbia, MO), where samples were stored at -19 ± 10°C until analysis.

B.3. Analytical Methodology

Samples of cucumbers were analyzed for residues of lambda-cyhalothrin and R157836 using a GC/ECD method, which is based on the current tolerance enforcement method (PRAM 81).

Residues of lambda-cyhalothrin and R157836 were extracted from cucumbers by blending with acetone/hexane (1:1, v/v) and sodium sulfate. Residues were filtered, and partitioned twice against aqueous saturated sodium chloride, discarding the aqueous layers. Residues in the remaining hexane fraction were then filtered through sodium sulfate, concentrated to dryness, and re-dissolved in hexane. Residues were next cleaned up using two Florisil columns, each washed with hexane, and then eluted with ethyl ether/hexane (1:3, v/v). Residues of both analytes were determined in a single injection by GC/ECD using external standards. The validated LOQs for both analytes are 0.01 ppm; the LODs were not reported.

The above method was validated using control samples of cucumbers fortified with lambda-cyhalothrin at 0.0068-0.680 ppm, and R157836 at 0.013-1.30 ppm.

C. RESULTS AND DISCUSSION

In seven field trials conducted in growing zones 1, 2, 3, 5, 6, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to cucumbers as six broadcast foliar applications during fruit development at rates of 0.029-0.031 lb ai/A per application, at RTIs of 5-9 days, for total application rates of 0.179-0.181 lb ai/A. All applications were made using ground equipment in spray volumes of either 8-10 or 10-60 GPA, and did not include the use of any adjuvants. Single control and duplicate treated samples of cucumbers were collected at 1 and 7 DAT from each trial.

The GC/ECD method used to determine residues of lambda-cyhalothrin and R157836 in cucumbers was adequately validated prior to, and in conjunction with, the analysis of field trial samples. Method validation recoveries from cucumbers averaged 77% (with standard deviation of 6%) for lambda-cyhalothrin fortified at 0.0068-0.680 ppm, and 78% (std. dev. 5%) for R157836 fortified at 0.013-1.30 ppm (see Table C.1, below). Concurrent recoveries averaged 90% (std. dev. 10%) for lambda-cyhalothrin at 0.007-0.070 ppm, and 91% (std. dev. 11%) for R157836 at 0.013-0.130 ppm. Apparent residues of each analyte were <LOQ in all control samples; adequate sample calculations and example chromatograms were provided.

Cucumber samples were stored frozen for durations of up to 89 days prior to extraction (see Table C.2, below). Adequate storage stability data have been previously reviewed (PP#1F3952/1H5607, M. Flood, 9/19/1991) indicating that lambda-cyhalothrin and R157836 are stable at -18°C for intervals of up to 26 months in peaches, peas, rapeseed, wheat grain, sugar beet roots, cottonseed, apples, cabbage, and potatoes. These data will support the sample storage conditions and durations for the current cucumber study.

Following applications at rates totaling 0.18 lb ai/A, residues of lambda-cyhalothrin were <0.01-0.02 ppm in cucumber samples at 1 DAT, with 6 of the 14 samples having residues <LOQ (see Table C.3, below). By 7 DAT, residues of lambda-cyhalothrin were ≤0.01 ppm, with 11 samples having residues <LOQ. Residues of R157836 were <LOQ in all samples at both intervals, for combined residues of <0.02-<0.03 ppm at 1 DAT, and <0.02 ppm at 7 DAT. Combined HAFT residues were 0.02 ppm at both 1 and 7 DAT, while average combined residues were 0.014 ppm at 1 DAT, and 0.011 ppm at 7 DAT (see Table C.4, below).

Common cultural practices were used to maintain plants; the weather conditions, maintenance chemicals, and fertilizers used in the study did not have a notable impact on the residue data.

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Cucumbers.

Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean [Std. Dev.] (%)
Method Validation Recoveries				
Lambda-Cyhalothrin	0.0068	2	71, 83	77
	0.068	2	74, 72	73
	0.680	2	79, 85	82
	Overall	**6**	**71-85**	**77 [6]**

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Cucumbers.				
Analyte	**Spike Level (ppm)**	**Sample Size (n)**	**Recoveries (%)**	**Mean [Std. Dev.] (%)**
Method Validation Recoveries				
R157836	0.013	2	76, 84	80
	0.130	2	75, 73	74
	1.30	2	77, 84	81
	Overall	**6**	**73-84**	**78 [5]**
Concurrent Recoveries				
Lambda Cyhalothrin	0.007	1	100	NA
	0.070	5	91, 75, 81, 99, 94	88 [10]
	Overall	**6**	**75-100**	**90 [10]**
R157836	0.013	1	100	NA
	0.130	5	95, 74, 80, 99, 96	89 [11]
	Overall	**6**	**74-100**	**91 [11]**

TABLE C.2 Summary of Storage Conditions.			
Crop [Matrix]	**Storage Temperature (°C)**	**Actual Storage Duration (Days)** [1]	**Interval of Demonstrated Storage Stability (Months)** [2]
Cucumber [Fruit]	-19	21-89	26

1. Storage duration from harvest to extraction. Extracts were stored for up to 5 days prior to analysis.
2. PP#1F3953; 1115607; M. Flood; 9/19/1991.

TABLE C.3 Residue Data from Cucumber Field Trials with Lambda-Cyhalothrin.								
Location (City, State; Year) [Trial ID]	**Zone**	**Cucumber Variety**	**Matrix**	**Total Rate (lb ai/A)**	**PHI (Days)**	**Residues (ppm)** [1]		
						Lambda-Cyhalothrin	**R157836**	**Combined**
Suffolk, VA 2000 [302]	2	Straight Eight	Fruit	0.181	1	<0.01[2], 0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Chula, GA; 2000 [303]	2	Lightning	Fruit	0.180	1	0.02, <0.01	<0.01, <0.01	<0.03, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Oviedo, FL; 2000 [304]	3	General Lee	Fruit	0.181	1	0.01, <0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Columbia, MO; 2000 [305]	5	Straight Eight	Fruit	0.180	1	<0.01[2], <0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Carlyle, IL; 2000 [306]	5	Straight Nine	Fruit	0.180	1	0.01, 0.02	<0.01, <0.01	<0.02, <0.03
					7	0.01, 0.01	<0.01, <0.01	<0.02, <0.02
East Bernard TX; 2000 [307]	6	Straight Nine	Fruit	0.179	1	0.01[2], <0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Madera, CA; 2000 [308]	10	Dasher II	Fruit	0.181	1	0.01[2], 0.01	<0.01, <0.01	<0.02, <0.02
					7	0.01, <0.01	<0.01, <0.01	<0.02, <0.02

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm.
2. Average of two analyses of the same sample.

TABLE C.4 Summary of Residue Data from Cucumber Field Trials with Lambda-Cyhalothrin.									
Crop [Matrix]	Total Rate (lb ai/A)	PHI (Days)	Combined Residue Levels (ppm) [1]						
			n	Min.	Max.	HAFT [2]	Median	Mean	Std. Dev.
Cucumber [Fruit]	0.179-0.181	1	14	<0.02	<0.03	0.020	0.015	0.014	0.005
		7	14	<0.02	<0.02	0.020	0.010	0.011	0.002

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. For calculation of the median, mean, and standard deviation, ½LOQ (0.005 ppm) was used each analyte below the LOQ.
2. HAFT = Highest Average Field Trial.

D. CONCLUSION

The field trial data are adequate, and support the use of up to six broadcast foliar applications of lambda-cyhalothrin (CS) on cucumbers (during fruit development) at a rate of 0.03 lb ai/A per application, for a total seasonal application rate of 0.18 lb ai/A. The data support RTIs of 5-7 days, and a PHI of either 1 or 7 days.

E. REFERENCES

PP#0F6092. Request for the Use of Lambda-cyhalothrin in Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.; D284860; Kit Farwell; 8/15/2002.

F. DOCUMENT TRACKING

RDI: W.T. Drew (12/27/2006)
Petition Number: 5F6994
DP Barcode: D324219
PC Code: 128897

Primary Evaluator: William T. Drew, Chemist, HED/RAB2 — Date: 12/27/2006

Approved by: Richard A. Loranger, Branch Senior Scientist, HED/RAB2 — Date: 12/27/2006

This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B; Durham, NC 27713). It has been reviewed by HED, and revised to reflect current OPP policy.

STUDY REPORTS

MRID #46665301. Dave Schwab, Carol Anderson, Jason Niekamp (2001) *Lambda-Cyhalothrin: Residue Levels on Cantaloupe from Trials Conducted in the United States During 2000.* Lab Study ID Numbers: 45939 (ABC); RR 00-076, WINO 30820, LCYH-00-MR-02 (Zeneca); 1425-01 (Syngenta). Unpublished study prepared by Analytical Bio-Chemistry Laboratories and Syngenta Crop Protection. 142 pages. {OPPTS Residue Chemistry Test Guideline 860.1500}

EXECUTIVE SUMMARY

Syngenta Crop Protection submitted crop field trials supporting the use on muskmelons of lambda-cyhalothrin, formulated as a capsule suspension (CS) having 1 pound of active ingredient per gallon (lb ai/gal). In six field trials conducted in growing zones 2, 5, 6, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to cantaloupes or honeydew melons as six broadcast foliar applications at rates of 0.029-0.031 pounds of ai per acre (lb ai/A) per application during fruit development, at re-treatment intervals (RTIs) of 5-9 days, for total application rates of 0.176-0.182 lb ai/A. All applications were made using ground equipment in spray volumes of 8-31 gallons per acre (GPA), and did not include the use of any adjuvants. Single control and duplicate treated samples of whole melons were collected from each trial at 1 and 7 days after the last treatment (DAT), while single subsamples of melon meat (pulp without rind and seeds) were collected from two trials at 1 and 7 DAT. Samples were stored at -18°C for up to 110 days prior to analysis, a duration supported by available storage stability data.

