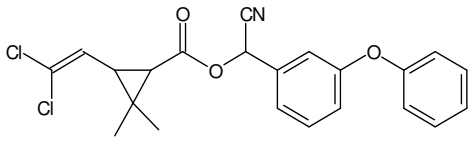
ZETA-CYPERMETHRIN

See also monographs on cypermethrin and alpha-cypermethrin.

IDENTITY

ISO common name	zeta-cypermethrin
Synonyms:	FMC56701 FMC45497 cypermethrin, cis isomers FMC45724 cypermethrin, trans isomers FMC30980 cypermethrin cis:trans 48:52 WL 43467: cypermethrin
IUPAC name (Wood, 2008)	mixture of the stereoisomers (*S*)-α-cyano-3-phenoxybenzyl (1*RS*,3*RS*;1*RS*,3*SR*)-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate where the ratio of the (*S*);(1*RS*,3*RS*) isomeric pair to the (*S*);(1*RS*,3*SR*) isomeric pair lies in the ratio range 45-55 to 55-45 respectively
Chemical Abstracts name (Wood, 2008)	(*S*)-cyano(3-phenoxyphenyl)methyl 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate
CAS Number (Wood, 2008)	52315-07-8
CIPAC Number	733
Molecular formula	$C_{22}H_{19}Cl_2NO_3$
Molecular mass	416.3
Structural formula	

Comparison with cypermethrin and alpha-cypermethrin

Isomer	cypermethrin	alpha-cypermethrin	zeta-cypermethrin
1R, cis-R	14	–	3
1S, cis-S	14	–	22
1R, cis-S	11	50	22
1S, cis-R	11	50	3
1R, trans-R	14	–	3
1S, trans-S	14	–	22
1R, trans-S	11	–	22
1S, trans-R	11	–	3

PHYSICAL AND CHEMICAL PROPERTIES

Pure active ingredient

Property	Results	Ref
Melting point (cis purity 99.3%, trans purity 99.2%)	56.3 ˚C cis 53.2 ˚C trans	P-2594
Relative density (purity%)		

Property	Results	Ref
Vapour pressure (purity 99.3% cis:trans 52:48)	$4.1 \pm 0.8 \times 10^{-7}$ Pa at 25 ˚C Gas saturation method, measurements at 25 ˚C.	P-2594
Vapour pressure (purity 97.7%)	$2.5 \pm 0.8 \times 10^{-7}$ Pa at 25 ˚C Gas saturation method, measurements at 25 ˚C.	P-2595
Solubility in water (purity)	??	
Octanol/water partition coefficient (purity 99.3% cis:trans 52:48)	K_{ow} = 355–1290 (scattered results, questionable)	P-2594
Octanol/water partition coefficient (purity 97.7%)	K_{ow} = 124–3940 (scattered results, questionable)	P-2595
Octanol/water partition coefficient (purity 96.8%)	$K_{ow} = 2.01\times10^6$–4.50×10^6 (n = 6) Mean $K_{ow} = 3.0\pm1\times10^6$ Log K_{ow} = 6.5	P-3040
Hydrolysis rate, cypermethrin cis isomer, 25 ˚C	pH 3: 94% remaining after 28 days pH 6: 98% remaining after 28 days pH 9: Half-life = 93 hours cis-DCVA identified as hydrolysis product	W-0131
Hydrolysis rate, cypermethrin trans isomer, 25 ˚C	pH 3: 94% remaining after 28 days pH 6: Half-life = 26 days pH 9: Half-life = 24 hours trans-DCVA identified as hydrolysis product	W-0131
Hydrolysis rate, cypermethrin cis:trans 48:52, 25 ˚C	pH 3: 94% remaining after 28 days pH 6: 62% remaining after 28 days pH 9: Half-life = 38 hours *cis*- and *trans*-DCVA identified as hydrolysis products	W-0131
Hydrolysis rate, cypermethrin cis:trans ratio, not stated. [^{14}C-cyclopropyl]cypermethrin radiochem purity 99.4% 25 ˚C, 10 µg/L in 1% acetonitrile buffer solutions, in the dark	pH 5: 95% remaining after 30 days pH 7: 88% remaining after 30 days pH 9: Half-life = 1.8 days *cis*- and *trans*-DCVA identified as hydrolysis products, constituting 79% yield in pH 9 hydrolysis by day 30	P-2771
Hydrolysis rate, cypermethrin cis:trans ratio, not stated. [^{14}C-benzyl ring]cypermethrin radiochem purity 98.3% 25 ˚C, 10 µg/L in 1% acetonitrile buffer solutions, in the dark	pH 5: 93% remaining after 30 days pH 7: 93% remaining after 30 days pH 9: Half-life = 2.5 days 3-phenoxybenzaldehyde identified as hydrolysis product, constituting 65% yield in pH 9 hydrolysis by day 30.	P-2771
Photolysis rate, cypermethrin (radiopurity 95.4% cyclopropyl label, 96.9% benzyl ring label)	Conditions: Aqueous sterile buffer pH 7, 0.1 mg/L, 25 ˚C, natural sunlight (California Jan–April), duration 30 and 35 days. Estimated half-lives 36 and 20 days. Identified photolysis products: PBA and DCVA.	PC-0163
Dissociation constant in water	not applicable	