Melon samples were analyzed for residues of lambda-cyhalothrin and its epimer (R157836) using a gas chromatograph with electron capture detection (GC/ECD) method derived from the current tolerance enforcement method. For this method, residues were extracted with acetone/hexane (1:1, v/v) and sodium sulfate, filtered, and partitioned with aqueous sodium chloride. Residues in the hexane fraction were then cleaned up using Florisil columns, and analyzed by GC/ECD using external standards. The validated limits of quantitation (LOQs) are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. The limits of detection (LODs) were not specified.

Residues of lambda-cyhalothrin were <0.01-0.02 ppm in melons harvested at 1 DAT, with 6 of the 12 samples having residues <LOQ. Residues of lambda-cyhalothrin were also <0.01-0.02 ppm at 7 DAT, with 8 samples having residues <LOQ. At both sampling intervals, residues of R157836 were <LOQ in all samples, for combined residues of <0.02-<0.03 ppm at both intervals. Combined HAFT residues were 0.03 ppm at both intervals, while average combined residues were 0.016 ppm at 1 DAT, and 0.013 ppm at 7 DAT. Combined residues were <0.02 ppm (<LOQ) in subsamples of melon pulp collected from two trials at both 1 and 7 DAT.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS

Although details of climatic conditions for each trial site were not provided in the study, the muskmelon field trial residue data are classified as scientifically acceptable. The acceptability of this study for regulatory purposes is addressed in the US EPA Residue Chemistry Summary Document (DP #313315).

COMPLIANCE

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No deviations from regulatory requirements were reported which would have an impact on the validity of the study.

A. BACKGROUND INFORMATION

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food/feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones (40CFR §180.438[a][1]). Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances have also been established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection has submitted a petition (PP#5F6994) supporting the use of a 1 lb ai/gal CS formulation of lambda-cyhalothrin on cucurbit vegetables, Group 9.

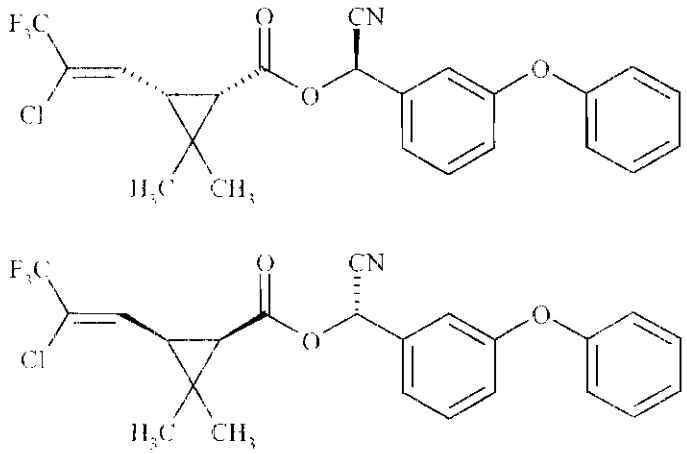
Table A.1 Lambda-Cyhalothrin Nomenclature.	
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common Name	Lambda-Cyhalothrin
Company Experimental Name	ICIA0321
Molecular Formula	$C_{23}H_{19}ClF_3NO_3$
Molecular Weight	449.9
IUPAC Name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Registry Number	91465-08-6
End-use Products (EP)	1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™; EPA Registration #100-1112)

Table A.2 Physicochemical Properties of Lambda-Cyhalothrin.		
Parameter	**Value**	**Reference**
Melting Point/Range (°C)	49.2	D284860 [1]
pH	NA [2]	
Density (g/cm³ at 25°C)	1.33	
Water Solubility (mg/L at 20°C, pH 6.5)	0.005	
Solvent Solubility (g/L)	NA	
Vapor Pressure (mm Hg at 20°C)	1.5×10^{-9}	
Dissociation Constant (pK_a at 20°C)	>9	
Octanol/water Partition Coefficient ($Log[K_{OW}]$)	7.00	
UV/visible Absorption Spectrum	NA	

1. Kit Farwell, 3/15/2002.
2. NA = Not Available.

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

Six muskmelon field trials were conducted in growing zones 2, 5, 6, and 10 during 2000 (see Table B.1.1, below). During each field trial, temperatures and rainfall were reportedly within normal parameters with only minor exceptions. No information on climatic conditions was provided for any of the field trial sites. The study only indicated that crops were grown under typical climatic conditions with supplemental irrigation provided as needed. At each site, lambda-cyhalothrin (1 lb ai/gal CS) was applied as six broadcast foliar applications at a target rate of 0.03 lb ai/A per application, beginning approximately 30-40 days prior to normal crop maturity (see Table B.1.2, below).

TABLE B.1.1 Trial Site Conditions.

Location (City, State; Year) [Trial ID]	Soil Characteristics			
	Type	%OM	pH	CEC (meq/g)
Ivor, VA; 2000 [293]	Sandy Loam	NR*	NR	NR
Columbia, MO; 2000 [294]	Silt Loam	NR	NR	NR
East Bernard, TX; 2000 [295]	Sandy Loam	NR	NR	NR
Maricopa, AZ; 2000 [296]	Clay Loam	NR	NR	NR
Porterville, VA; 2000 [297]	Fine Sandy Loam	NR	NR	NR
Fresno, CA; 2000 [298]	Loamy Sand	NR	NR	NR

* NR = Not Reported.

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) [Trial ID]	End-Use Product	Application Information [1]					Tank Mix Adjuvants
		Timing	Spray Volume (GPA) [2]	Single Rate (lb ai/A)	RTI [3] (Days)	Total Rate (lb ai/A)	
Ivor, VA; 2000 [293]	1.0 lb ai/gal CS	Vigorous blooming to fruit maturity.	8-31	0.030-0.031	5-9	0.181	None
Columbia, MO; 2000 [294]	1.0 lb ai/gal CS	2" fruits to harvest maturity.	8-31	0.030-0.031	5-6	0.182	None
East Bernard, TX; 2000 [295]	1.0 lb ai/gal CS	Fruit set to maturity.	8-31	0.029-0.031	6-7	0.176	None
Maricopa, AZ; 2000 [296]	1.0 lb ai/gal CS	Immature fruit to mature fruit.	8-31	0.029-0.030	5	0.178	None
Porterville, CA; 2000 [297]	1.0 lb ai/gal CS	Fruit sizing to mature fruit.	8-31	0.030-0.031	7	0.181	None
Fresno, CA; 2000 [298]	1.0 lb ai/gal CS	Blooming to mature melons.	8-31	0.030	5-7	0.180	None

1. All treatments consisted of 6 broadcast foliar applications which were made using ground equipment.
2. GPA = Gallons Per Acre. Spray volumes for specific trials were not reported.
3. RTI = Re-Treatment Interval

TABLE B.1.3 Trial Numbers and Geographical Locations.			
NAFTA Growing Zones	Muskmelons		
	Submitted	Requested	
		Canada	U.S.
1	--	--	--
2	1	--	1
3	--	--	--
4	--	--	--
5	1	--	1
6	1	--	1
7	--	--	--
8	--	--	--
9	--	--	--
10	3	--	3
11	--	--	--
12	--	--	--
Total	**6**	**--**	**6***

* Number of muskmelon field trials required for crop group tolerance on cucurbit vegetables, Group 9.

B.2. Sample Handling and Preparation

Single control and duplicate treated samples of cantaloupes or honeydew melons (6-12 fruit, each weighing at least 1 kg) were collected from each trial site at two post-treatment intervals, 1 and 7 DAT. Samples of whole melons were placed in a freezer within 2 hours of collection, and were shipped by freezer truck to the analytical laboratory (ABC Laboratories in Columbia, MO). Single control and treated subsamples of melon meat (pulp without rind and seeds) were also collected from two sites (MO and AZ) at both intervals. These samples were shipped to the analytical laboratory on dry ice or blue ice. The report noted that the melon meat samples from the AZ trial site arrived at the laboratory at ambient temperatures, but were otherwise intact. At the laboratory, all samples were stored at -18.5 ± 8°C until analysis.

B.3. Analytical Methodology

Samples of cantaloupes and honeydew melons were analyzed for residues of lambda-cyhalothrin and R157836 using a GC/ECD method, which is based on the current tolerance enforcement method (PRAM 81).

Residues of lambda-cyhalothrin and R157836 were extracted from melons by blending with acetone-hexane (1:1, v/v) and sodium sulfate. Residues were filtered, and partitioned twice against aqueous saturated sodium chloride, discarding the aqueous layers. Residues in the remaining hexane fraction were then filtered through sodium sulfate, concentrated to dryness, and re-dissolved in hexane. Residues were next cleaned up using two Florisil columns, each washed with hexane, and then eluted with ethyl ether/hexane (1:3, v/v). Residues of both analytes were determined in a single injection by GC/ECD using external standards. The validated LOQs for both analytes are 0.01 ppm; the LODs were not reported.

The above method was validated using control samples of melons fortified with lambda-cyhalothrin at 0.007-0.700 ppm, and R157836 at 0.013-1.30 ppm.

C. RESULTS AND DISCUSSION

In six muskmelon field trials conducted in growing zones 2, 5, 6, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to cantaloupes or honeydew melons as six broadcast foliar applications at rates of 0.029-0.031 lb ai/A per application during fruit development, at RTIs of 5-9 days, for total application rates of 0.176-0.182 lb ai/A. All applications were made using ground equipment in spray volumes of 8-31 GPA, and did not include the use of any adjuvants. Single control and duplicate treated samples of whole melons were collected at 1 and 7 DAT from each trial, and single subsamples of melon meat (pulp without rind and seeds) were collected from two trials at 1 and 7 DAT.

The GC/ECD method used to determine residues of lambda-cyhalothrin and R157836 in muskmelons was adequately validated prior to, and in conjunction with, the analysis of field trial samples. Method validation recoveries from melons averaged 88% (with standard deviation of 7%) for lambda-cyhalothrin fortified at 0.007-0.700 ppm, and 91% (std. dev. 4%) for R157836 fortified at 0.013-1.30 ppm (see Table C.1, below). Concurrent recoveries averaged 89% (std dev. 13%) for lambda-cyhalothrin at 0.0068-0.680 ppm, and 87% (std. dev. 8%) for R157836 at 0.013-1.30 ppm. Apparent residues of each analyte were <LOQ in all control samples; adequate sample calculations and example chromatograms were provided.

Melon samples were stored frozen for durations of up to 110 days (see Table C.2, below). Adequate storage stability data have been previously reviewed (PP#1F3952/1H5607; M. Flood; 9/19/1991) indicating that lambda-cyhalothrin and R157836 are stable at -18°C for intervals of up to 26 months in peaches, peas, rapeseed, wheat grain, sugar beet roots, cottonseed, apples, cabbage, and potatoes. The data will support the sample storage conditions and durations for the current muskmelon study.

Following applications at rates totaling 0.176-0.182 lb ai/A, residues of lambda-cyhalothrin were <0.01-0.02 ppm in 12 samples of melons harvested at 1 DAT, with 6 of the 12 samples having residues <LOQ (see Table C.3, below). By 7 DAT, residues of lambda-cyhalothrin were <0.01-0.02 ppm, with 8 samples having residues <LOQ. At both sampling intervals, residues of R157836 were <LOQ in all samples, for combined residues of <0.02-<0.03 ppm at both 1 and 7 DAT. Combined HAFT residues were 0.03 ppm at both intervals, while average combined residues were 0.016 ppm at 1 DAT, and 0.013 ppm at 7 DAT (see Table C.4, below). Combined residues were <0.02 ppm (<LOQ) in both samples of melon pulp collected from two trials at either 1 or 7 DAT.

Common cultural practices were used to maintain plants; the weather conditions, maintenance chemicals, and fertilizers used in the study did not have a notable impact on the residue data.

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Muskmelons.				
Analyte	**Spike Level (ppm)**	**Sample Size (n)**	**Recoveries (%)**	**Mean [Std. Dev.] (%)**
Method Validation Recoveries				
Lambda-Cyhalothrin	0.007	3	71, 86, 86	81 [9]
	0.070	6	93, 93, 87, 94, 89, 93	92 [3]
	0.700	2	89, 91	90
	Overall	**11**	**71-94**	**88 [7]**
R157836	0.013	3	92, 85, 92	90 [4]
	0.130	6	93, 94, 88, 95, 88, 94	92 [3]
	1.30	2	90, 92	91
	Overall	**11**	**85-95**	**91 [4]**
Concurrent Recoveries				
Lambda-Cyhalothrin	0.0068	3	110, 81, 82	91 [16]
	0.068	2	75, 85	80
	0.680	3	106, 84, 85	92 [12]
	Overall	**8**	**75-110**	**89 [13]**
R157836	0.013	3	94, 81, 88	88 [7]
	0.130	2	74, 90	82
	1.30	3	100, 84, 84	89 [9]
	Overall	**8**	**74-100**	**87 [8]**

TABLE C.2 Summary of Storage Conditions.			
Crop [Matrix]	**Storage Temperature (°C)**	**Actual Storage Duration (Days)** [1]	**Interval of Demonstrated Storage Stability (Months)** [2]
Muskmelons [Fruit]	<-15	48-110	26

1. Storage duration from harvest to analysis. Extracts were stored for up to 7 days prior to analysis.
2. PP#1F395[illegible] 15607; M. Flood; 9/19/1991.

TABLE C.3 Residue Data from Muskmelon Field Trials with Lambda-Cyhalothrin.								
Location (City, State; Year) [Trial ID]	**Zone**	**Melon Variety**	**Matrix**	**Total Rate (lb ai/A)**	**PHI (Days)**	**Residues (ppm)** [1]		
						Lambda-cyhalothrin	**R157836**	**Combined**
Ivor, VA; 2000 [293]	2	Cantaloupe; Hale's Best Jumbo	Fruit	0.181	1	0.015[2], 0.01	<0.01[2], <0.01	<0.025, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Columbia, MO; 2000 [294]	5	Cantaloupe; Sweet 'N Early	Fruit	0.182	1	0.02[2], 0.02	<0.01[2], <0.01	<0.03, <0.03
					7	0.01, <0.01	<0.01, <0.01	<0.02, <0.02
			Pulp[3]		1	<0.01	<0.01	<0.02
					7	<0.01	<0.01	<0.02
East Bernard, TX; 2000 [295]	6	Honeydew; Tamdew	Fruit	0.176	1	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02

TABLE C.3 Residue Data from Muskmelon Field Trials with Lambda-Cyhalothrin.								
Location (City, State; Year) [Trial ID]	Zone	Melon Variety	Matrix	Total Rate (lb ai/A)	PHI (Days)	Residues (ppm) [1]		
						Lambda-cyhalothrin	R157836	Combined
Maricopa, AZ; 2000 [296]	10	Honeydew; TAKI	Fruit	0.178	1	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
					7	0.01, <0.01	<0.01, <0.01	<0.02, <0.02
			Pulp [3]		1	<0.01	<0.01	<0.02
					7	<0.01	<0.01	<0.02
Porterville, CA; 2000 [297]	10	Cantaloupe; Hales Best Jumbo	Fruit	0.181	1	0.02, 0.02	<0.01, <0.01	<0.03, <0.03
					7	0.02, 0.01	<0.01, <0.01	<0.03, <0.02
Fresno, CA; 2000 [298]	10	Honeydew; Hog	Fruit	0.180	1	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm.
2. Average of two analyses of the same sample.
3. Subsamples of melon pulp (without rind or seeds) were analyzed from two trial sites.

TABLE C.4 Summary of Residue Data from Muskmelon Field Trials with Lambda-Cyhalothrin.									
Crop [Matrix]	Total Rate (lb ai/A)	PHI (Days)	Combined Residue Levels (ppm) [1]						
			n	Min.	Max.	HAFT [2]	Median	Mean	Std. Dev.
Muskmelons [Fruit]	0.176-0.182	1	12	<0.02	<0.03	0.030	0.013	0.016	0.007
		7	12	<0.02	<0.03	0.025	0.010	0.013	0.005

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. For calculation of the median, mean, and standard deviation, ½LOQ (0.005 ppm) was used each analyte below the LOQ.
2. HAFT = Highest Average Field Trial.

D. CONCLUSION

The field trial data are adequate, and support the use of up to six broadcast foliar applications of lambda-cyhalothrin (CS) on muskmelons (during fruit development) at a rate of 0.03 lb ai/A per application, for a total seasonal application rate of 0.18 lb ai/A. The data support RTIs of 5-7 days, and a PHI of either 1 or 7 days.

E. REFERENCES

PP#0F6092. Request for the Use of Lambda-cyhalothrin in Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.; D284860; Kit Farwell; 8/15/2002.

F. DOCUMENT TRACKING

RDI: W.T. Drew (12/27/2006)
Petition Number: 5F6994
DP Barcode: D324219
PC Code: 128897

Lambda-Cyhalothrin/100-1112/PC Code 128897/Syngenta Crop Protection/100
DACO 7.4.1/7.4.2/OPPTS 860.1500/OECD IIA 6.3.1, 6.3.2, 6.3.3 and IIIA 8.3.1, 8.3.2, 8.3.3
Crop Field Trial/Residue Decline – Summer Squash (Fruit)

Primary Evaluator: William T. Drew, Chemist, HED/RAB2 — Date: 12/27/2006

Approved by: Richard A. Loranger, Branch Senior Scientist, HED/RAB2 — Date: 12/27/2006

This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B; Durham, NC 27713). It has been reviewed by HED, and revised to reflect current OPP policy.

STUDY REPORTS

MRID #46665303. Dave Schwab, Carol Anderson, Jason Niekamp (2001) *Lambda-Cyhalothrin: Residue Levels on Summer Squash from Trials Conducted in the United States during 2000.* Lab Study ID Numbers: 45941 (ABC); RR 00-078B, WINO 33119, LCYH-00-MR-04 (Zeneca); 1427-01 (Syngenta). Unpublished study prepared by Analytical Bio-Chemistry Laboratories and Syngenta Crop Protection. 134 pages. {OPPTS Residue Chemistry Test Guideline 860.1500}

EXECUTIVE SUMMARY

Syngenta Crop Protection submitted crop field trials supporting the use on summer squash of lambda-cyhalothrin, formulated as a capsule suspension (CS) having 1 pound of active ingredient per gallon (lb ai/gal). In five field trials conducted in growing zones 1, 2, 3, 5, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to squash as six broadcast foliar applications at rates of 0.029-0.031 lb ai/A per application during fruit development, at re-treatment intervals (RTIs) of 5-9 days, for total application rates of 0.179-0.184 lb ai/A. All applications were made using ground equipment in spray volumes of either 8-10 or 10-60 gallons per acre (GPA), and did not include the use of any adjuvants. Single control and duplicate treated samples of squash were collected from each trial at 1 and 7 days after the last treatment (DAT). Samples were stored at -18°C for up to 98 days prior to analysis, a duration supported by available storage stability data.

Squash samples were analyzed for residues of lambda-cyhalothrin and its epimer (R157836) using a gas chromatograph with electron capture detection (GC/ECD) method derived from the current tolerance enforcement method. For this method, residues were extracted with acetone/hexane (1:1, v/v) and sodium sulfate, filtered, and partitioned with aqueous sodium chloride. Residues in the hexane fraction were then cleaned up using Florisil columns, and analyzed by GC/ECD using external standards. The validated limits of quantitation (LOQs) are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. The limits of detection (LODs) were not specified.