Technical material—zeta-cypermethrin

Property	Result	Ref
Minimum purity	800 g/kg (S-isomers). Also contains R-isomers (max 125 g/kg)	
Description (purity 89.7%, 83% cis isomers)	dark reddish brown viscous liquid	P-2595
Density (purity 89.7%, 83% cis isomers)	1.219 g/mL at 25 ˚C	P-2595
Solubility in organic solvents at 23 °C (purity 89.7%, 83% cis isomers)	miscible with acetone, acetonitrile, dichloromethane, toluene	P-2595
Solubility in organic solvents at 25 °C (purity 85.3%, 95.1% total cypermethrin)	miscible with methanol and ethyl acetate	P-3109
Solubility in water (purity 89.7%, 83% cis isomers)	45 µg/L at 25 ˚C	P-2595

Technical material—cypermethrin

Property	Result	Ref
Description (purity 95.2%)	dark reddish brown viscous liquid	P-2594
Density (purity 95.2%)	1.204 g/mL at 25 ˚C	P-2594
Boiling point (purity 95.2%)	216 ˚C with decomposition, at atmospheric pressure	P-2844
Solubility in organic solvents at 23 °C (purity 95.2%)	miscible with acetone, acetonitrile, dichloromethane, toluene	P-2594
Solubility in water (purity 95.2%)	7.6 µg/L at 25 ˚C	P-2594

Formulations

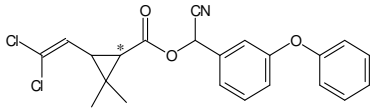
Zeta-cypermethrin is available as EC and EW commercial formulations.

Code	Description	Concentration	Examples	
EC	emulsifiable concentrate	15 g/L	Fury® 1.5 EC	Italy
EC	emulsifiable concentrate	96 g/kg	Mustang® Max EC Insecticide	USA
EW	emulsion, oil in water	100 g/L	Fury® 100 EW	Spain
EW	emulsion, oil in water	100 g/L	Fury® 10 EW	France
EW	emulsion, oil in water	171 g/kg	Mustang® Insecticide	USA
EW	emulsion, oil in water	180 g/L	Fury® 180 EW	Brazil
EC	emulsifiable concentrate	181 g/kg	Fury® 1.5 EC	USA
EW	emulsion, oil in water	181 g/kg	Fury® Insecticide	USA
EC	emulsifiable concentrate	200 g/L	Arrivo® 200 CE	Brazil

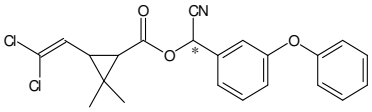
Code	Description	Concentration	Examples	
EW	emulsion, oil in water	200 g/L	Fury® 200 EW	Brazil
EC	emulsifiable concentrate	400 g/L	Fury® 400 CE	Brazil

METABOLISM

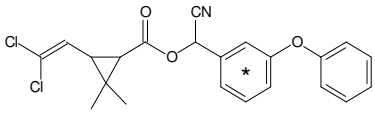
Animal and plant metabolism and environmental fate studies used cypermethrin ^{14}C labelled in the cyclopropyl, benzyl alpha carbon, benzyl ring and phenoxy ring carbon positions.