Residues of lambda-cyhalothrin were <0.01-0.03 ppm in squash samples at 1 DAT, with 5 of the 10 samples having residues <LOQ, and <0.01 ppm in all 10 samples by 7 DAT.

Residues of R157836 were <LOQ in all samples at both intervals, for combined residues of <0.02-<0.04 ppm at 1 DAT, and <0.02 ppm at 7 DAT. Combined HAFT residues were 0.035 ppm at 1 DAT, and 0.02 ppm at 7 DAT, while average combined residues were 0.017 ppm at 1 DAT, and 0.010 ppm at 7 DAT.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS

Although details of climatic conditions for each trial site were not provided in the study, the summer squash field trial residue data are classified as scientifically acceptable. The acceptability of this study for regulatory purposes is addressed in the US EPA Residue Chemistry Summary Document (DP #313315).

COMPLIANCE

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No deviations from regulatory requirements were reported which would have an impact on the validity of the study.

A. BACKGROUND INFORMATION

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food/feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones (40CFR §180.438[a][1]). Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances have also been established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection has submitted a petition (PP#5F6994) supporting the use of a 1 lb ai/gal CS formulation of lambda-cyhalothrin on cucurbit vegetables, Group 9.

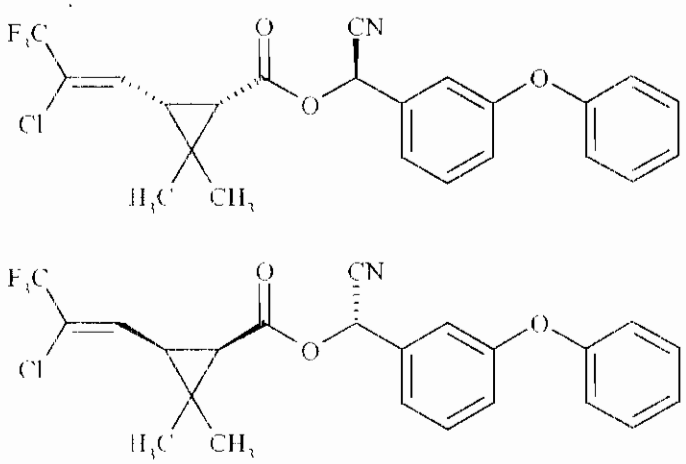
Table A.1 Lambda-Cyhalothrin Nomenclature.	
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common Name	Lambda-Cyhalothrin
Company Experimental Name	ICIA0321
Molecular Formula	$C_{23}H_{19}ClF_3NO_3$
Molecular Weight	449.9
IUPAC Name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Registry Number	91465-08-6
End-use Products (EP)	1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™; EPA Registration #100-1112)

Table A.2 Physicochemical Properties of Lambda-Cyhalothrin.		
Parameter	**Value**	**Reference**
Melting Point/Range (°C)	49.2	D284860[1]
pH	NA[2]	
Density (g/cm^3 at 25°C)	1.33	
Water Solubility (mg/L at 20°C, pH 6.5)	0.005	
Solvent Solubility (g/L)	NA	
Vapor Pressure (mm Hg at 20°C)	1.5×10^{-7}	
Dissociation Constant (pK_a at 20°C)	>9	
Octanol/water Partition Coefficient (Log[K_{OW}])	7.00	
UV/visible Absorption Spectrum	NA	

1. Kit Farwell, 8/15/2002.
2. NA = Not Available.

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

Five summer squash field trials were conducted in growing zones 1, 2, 3, 5, and 10 during 2000 (see Table B.1.1, below). During each field trial, temperatures and rainfall were reportedly within normal parameters. No information on climatic conditions was provided for any of the field sites. The study only indicated that crops were grown under typical climatic conditions with supplemental irrigation provided as needed. At each site, lambda-cyhalothrin (1 lb ai/gal CS) was applied as six broadcast foliar applications at a target rate of 0.03 lb ai/A per application, beginning approximately 30-40 days prior to normal crop maturity (see Table B.1.2, below).

TABLE B.1.1 Trial Site Conditions.

Location (City, State; Year) [Trial ID]	Soil Characteristics			
	Type	%OM	pH	CEC (meq/g)
North Rose, NY; 2000 [312]	Sand	NR*	NR	NR
Suffolk, VA; 2000 [313]	Sandy Loam	NR	NR	NR
Oviedo, FL; 2000 [314]	Sand	NR	NR	NR
Columbia, MO; 2000 [315]	Silt Loam	NR	NR	NR
Madera, CA; 2000 [316]	Loamy Sand	NR	NR	NR

* NR = Not Reported.

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) [Trial ID]	End-Use Product	Application Information [1]					Tank Mix Adjuvants
		Timing	Spray Volume (GPA) [2]	Single Rate (lb ai/A)	RTI [3] (Days)	Total Rate (lb ai/A)	
North Rose, NY; 2000 [312]	1.0 lb ai/gal CS	From 2nd leaf to mature fruit.	10-60	0.029-0.031	7	0.179	None
Suffolk, VA; 2000 [313]	1.0 lb ai/gal CS	From blooming to maturity.	8-10	0.030-0.031	5-9	0.184	None
Oviedo, FL; 2000 [314]	1.0 lb ai/gal CS	From blooming to large fruit.	10-60	0.030-0.031	5-7	0.182	None
Columbia, MO; 2000 [315]	1.0 lb ai/gal CS	From flowering to fruiting.	8-10	0.029-0.031	5-6	0.179	None
Madera, CA; 2000 [316]	1.0 lb ai/gal CS	From 4-6 true leaves to mature fruit.	8-10	0.030-0.031	5-7	0.182	None

1. All treatments consisted of 6 broadcast foliar applications which were made using ground equipment
2. GPA = Gallons Per Acre. Spray volumes for specific trials were not reported.
3. RTI = Re-Treatment Interval.

TABLE B.1.3 Trial Numbers and Geographical Locations.			
NAFTA Growing Zones	Summer Squash		
	Submitted	Requested	
		Canada	U.S.
1	1	--	1
2	1	--	1
3	1	--	1
4	--	--	--
5	1	--	1
6	--	--	--
7	--	--	--
8	--	--	--
9	--	--	--
10	1	--	1
11	--	--	--
12	--	--	--
Total	**5**	--	**5***

* Number of squash field trials required for crop group tolerance on cucurbit vegetables, Group 9.

B.2. Sample Handling and Preparation

Single control and duplicate treated samples of summer squash (weighing at least 2.5 lb per sample) were collected from each trial site at two post-treatment intervals, 1 and 7 DAT. Samples of squash were placed in freezers within 2 hours of collection, and were shipped by freezer truck to the analytical laboratory (ABC Laboratories in Columbia, MO), where samples were stored at -18 ± 12°C until analysis.

B.3. Analytical Methodology

Samples of summer squash were analyzed for residues of lambda-cyhalothrin and R157836 using a GC/ECD method, which is based on the current tolerance enforcement method (PRAM 81).

Residues of lambda-cyhalothrin and R157836 were extracted from squash by blending with acetone/hexane (1:1, v/v) and sodium sulfate. Residues were filtered, and partitioned twice against aqueous saturated sodium chloride, discarding the aqueous layers. Residues in the remaining hexane fraction were then filtered through sodium sulfate, concentrated to dryness, and re-dissolved in hexane. Residues were next cleaned up using two Florisil columns, each washed with hexane, and then eluted with ethyl ether/hexane (1:3, v/v). Residues of both analytes were determined in a single injection by GC/ECD using external standards. The validated LOQs for both analytes are 0.01 ppm; the LODs were not reported.

The above method was validated using control samples of squash fortified with lambda-cyhalothrin at 0.0068-0.680 ppm, and R157836 at 0.013-1.30 ppm.

C. RESULTS AND DISCUSSION

In five field trials conducted in growing zones 1, 2, 3, 5, and 10 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to summer squash as six broadcast foliar applications at rates of 0.029-0.031 lb ai/A per application during fruit development, at RTIs of 5-9 days, for total application rates of 0.179-0.184 lb ai/A. All applications were made using ground equipment in spray volumes of either 8-10 or 10-60 GPA, and did not include the use of any adjuvants. Single control and duplicate treated samples of squash were collected at 1 and 7 DAT from each trial.

The GC/ECD method used to determine residues of lambda-cyhalothrin and R157836 in squash was adequately validated prior to, and in conjunction with, the analysis of field trial samples. Method validation recoveries from squash averaged 94% (with standard deviation of 5%) for lambda-cyhalothrin fortified at 0.0068-0.680 ppm, and 95% (std. dev. 4%) for R157836 fortified at 0.013-1.30 ppm (see Table C.1, below). Concurrent recoveries averaged 96% (std dev. 12%) for lambda-cyhalothrin at 0.007-0.070 ppm, and 99% (std. dev. 15%) for R157836 at 0.013-0.130 ppm. Apparent residues of each analyte were <LOQ in all control samples; adequate sample calculations and example chromatograms were provided.

Summer squash samples were stored frozen for durations of up to 98 days prior to extraction (see Table C.2, below). Adequate storage stability data have been previously reviewed (PP#1F3952/1115607; M. Flood; 9/19/1991) indicating that lambda-cyhalothrin and R157836 are stable at -18°C for intervals of up to 26 months in peaches, peas, rapeseed, wheat grain, sugar beet roots, cottonseed, apples, cabbage, and potatoes. These data will support the sample storage conditions and durations for the current squash study.

Following applications at rates totaling 0.18 lb ai/A, residues of lambda-cyhalothrin were <0.01-0.03 ppm in squash samples at 1 DAT, with 5 of the 10 samples having residues < LOQ (see Table C.3, below). By 7 DAT, residues of lambda-cyhalothrin were <0.01 ppm in all 10 samples. Residues of R157836 were < LOQ in all samples at both intervals, for combined residues of <0.02-<0.04 ppm at 1 DAT, and <0.02 ppm at 7 DAT. Combined HAFT residues were 0.035 ppm at 1 DAT, and 0.02 ppm at 7 DAT, while average combined residues were 0.017 ppm at 1 DAT, and 0.010 ppm at 7 DAT (see Table C.4, below).

Common cultural practices were used to maintain plants; the weather conditions, maintenance chemicals, and fertilizers used in the study did not have a notable impact on the residue data.

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Summer Squash.

Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean [Std. Dev.] (%)
Method Validation Recoveries				
Lambda-Cyhalothrin	0.0068	2	101, 99	100
	0.068	2	90, 87	89
	0.680	2	93, 91	92
	Overall	**6**	**87-101**	**94 [5**

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Summer Squash.				
Analyte	**Spike Level (ppm)**	**Sample Size (n)**	**Recoveries (%)**	**Mean [Std. Dev.] (%)**
Method Validation Recoveries				
R157836	0.013	2	100, 100	100
	0.130	2	92, 92	92
	1.30	2	92, 92	92
	Overall	**6**	**92-100**	**95 [4]**
Concurrent Recoveries				
Lambda Cyhalothrin	0.007	2	91, 114	103
	0.070	3	91, 84, 100	92 [8]
	Overall	**5**	**84-114**	**96 [12]**
R157836	0.013	2	95, 123	109
	0.130	3	93, 84, 101	93 [9]
	Overall	**5**	**84-123**	**99 [15]**

TABLE C.2 Summary of Storage Conditions.			
Crop [Matrix]	**Storage Temperature (°C)**	**Actual Storage Duration (Days)** [1]	**Interval of Demonstrated Storage Stability (Months)** [2]
Summer Squash [Fruit]	-18	40-98	26

1. Storage duration from harvest to extraction. Extracts were stored for up to 6 days prior to analysis.
2. PP#1F395 / 15607; M. Flood; 9/19/1991.

TABLE C.3 Residue Data from Summer Squash Field Trials with Lambda-Cyhalothrin.								
Location (City, State; Year) [Trial ID]	**Zone**	**Summer Squash Variety**	**Matrix**	**Total Rate (lb ai/A)**	**PHI (Days)**	**Residues (ppm)** [1]		
						Lambda-cyhalothrin	**R157836**	**Combined**
North Rose, NY; 2000 [312]	1	Zucchini Select 297A	Fruit	0.179	1	0.02[2], 0.03	<0.01, <0.01	<0.03, <0.04
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Suffolk, VA 2000 [313]	2	Early Profile Straight Neck	Fruit	0.184	1	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Oviedo, FL 2000 [314]	3	Early Summer Crook Neck	Fruit	0.182	1	0.01, 0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Columbia, MO 2000 [315]	5	Black Zucchini	Fruit	0.179	1	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Madera, CA 2000 [316]	10	Beginnings Green Tins	Fruit	0.182	1	0.025[2], <0.01	<0.01, <0.01	<0.035, <0.02
					7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm.
2. Average of two analyses of the same sample

TABLE C.4 Summary of Residue Data from Summer Squash Field Trials with Lambda-Cyhalothrin.									
Crop [Matrix]	Total Rate (lb ai/A)	PHI (Days)	Residue Levels (ppm) [1]						
			n	Min.	Max.	HAFT [2]	Median	Mean	Std. Dev.
Summer Squash [Fruit]	0.179-0.184	1	10	<0.02	<0.04	0.035	0.013	0.017	0.009
		7	10	<0.02	<0.02	0.020	0.010	0.010	0.000

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. For calculation of the median, mean, and standard deviation, ½LOQ (0.005 ppm) was used each analyte below the LOQ.
2. HAFT = Highest Average Field Trial.

D. CONCLUSION

The field trial data are adequate, and support the use of up to six broadcast foliar applications of lambda-cyhalothrin (CS) on summer squash (during fruit development) at a rate of 0.03 lb ai/A per application, for at total seasonal application rate of 0.18 lb ai/A. The data support RTIs of 5-7 days, and a PHI of either 1 or 7 days.

E. REFERENCES

PP#0F6092. Request for the Use of Lambda-cyhalothrin in Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.; D284860; Kit Farwell; 8/15/2002.

F. DOCUMENT TRACKING

RDI: W.T. Drew (12/27/2006)
Petition Number: 5F6994
DP Barcode: D324219
PC Code: 128897

Lambda-Cyhalothrin/100-1112/PC Code 128897/Syngenta Crop Protection/100
DACO 7.4.1/7.4.2/OPPTS 860 1500/OECD IIA 6.3.1, 6.3.2, 6.3.3 and IIIA 8.3.1, 8.3.2, 8.3.3
Crop Field Trial – Potato (Tuber)

Primary Evaluator: William T. Drew, Chemist, HED/RAB2 — Date: 12/27/2006

Approved by: Richard A. Loranger, Branch Senior Scientist, HED/RAB2 — Date: 12/27/2006

This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B; Durham, NC 27713). It has been reviewed by HED, and revised to reflect current OPP policy.

STUDY REPORTS

MRID #46665304. Dave Schwab, Carol Anderson, Jason Niekamp (2001) *Lambda-Cyhalothrin: Residue Levels on Potato from Trials Conducted in the United States During 2000.* Lab Study ID Numbers: 45942 (ABC); RR 00-079B, WINO 49051, LCYH-00-MR-05 (Zeneca); 1428-01 (Syngenta). Unpublished study prepared by Analytical Bio-Chemistry Laboratories and Syngenta Crop Protection. 142 pages. {OPPTS Residue Chemistry Test Guideline 860.1500}

EXECUTIVE SUMMARY

Syngenta Crop Protection submitted crop field trials supporting the use on potatoes of lambda-cyhalothrin, formulated as a capsule suspension (CS) having 1 pound of active ingredient per gallon (lb ai/gal). In 16 field trials conducted in growing zones 1, 2, 3, 5, 9, 10, and 11 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to potatoes as four broadcast foliar applications during tuber development at rates of 0.029-0.031 pounds of ai per acre (lb ai/A) per application, at re-treatment intervals (RTIs) of 7-10 days, for total application rates of 0.117-0.124 lb ai/A. All applications were made using ground equipment in spray volumes of 8-10 or 10-60 gallons per acre (GPA), and did not include the use of any adjuvants. Single control and duplicate treated samples of potato tubers were collected from each trial at 7 days after the last application (DAT). Tuber samples were stored at -17°C for up to 99 days prior to analysis, a duration supported by available storage stability data.

Potato tubers were analyzed for residues of lambda-cyhalothrin and its epimer (R157836) using a gas chromatograph with electron capture detection (GC/ECD) method derived from the current tolerance enforcement method. For this method, residues were extracted with acetone/hexane (1:1, v/v) and sodium sulfate, filtered, and partitioned with aqueous sodium chloride. Residues in the hexane fraction were then cleaned up using Florisil columns, and analyzed by GC/ECD using external standards. The validated limits of quantitation (LOQs) are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. The limits of detection (LODs) were not specified.

Following four applications at rates totaling 0.117-0.124 lb ai/A, residues of lambda-cyhalothrin and R157836 were each <LOQ in all 32 potato samples harvested at 7 DAT. Combined HAFT residues were 0.02 ppm, while average combined residues were 0.01 ppm.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS

Although details of climatic conditions were not provided for any trial site, and the growth stage at application was not reported for four of the 16 sites, the potato field trial residue data are classified as scientifically acceptable as these were relatively minor deficiencies. The acceptability of this study for regulatory purposes is addressed in the US EPA Residue Chemistry Summary Document (DP #324219).

COMPLIANCE

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No deviations from regulatory requirements were reported which would have an impact on the validity of the study.

A. BACKGROUND INFORMATION

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food/feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones (40CFR §180.438[a][1]) . Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances have also been established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection has submitted a petition (PP#5F6994) supporting the use of a 1 lb ai/gal CS formulation of lambda-cyhalothrin on tuberous and corm vegetables, Subgroup 1C.

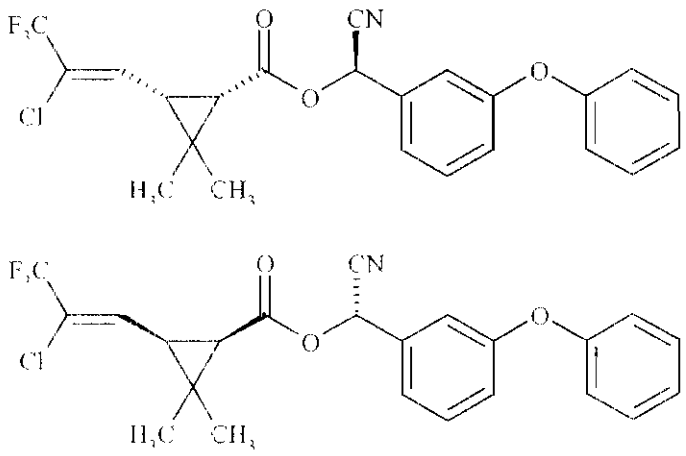
Table A.1 Lambda-Cyhalothrin Nomenclature.	
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common Name	Lambda-Cyhalothrin
Company Experimental Name	ICIA0321
Molecular Formula	$C_{23}H_{19}ClF_3NO_3$
Molecular Weight	449.9
IUPAC Name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Registry Number	91465-08-6
End-use Products (EP)	1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™; EPA Registration #100-1112)

Table A.2 Physicochemical Properties of Lambda-Cyhalothrin.		
Parameter	**Value**	**Reference**
Melting Point/Range (°C)	49.2	D284860 [1]
pH	NA [2]	
Density (g/cm^3 at 25°C)	1.33	
Water Solubility (mg/L at 20°C, pH 6.5)	0.005	
Solvent Solubility (g/L)	NA	
Vapor Pressure (mm Hg at 20°C)	1.5×10^{-5}	
Dissociation Constant (pK_a at 20°C)	>9	
Octanol/water Partition Coefficient (Log[K_{OW}])	7.00	
UV/visible Absorption Spectrum	NA	

1. Kit Farwell, 8/15/2002.
2. NA = Not Available.

B. EXPERIMENTAL DESIGN

B.1. Study Site Information

Sixteen potato field trials were conducted in growing zones 1, 2, 3, 5, 9, 10, and 11 during 2000 (see Table B.1.1. below). During each field trial, temperatures and rainfall were reportedly within normal parameters; however, no detailed information on climatic conditions was provided for any of the field sites. The study only indicated that crops were grown under typical climatic conditions, with supplemental irrigation provided as needed. At each site, lambda-cyhalothrin (1 lb ai/gal CS) was applied as four broadcast foliar applications at a target rate of 0.03 lb ai/A per application, beginning approximately 30-40 days prior to normal crop maturity (see Table B.1.2. below).