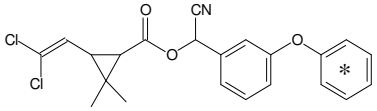
cyclopropyl label



benzyl alpha-carbon label



benzyl ring label

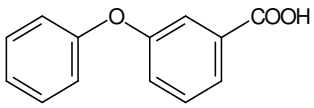
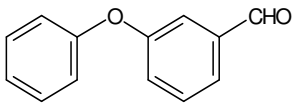
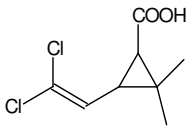
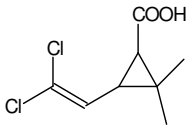


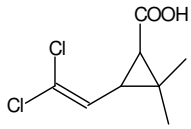
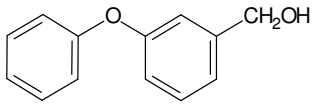
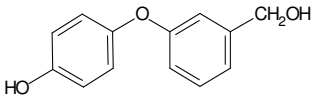
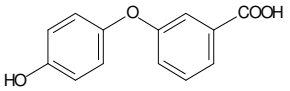
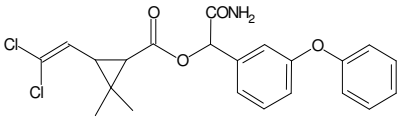
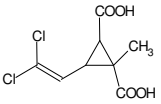
phenoxy ring label

Structures, names and codes for metabolites are summarised below. Five possibilities for describing each metabolite are:

- A simple name, which could be a common name, a simplified systematic name, an abbreviation or a pseudo-common name (e.g., hydroxy-cypermethrin)
- The systematic chemical name—it may be too cumbersome for use in discussion and tables
- The CAS number—CAS numbers are not available for many metabolites
- The company code number, e.g., FMC56701
- Serial numbers, e.g., metab 1, metab 2, etc—not generally used here.

In this evaluation, metabolites are described by a simple name, often an abbreviation in tables.

Simple: 3-phenoxybenzoic acid, PBA, mPB acid Systematic: 3-phenoxybenzoic acid CAS number: 3739-38-6 Code: FMC30952	
Simple: 3-phenoxybenzaldehyde, mPB aldehyde Systematic: 3-phenoxybenzaldehyde CAS number: 39515-51-0 Code: FMC51046	
Simple: Cl2CA, DCVC acid, DCVA Systematic: 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid CAS number: Code:	
Simple: *cis*-DCVA Systematic: *cis*-3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid CAS number: cis: 59042-49-8 Code: FMC53962	

Simple: *trans*-DCVA Systematic: *trans*-3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid CAS number: 59042-50-1 Code: FMC53963	
Simple: 3-phenoxybenzyl alcohol, mPB alcohol Systematic: 3-phenoxybenzyl alcohol CAS number: 13826-35-2 Code: FMC30953	
Simple: 4'-OH mPB alcohol Systematic: 4'-hydroxy-3-phenoxybenzyl alcohol CAS number: Code:	
Simple: 4'-OH mPB acid Systematic: 4'-hydroxy-3-phenoxybenzoic acid CAS number: Code:	
Simple: Cyperamide Systematic: CAS number: Code: FMC53905	
Simple: DCVA-dicarboxylic acid Systematic: 3-(2,2-dichlorovinyl)-2-methylcyclopropane-1,2-dicarboxylic acid CAS number: Code:	

Animal metabolism

The Meeting received animal metabolism studies with cypermethrin in rats, lactating goats and laying hens.

Laboratory animals

The metabolic fate of orally administered cypermethrin in rats and mice was reported by the 2006 JMPR (JMPR, 2006):

"In laboratory animals, cypermethrin was readily hydrolysed at the ester bond, followed by hydroxylation and conjugation of the cyclopropyl and phenoxybenzyl moieties of the molecule. Urinary metabolites consistent with a similar metabolic pathway in humans were recovered from orally dosed volunteers. The animal data indicated that there is little isomeric interconversion during metabolism of cypermethrin or alpha-cypermethrin."