TABLE B.1.1 Trial Site Conditions.

Location (City, State; Year) [Trial ID]	Soil Characteristics			
	Type	%OM	pH	CEC (meq/g)
North Rose, NY; 2000 [320]	Loam	NR*	NR	NR
Germansville, PA; 2000 [321]	Shaly Loam	NR	NR	NR
Babcock, GA; 2000 [322]	Loamy Sand	NR	NR	NR
Oviedo, FL; 2000 [323]	Sand	NR	NR	NR
Columbia MO; 2000 [324]	Silt Loam	NR	NR	NR
Arkansaw, WI; 2000 [325]	Sandy Loam	NR	NR	NR
Geneva, MN; 2000 [326]	Harps	NR	NR	NR
Gardner, ND; 2000 [327]	Bearden	NR	NR	NR
Center, CO; 2000 [328]	Sandy Loam	NR	NR	NR
Madera, CA; 2000 [329]	Loam	NR	NR	NR
Harrah, WA; 2000 [330]	Silt Loam	NR	NR	NR
Prosser, WA; 2000 [331]	Loam	NR	NR	NR
Hermiston, OR; 2000 [332]	Silt Loam	NR	NR	NR
Ashton, ID; 2000 [333]	Silt Loam	NR	NR	NR
Jerome, ID; 2000 [334]	Loam	NR	NR	NR
Bliss, ID; 2000 [335]	Loamy Fine Sand	NR	NR	NR

* NR = Not Reported.

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) [Trial ID]	End-Use Product	Application Information [1]					Tank Mix Adjuvants
		Timing	Spray Volume (GPA) [2]	Single Rate (lb ai/A)	RTI [3] (Days)	Total Rate (lb ai/A)	
North Rose, NY; 2000 [320]	1.0 lb ai/gal CS	Late bloom to beginning senescence.	10-60	0.03-0.031	7	0.121	None
Germansville, PA; 2000 [321]	1.0 lb ai/gal CS	Early bloom to tuber bulking.	10-60	0.03-0.032	7-10	0.124	None
Babcock, GA; 2000 [322]	1.0 lb ai/gal CS	1" potatoes to 2.5" potatoes.	8-10	0.03-0.031	7	0.121	None

TABLE B.1.2 Study Use Pattern.

Location (City, State; Year) [Trial ID]	End-Use Product	Application Information [1]					Tank Mix Adjuvants
		Timing	Spray Volume (GPA) [2]	Single Rate (lb ai/A)	RTI [3] (Days)	Total Rate (lb ai/A)	
Oviedo, FL; 2000 [323]	1.0 lb ai/gal CS	Immature tubers to mature tubers.	10-60	0.03-0.031	7-8	0.121	None
Columbia MO; 2000 [324]	1.0 lb ai/gal CS	25% to 90% bulking	10-60	0.029-0.031	7	0.120	None
Arkansaw, WI 2000 [325]	1.0 lb ai/gal CS	Post bloom to maturity.	10-60	0.03-0.031	7	0.123	None
Geneva, MN; 2000 [326]	1.0 lb ai/gal CS	Flowering to tuber expansion.	10-60	0.03	8-9	0.120	None
Gardner, ND; 2000 [327]	1.0 lb ai/gal CS	Timing not reported. [4]	10-60	0.03-0.031	7-8	0.121	None
Center, CO; 2000 [328]	1.0 lb ai/gal CS	2-4 ounce to senescing tubers.	10-60	0.029-0.03	7-8	0.117	None
Madera, CA; 2000 [329]	1.0 lb ai/gal CS	Full foliage to maturing potatoes.	8-10	0.03	7-10	0.120	None
Harrah, WA; 2000 [330]	1.0 lb ai/gal CS	Immature potatoes. [4]	10-60	0.029-0.03	7-9	0.117	None
Prosser, WA; 2000 [331]	1.0 lb ai/gal CS	Timing not reported. [4]	8-10	0.03	7-9	0.120	None
Hermiston, OR; 2000 [332]	1.0 lb ai/gal CS	3" tubers. [4]	10-60	0.03-0.031	7-8	0.122	None
Ashton, ID; 2000 [333]	1.0 lb ai/gal CS	During bulking.	10-60	0.029-0.031	7	0.122	None
Jerome, ID; 2000 [334]	1.0 lb ai/gal CS	BBCH 47-48.	10-60	0.03-0.031	7	0.121	None
Bliss, ID; 2000 [335]	1.0 lb ai/gal CS	BBCH 45-48.	10-60	0.03	7-8	0.120	None

1. All treatments consisted of 4 broadcast foliar applications which were made using ground equipment.
2. GPA – Gallons Per Acre. Spray volumes for specific trials were not reported.
3. RTI = Re-Treatment Interval.
4. Growth stages for the potato crop at each application were not reported at four sites.

TABLE B.1.3 Trial Numbers and Geographical Locations.

NAFTA Growing Zones	Potatoes		
	Submitted	Requested	
		Canada	U.S.
1	2	--	2
2	1	--	1
3	1	--	1
4	--	--	--
5	4	--	4
6	--	--	--
7	--	--	--
8	--	--	--
9	1	--	1
10	1	--	1
11	6	--	6
12	--	--	--
Total	**16**	**--**	**16***

* Number of potato field trials required for crop subgroup tolerance on tuberous and corm vegetables, Subgroup 1C

B.2. Sample Handling and Preparation

Single control and duplicate treated samples of potato tubers (24 tubers per sample) were collected from each trial site at commercial maturity, 7 DAT. Samples were placed in freezers within 4 hours of collection, and were shipped by freezer truck to the analytical laboratory (ABC Laboratories in Columbia, MO), where samples were stored at -19 ± 9°C until analysis.

B.3. Analytical Methodology

Samples of potato tubers were analyzed for residues of lambda-cyhalothrin and R157836 using a GC/ECD method, which is based on the current tolerance enforcement method (PRAM 81).

Residues of lambda-cyhalothrin and R157836 were extracted from potatoes by blending with acetone/hexane (1:1, v/v) and sodium sulfate. Residues were filtered, and partitioned twice against aqueous saturated sodium chloride, discarding the aqueous layers. Residues in the remaining hexane fraction were then filtered through sodium sulfate, concentrated to dryness, and re-dissolved in hexane. Residues were next cleaned up using two Florisil columns, each washed with hexane, and then eluted with ethyl ether/hexane (1:3, v/v). Residues of both analytes were determined in a single injection by GC/ECD using external standards. The validated LOQs for both analytes are 0.01 ppm; the LODs were not reported.

The above method was validated using control samples of potato tubers fortified with lambda-cyhalothrin at 0.007-0.700 ppm, and R157836 at 0.013-1.30 ppm.

C. RESULTS AND DISCUSSION

In 16 field trials conducted in growing zones 1, 2, 3, 5, 9, 10, and 11 during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to potatoes as four broadcast foliar applications during tuber development at rates of 0.029-0.031 lb ai/A per application, at RTIs of 7-10 days, for total application rates of 0.117-0.124 lb ai/A. All applications were made using ground equipment in spray volumes of either 8-10 or 10-60 GPA, and did not include the use of any adjuvants. Single control and duplicate treated samples of potato tubers were collected from each trial at 7 DAT.

The GC/ECD method used to determine residues of lambda-cyhalothrin and R157836 in potatoes was adequately validated prior to, and in conjunction with, the analysis of field trial samples. Method validation recoveries from potatoes averaged 91% (with standard deviation of 4%) for lambda-cyhalothrin fortified at 0.007-0.700 ppm, and 92% (std. dev. 5%) for R157836 fortified at 0.013-1.30 ppm (see Table C.1, below). Concurrent recoveries averaged 99% (std. dev. 11%) for lambda-cyhalothrin at 0.007-0.070 ppm, and 96% (std. dev. 8%) for R157836 at 0.013-0.130 ppm. Apparent residues of each analyte were <LOQ in all control samples; adequate sample calculations and example chromatograms were provided.

Samples were stored frozen for durations of up to 99 days prior to extraction (see Table C.2, below). Adequate storage stability data have been previously reviewed (PP#1F3952/H5607; M. Flood; 9/19/1991) indicating that lambda-cyhalothrin and R157836 are stable at -18°C for intervals of up to 26 months in potatoes. These data will support the sample storage conditions and durations for the current potato study.