Livestock

See also alpha-cypermethrin monograph for studies on lactating dairy cows (alpha-cypermethrin) and laying hens (alpha-cypermethrin).

Lactating dairy animals

Two lactating Friesian dairy cows were dosed orally twice daily with treated feed for 20 and 21 days with [^{14}C-benzyl ring]cypermethrin (cis:trans 50:50) at 1 mg per dose, equivalent to approximately 0.2 ppm cypermethrin in the total diet, assuming a daily diet of 10 kg of the residue-containing concentrate such as cotton seed cake (Crawford, 1978, TLGR.0029.78). Milk was collected twice daily. The animals were slaughtered after the final doses, (interval not stated), for tissue collection.

TRR in milk reached a plateau on the 2nd or 3rd day of dosing. Plateau levels were approximately 0.0007–0.0009 mg/kg. The majority of the ^{14}C (68% and 59%) resided in the cream fraction. Urine (54%) and faeces (43%) were the major routes of excretion of the administered ^{14}C.

Levels of ^{14}C in the fat were generally higher than in the other tissues. TRR in the tissues were: muscle < 0.001 mg/kg, renal fat 0.010–0.012 mg/kg, subcutaneous fat 0.008–0.009 mg/kg, liver 0.004–0.008 mg/kg and kidney 0.003–0.004 mg/kg.

In another dairy cow study, lactating Friesian dairy cows were dosed orally twice daily with treated feed for seven days with [^{14}C-cyclopropyl]cypermethrin (two cows) and [^{14}C-benzyl ring]cypermethrin (one cow) at 25 mg per dose, equivalent to approximately 5 ppm cypermethrin in the total diet (Crawford, 1978, TLGR.0029.78). Milk was collected twice daily. The animals were slaughtered after the final doses, (interval not stated), for tissue collection.

TRR in milk reached a plateau on the 3rd or 4th day of dosing. Plateau levels were approximately 0.011–0.013 mg/kg. Urine (49%) and faeces (38%) were the major routes of excretion of the administered ^{14}C.

Levels of ^{14}C in the tissues were generally similar from the two labelling positions. TRR in the tissues were: muscle < o.04 mg/kg, renal fat 0.03–0.10 mg/kg, subcutaneous fat 0.01–0.06 mg/kg, liver 0.10 mg/kg and kidney 0.05–0.13 mg/kg.

Laying hens

A group of laying Warren domestic fowl (four birds) was dosed orally once daily via capsule for 14 consecutive days with 1.5 mg/bird/day of [^{14}C-phenoxy ring]cypermethrin (Hutson, 1982, SBER.82.002). The cypermethrin had a cis:trans ratio of 55:45. Birds were given access to food and water *ad libitum*. Eggs were collected daily. The birds were slaughtered approximately 4.5 hours after the final doses and tissue samples were taken. Body weights were in the range 2.1–2.3 kg.

TRR reached a plateau (approximately 0.12–0.19 mg/kg) in egg yolks after 7–8 days of dosing. TRR in egg whites was consistently below 0.01 mg/kg. Parent cypermethrin was identified as a component of the residue in egg yolks.

TRR in the liver (mean 0.37 mg/kg) was higher than mean residues in the other tissues: peritoneal fat 0.08 mg/kg, subcutaneous fat 0.08 mg/kg, breast muscle 0.012 mg/kg and leg muscle 0.022 mg/kg. Parent cypermethrin was identified as a major component of the residues in peritoneal fat (0.046 mg/kg) and subcutaneous fat (0.047 mg/kg). In the liver, cypermethrin accounted for 0.06 mg/kg and 3-phenoxybenzoic acid 0.01 mg/kg.

Groups of laying white leghorn hens (12 birds per group), mean body weight 1.5 kg at study initiation, were dosed orally once daily via capsule for 14 consecutive days with 1 mg/bird/day of [^{14}C]cypermethrin (one group with [^{14}C]benzyl ring label and the other group with [^{14}C]cyclopropyl label), equivalent to 10 ppm (actual 8.5–8.7 ppm) in the feed for a 100 g/day mean feed consumption (ElNaggar, 1993, P-2851).

Eggs were collected twice daily. The birds were slaughtered approximately 22 hours after the final doses for tissue collection (breast muscle, liver and peritoneal fat). Recoveries of ^{14}C were 90% and 91% of the administered dose. Most of the ^{14}C (97–99% of recovered doses) was eliminated via the excreta.

Tissues, egg whites and egg yolks were extracted with various solvent combinations of methanol, water, dichloromethane, acetone, hexane and acetonitrile. The remaining non-extractables were subject to enzyme treatment to release metabolites from conjugates. The distribution of residues and metabolite identification are summarised in Table 1.

Concentration of TRR in eggs reached a plateau between 7 and 12 days.

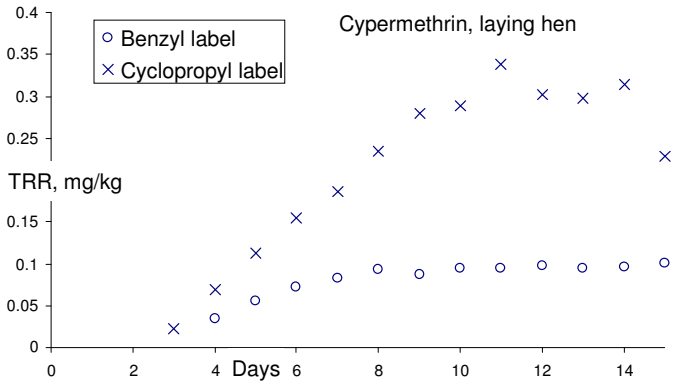


Figure 1 TRR in egg yolks from eggs collected daily during the dosing of laying hens with [^{14}C]cypermethrin at 1 mg/bird/day (ElNaggar, 1993, P-2851)

Sample storage stability at –20 ˚C was tested comparing the metabolite profile of test samples at the beginning of the analytical phase and at a later stage. No significant change was observed. Liver and fat tissues were also fortified with residues and stored for six months with no significant changes in cypermethrin residue levels.

Ester hydrolysis is the the main initial metabolic pathway for cypermethrin. Parent cypermethrin is a significant part of the residue in fat and egg yolks. DCVA is a major part of the residue in liver and muscle and is significant in fat and egg yolk.

Table 1 Distribution of ^{14}C residue and metabolites in tissues and eggs of laying hens dosed orally daily for 14 consecutive days with 1 mg/bird/day of [^{14}C]cypermethrin, equivalent to 10 ppm in the feed (ElNaggar, 1993, P-2851)

Residue component	Concentration, mg/kg, expressed as parent					
	Liver	Kidney	Breast muscle	Peritoneal fat	Egg white, day 10–15	Egg yolk, day 10–15
[^{14}C-benzyl ring] label						
Total ^{14}C residue (TRR)	0.18	0.22	nd	0.098	nd	0.11
Extracted residue%	66%			100%		73%
Unextractable%	34%			0%		27%
Cypermethrin	0.007			0.068		0.033
3-OH-B acid	0.016			< 0.0005		0.004
4'-hydroxy-3-phenoxybenzyl alcohol	0.004			< 0.0005		0.001
4'-hydroxy-3-phenoxybenzoic acid	0.034			< 0.0005		0.001
2'-hydroxy-3-phenoxybenzoic acid	0.009			< 0.0005		0.002
3-phenoxybenzoic acid	0.026			0.001		0.002
3-phenoxybenzoic acid conjugate				0.010		0.010
3-phenoxybenzaldehyde conjugate						0.005
% of TRR identified	53%			70%		39%
[^{14}C-cyclopropyl] label						
Total ^{14}C residue (TRR)	2.7	0.93	0.195	0.23	0.12	0.53
Extracted residue%	89%		94%	100%		80%
Unextractable%	11%		5.1%	0%		20%
Cypermethrin	0.001		0.005	0.071		0.043
DCVA	2.2		0.18	0.098		0.12
DCVA lipid conjugates				0.002		0.011

Residue component	Concentration, mg/kg, expressed as parent					
	Liver	Kidney	Breast muscle	Peritoneal fat	Egg white, day 10–15	Egg yolk, day 10–15
DCVA amino acid conjugates						0.008
% of TRR identified	82%		95%	74%		34%

nd: not detectable (no limit specified).