Following four applications of lambda-cyhalothrin (1 lb ai/gal CS) at rates totaling 0.117-0.124 lb ai/A, residues of lambda-cyhalothrin and R157836 were each <LOQ in all 32 samples harvested at 7 DAT (see Table C.3, below). Combined HAFT residues were 0.02 ppm, while average combined residues were 0.01 ppm (see Table C.4, below).

Common cultural practices were used to maintain plants; the weather conditions, maintenance chemicals, and fertilizers used in the study did not have a notable impact on the residue data.

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Potatoes.

Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean [Std. Dev.] (%)
Method Validation Recoveries				
Lambda-Cyhalothrin	0.007	2	93, 97	95
	0.070	2	93, 91	92
	0.700	2	90, 84	87
	Overall	**6**	**84-97**	**91 [4]**
R157836	0.013	2	92, 100	96
	0.130	2	91, 91	91
	1.30	2	92, 85	89

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Potatoes.

Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean [Std. Dev.] (%)
Method Validation Recoveries				
	Overall	**6**	**85-100**	**92 [5]**
Concurrent Recoveries				
Lambda - Cyhalothrin	0.007	4	114, 86, 114, 100	104 [13]
	0.070	4	86, 96, 96, 103	95 [7]
	Overall	**8**	**86-114**	**99 [11]**
R157836	0.013	4	108, 85, 100, 100	98 [10]
	0.130	4	86, 95, 97, 98	94 [5]
	Overall	**8**	**85-108**	**96 [8]**

TABLE C.2 Summary of Storage Conditions.

Crop [Matrix]	Storage Temperature (°C)	Actual Storage Duration (Days) [1]	Interval of Demonstrated Storage Stability (Months) [2]
Potato [Tuber]	-19	36-99	26

1. Storage duration from harvest to extraction. Extracts were stored up to 3 days prior to analysis.
2. PP#1F3952/1H5607; M. Flood; 9/19/1991.

TABLE C.3 Residue Data from Potato Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) [Trial ID]	Zone	Potato Variety	Total Rate (lb ai/A)	PHI (Days)	Residues (ppm) [1]		
					Lambda - Cyhalothrin	R157836	Combined
North Rose, NY; 2000 [320]	1	Norland Dark Red	0.121	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Germansville, PA; 2000 [321]	1	Snowden	0.124	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Babcock, GA; 2000 [322]	2	Snowden	0.121	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Oviedo, FL; 2000 [323]	3	Red Pontac	0.121	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Columbia MO; 2000 [324]	5	Norvalley	0.120	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Arkansaw, WI; 2000 [325]	5	Russet Burbank	0.123	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Geneva, MN; 2000 [326]	5	Norlands	0.120	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Gardner, ND; 2000 [327]	5	Red Norland	0.121	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Center, CO; 2000 [328]	9	Norkotah	0.117	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Madera, CA; 2000 [329]	10	Red LaSoda	0.120	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Harrah, WA; 2000 [330]	11	Russey Burbank	0.117	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Prosser, WA; 2000 [331]	11	Shepody	0.120	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Hermiston, OR; 2000 [332]	11	Russet	0.122	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Ashton, ID; 2000 [333]	11	Russet Burbank	0.122	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02

TABLE C.3 Residue Data from Potato Field Trials with Lambda-Cyhalothrin.

Location (City, State; Year) [Trial ID]	Zone	Potato Variety	Total Rate (lb ai/A)	PHI (Days)	Residues (ppm) [1]		
					Lambda - Cyhalothrin	R157836	Combined
Jerome, ID; 2000 [334]	11	Russet Burbank	0.121	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02
Bliss, ID; 2000 [335]	11	Norkota Selection 8	0.120	7	<0.01, <0.01	<0.01, <0.01	<0.02, <0.02

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm.
2. Average of two analyses of the same sample.

TABLE C.4 Summary of Residue Data from Potato Field Trials with Lambda-Cyhalothrin.

Crop [Matrix]	Total Rate (lb ai/A)	PHI (Days)	Combined Residue Levels (ppm) [1]						
			n	Min.	Max.	HAFT [2]	Median	Mean	Std. Dev.
Potato [Tuber]	0.117-0.124	7	32	<0.02	<0.02	0.02	0.010	0.010	NA [3]

1. The method LOQs are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. For calculation of the median, mean, and standard deviation, ½LOQ (0.005 ppm) was used each analyte below the LOQ.
2. HAFT = Highest Average Field Trial.
3. NA - not applicable.

D. CONCLUSION

The field trial data are adequate, and support the use of up to four broadcast foliar applications of lambda-cyhalothrin (CS) on potatoes (during tuber development) at 0.03 lb ai/A per application, for at total seasonal application rate of 0.12 lb ai/A. The data support both an RTI and PHI of 7 days.

E. REFERENCES

PP#0F6092. Request for the Use of Lambda-cyhalothrin in Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.: D284860; Kit Farwell; 8/15/2002.

F. DOCUMENT TRACKING

RDI: W.T. Drew (12/27/2006)
Petition Number: 5F6994
DP Barcode: D324219
PC Code: 128897

Primary Evaluator: William T. Drew, Chemist, HED/RAB2 — Date: 12/27/2006

Approved by: Richard A. Loranger, Branch Senior Scientist, HED/RAB2 — Date: 12/27/2006

This DER was originally prepared under contract by Dynamac Corporation (1910 Sedwick Road, Building 100, Suite B; Durham, NC 27713). It has been reviewed by HED, and revised to reflect current OPP policy.

STUDY REPORT

MRID #46665305. Dave Schwab, Carol Anderson, Jason Niekamp (2001) *Lambda-Cyhalothrin: Residue Levels on Potato Processed Products from a Trial Conducted in the United States During 2000.* Lab Study ID Numbers: 45943 (ABC); RR 00-080B, WINO 49052, LCYH-00-PR-01 (Zeneca); 1429-01 (Syngenta). Unpublished study prepared by Analytical Bio-Chemistry Laboratories and Syngenta Crop Protection. 129 pages. {OPPTS Residue Chemistry Test Guideline 860.1520}

EXECUTIVE SUMMARY

Syngenta Crop Protection submitted a processing study supporting the use on potatoes of lambda-cyhalothrin, formulated as a capsule suspension (CS) having 1 pound of active ingredient per gallon (lb ai/gal). In a single field trial conducted in WA during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to potatoes as four broadcast foliar applications during tuber development at rates of 0.15-0.16 pounds of ai per acre (lb ai/A) per application, at re-treatment intervals (RTIs) of 7 days, for a total application rate of 0.61 lb ai/A (approximately 5x the proposed maximum seasonal rate). Single bulk samples of control and treated tubers were harvested at 7 days after the last application (DAT), and processed into chips, flakes, and wet peel using simulated commercial procedures. Tuber samples were stored at -17°C for up to 89 days prior to analysis, a duration supported by available storage stability data.

Whole tubers were analyzed for residues of lambda-cyhalothrin and its epimer (R157836) using a gas chromatograph with electron capture detection (GC/ECD) method derived from the current tolerance enforcement method. For this method, residues were extracted with acetone/hexane (1:1, v/v) and sodium sulfate, filtered, and partitioned with aqueous sodium chloride. Residues in the hexane fraction were then cleaned up using Florisil columns, and analyzed by GC/ECD using external standards. The validated limits of quantitation (LOQs) are 0.01 ppm for each analyte, for a combined LOQ of 0.02 ppm. The limits of detection (LODs) were not specified.

Residues of lambda-cyhalothrin and R157836 were each <0.01 ppm (<LOQ) in duplicate samples of potato tubers (RAC) treated at 5x the proposed use rate. Because residues were <LOQ in tubers from a 5x treatment, samples of the potato processed fractions were not

analyzed. As the maximum theoretical concentration factor for potatoes is 5x, and residues in tubers were <LOQ at a 5x application rate, quantifiable residues are unlikely to occur in potato processed fractions from a 1x treatment.

STUDY/WAIVER ACCEPTABILITY/DEFICIENCIES/CLARIFICATIONS

Although details for climatic conditions were not provided, and the growth stage at application was not reported, the potato field trial residue data are classified as scientifically acceptable as these were relatively minor deficiencies in the case of this study. The acceptability of this study for regulatory purposes is addressed in the US EPA Residue Chemistry Summary Document (DP #324219).

COMPLIANCE

Signed and dated Good Laboratory Practice (GLP), Quality Assurance, and Data Confidentiality statements were provided. No deviations from regulatory requirements were reported which would have an impact on the validity of the study.

A. BACKGROUND INFORMATION

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used to control a wide range of pests on food/feed crops and livestock, as well as in and around buildings and structures. Tolerances are established for the combined residues of lambda-cyhalothrin and its epimer (R157836) in/on plant commodities at levels ranging from 0.01 ppm on soybeans to 10.0 ppm on dried hops cones (40CFR §180.438[a][1]) . Tolerances are also established for the combined residues of lambda-cyhalothrin and R157836 in animal commodities at levels ranging from 0.01 ppm in eggs, poultry meat, and poultry meat by-products to 5.0 ppm in milk fat (reflecting 0.2 ppm in whole milk). Temporary tolerances have also been established for barley, clover, grass, and wild rice commodities; these tolerances expire on 12/31/2008.

Syngenta Crop Protection has submitted a petition (PP#5F6994) supporting the use of a 1 lb ai/gal CS formulation of lambda-cyhalothrin on tuberous and corm vegetables, Subgroup 1C.

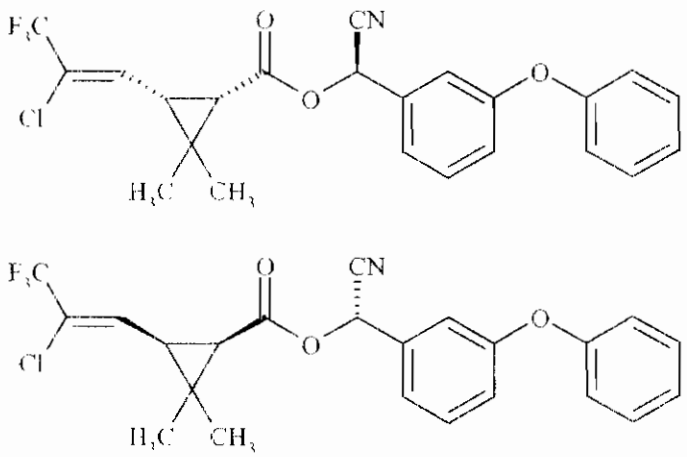
Table A.1 Lambda-Cyhalothrin Nomenclature.	
Compound	1:1 mixture of (Z)-(1R,3R), S-ester: (Z)-(1S,3S), R-ester 
Common Name	Lambda-Cyhalothrin
Company Experimental Name	ICIA0321
Molecular Formula	$C_{23}H_{19}ClF_3NO_3$
Molecular Weight	449.9
IUPAC Name	(*R*)-α-cyano-3-phenoxybenzyl (1*S*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate and (*S*)-α-cyano-3-phenoxybenzyl (1*R*)-*cis*-3-[(*Z*)-2-chloro-3,3,3-trifluoropropenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Name	*rel*-(*R*)-cyano(3-phenoxyphenyl)methyl (1*S*,3*S*)-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS Registry Number	91465-08-6
End-use Products (EP)	1.0 lb ai/gal CS (Warrior® Insecticide with Zeon Technology™; EPA Registration #100-1112)

Table A.2 Physicochemical Properties of Lambda-Cyhalothrin.		
Parameter	**Value**	**Reference**
Melting Point/Range (°C)	49.2	D284860 [1]
pH	NA [2]	
Density (g/cm³ at 25°C)	1.33	
Water Solubility (mg/L at 20°C, pH 6.5)	0.005	
Solvent Solubility (g/L)	NA	
Vapor Pressure (mm Hg at 20°C)	1.5×10^{-9}	
Dissociation Constant (pK_a at 20°C)	>9	
Octanol/water Partition Coefficient (Log[K_{OW}])	7.00	
UV/visible Absorption Spectrum	NA	

1. Kit Farwell, 8/15/2002.
2. NA – Not Available.

B. EXPERIMENTAL DESIGN

B.1. Application and Crop Information

The study report stated that climatic conditions were typical for the region, and that supplemental irrigation was used. However, no detailed climatic information was provided. Lambda-cyhalothrin (1 lb ai/gal CS) was applied to potatoes as four broadcast foliar applications, beginning roughly 1 month prior to normal maturity (see Table B.1, below). The target application rate was 0.15 lb ai/A per application, which is 5x the proposed maximum rate.

TABLE B.1 Study Use Pattern.

Location (County, State; Year) [Trial ID]	End-Use Product	Application Information					Tank Mix Adjuvants
		Method; Timing [1]	Spray Volume (GPA) [2]	Single Rate (lb ai/A)	RTI [3] (Days)	Total Rate (lb ai/A)	
Ephrata, WA; 2000 [339]	1.0 lb ai/gal CS	4 broadcast foliar applications during tuber development	10-60	0.15-0.16	7	0.61	None

1. Crop growth stages at each application were not reported, but the initial application was made ~30 days prior to normal crop maturity.
2. GPA = Gallons Per Acre. Spray volumes for specific trials were not reported.
3. RTI = Re-Treatment Interval.

B.2. Sample Handling and Processing Procedures

Single control and treated bulk samples of tubers (250 lbs per sample) were harvested at commercial maturity, 7 DAT, and were transported the same day under ambient conditions to the processing facility (Englar Food Laboratories in Moses Lake, WA), where the tubers were stored at 7°C. Within 8-9 days of receipt at the processing facility, whole tubers were processed into chips, flakes, and wet peel using simulated commercial procedures. Details of the processing procedures and processing flow sheets were provided. After processing, samples of tubers and each processed fraction were stored at -22°C for 18 days, until shipment by freezer truck to the analytical laboratory (ABC Laboratories in Columbia, MO), where samples were stored at -17 ± 15°C until extraction for analysis.

B.3. Analytical Methodology

Samples of potato tubers were analyzed for residues of lambda-cyhalothrin and R157836 using a GC/ECD method, which is based on the current tolerance enforcement method (PRAM 81).

Residues of lambda-cyhalothrin and R157836 were extracted from potatoes by blending with acetone/hexane (1:1, v/v) and sodium sulfate. Residues were filtered, and partitioned twice against aqueous saturated sodium chloride, discarding the aqueous layers. Residues in the remaining hexane fraction were then filtered through sodium sulfate, concentrated to dryness, and re-dissolved in hexane. Residues were next cleaned up using two Florisil columns, each washed with hexane, and then eluted with ethyl ether/hexane (1:3, v/v). Residues of both

analytes were determined in a single injection by GC/ECD using external standards. The validated LOQs for both analytes are 0.01 ppm; the LODs were not reported.

The above method was validated using control samples of potato tubers fortified with lambda-cyhalothrin at 0.007-0.700 ppm, and R157836 at 0.013-1.30 ppm. In conjunction with the analysis of the treated samples, the above method was validated using control samples of potato tubers fortified with lambda-cyhalothrin at 0.007 ppm, and R157836 at 0.013 ppm.

C. RESULTS AND DISCUSSION

In a single field trial conducted in WA during 2000, lambda-cyhalothrin (1 lb ai/gal CS) was applied to potatoes as four broadcast foliar applications during tuber development at rates of 0.15-0.16 lb ai/A per application, at RTIs of 7 days, for a total application rate of 0.61 lb ai/A (5x the proposed maximum seasonal rate). Single bulk samples of control and treated tubers were harvested at 7 DAT, and processed into chips, flakes, and wet peel using simulated commercial procedures.

The GC/ECD method used to determine residues of lambda-cyhalothrin and R157836 in potatoes was adequately validated prior to, and in conjunction with, the analysis of field trial samples. Method validation recoveries from potatoes averaged 91% (with standard deviation of 4%) for lambda-cyhalothrin fortified at 0.007-0.700 ppm, and 92% (std. dev. 5%) for R157836 fortified at 0.013-1.30 ppm (see Table C.1, below). Concurrent recoveries were 100% for both lambda-cyhalothrin and R157836. Apparent residues of each analyte were <LOQ in the control sample; adequate sample calculations and example chromatograms were provided.

Samples were stored frozen for durations of up to 81 days prior to extraction (see Table C.2, below). Adequate storage stability data have been previously reviewed (PP#1F3952/1H5607; M. Flood; 9/19/1991) indicating that lambda-cyhalothrin and R157836 are stable at -18°C for intervals of up to 26 months in potatoes. These data will support the sample storage conditions and durations for the current potato processing study.

Residues of lambda-cyhalothrin and R157836 were each <LOQ in duplicate samples of potato tubers, the raw agricultural commodity (RAC), treated at 5x the proposed use rate (see Table C.3, below). As residues were <LOQ in tubers from a 5x treatment, samples of the potato processed fraction were not analyzed.

TABLE C.1 Summary of Method Validation and Concurrent Recoveries of Lambda-Cyhalothrin and R157836 from Potatoes.

Analyte	Spike Level (ppm)	Sample Size (n)	Recoveries (%)	Mean [Std. Dev.] (%)
Method Validation Recoveries				
Lambda-Cyhalothrin	0.007	2	93, 97	95
	0.070	2	93, 91	92
	0.700	2	90, 84	87
	Overall	**6**	**84-97**	**91 [4]**
R157836	0.013	2	92, 100	96
	0.130	2	91, 91	91
	1.30	2	92, 85	89
	Overall	**6**	**85-100**	**92 [5]**
Concurrent Recoveries				
Lambda -Cyhalothrin	0.007	1	100	NA*
R157836	0.013	1	100	NA

* NA = Not Applicable.

TABLE C.2 Summary of Storage Conditions.

Crop [Matrix]	Storage Temperature (°C)	Actual Storage Duration (Days) [1]	Interval of Demonstrated Storage Stability (Months) [2]
Potato [Tuber]	-17	81	16

1. Storage duration from harvest to extraction. Extracts were analyzed the same day.
2. PP#1F3952/1H5607; M. Flood; 9/19/1991.

TABLE C.3 Residue Data from the Potato Processing Study with Lambda-Cyhalothrin.

RAC	Commodity	Total Rate (lb ai/A)	PHI (Days)	Residues (ppm)			Processing Factor
				Lambda - cyhalothrin	R157836	Combined	
Potato	Whole Tuber	0.61	7	<0.01	<0.01	<0.02	NA*

* NA = Not Applicable.

D. CONCLUSION

The potato processing study is adequate. As residues of both lambda-cyhalothrin and R157836 were <0.01 ppm in whole tubers (RAC) treated at 5x the proposed maximum seasonal use rate, and as the maximum theoretical concentration factor for potatoes is 5x, residues are unlikely to be detectable in potato processed fractions from a 1x treatment.

E. REFERENCES

PP#0F6092. Request for the Use of Lambda-cyhalothrin in Canola, Pome Fruits, Stone Fruits, Tree Nuts, Almond Hulls, and Tobacco.; D284860; Kit Farwell; 8/15/2002.

F. DOCUMENT TRACKING

RDI: W.T. Drew (12/27/2006)
Petition Number: 5F6994
DP Barcode: D324219
PC Code: 128897

13544

R142711

Chemical: lambda-Cyhalothrin

PC Code:
128897

HED File Code: 11500 Petition Files Chemistry
Memo Date: 12/27/2006
File ID: DPD313315
DPD324219
DPD330542
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