In a study to examine possible interaction effects of pyrethroids on distribution and excretion kinetics (no evidence for such interaction effects was found), a group of laying white leghorn hens (27 birds) was dosed orally once by gavage with a mixture of ^{14}C labelled cypermethrin, deltamethrin and fenvalerate at 10 mg/kg bw for each substance. (van Dijk, 1994, RCC346915). Cypermethrin was labelled in the phenoxy ring, deltamethrin in the benzyl alpha carbon and fenvalerate in the benzyl ring. Eggs were collected daily. Birds were killed at intervals after dosing and blood and tissue samples were taken.

Approximately 80% and 90% of the administered doses was excreted within 24 and 168 h of dosing respectively. At 168 hours, remaining radioactivity could not be detected in organs or tissues apart from fat, liver and kidney.

^{14}C levels in egg yolks reached a peak on day four and then declined with an estimated halflife of 1.3 days, reaching a level below LOQ after 10 days. Levels of ^{14}C in egg whites throughout were below LOQ.

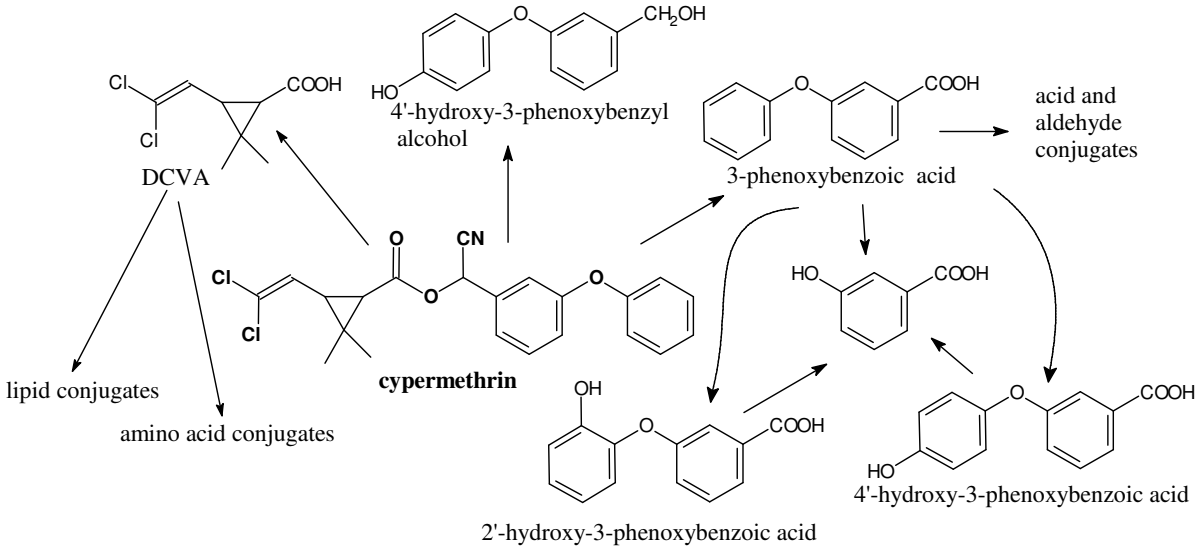


Figure 2 Proposed metabolic pathway for cypermethrin in the laying hen

Plant metabolism

See also alpha-cypermethrin monograph for studies on cabbage (alpha-cypermethrin) and wheat (alpha-cypermethrin).

See also cypermethrin monograph for a study on lettuce (cypermethrin).

The Meeting received plant metabolism studies with cypermethrin in sugar beet, maize, cotton, lettuce and apples and with zeta-cypermethrin in maize.

When cypermethrin or zeta-cypermethrin is applied to a crop, the highest residue occurs on parts of the plant exposed to the application. Parent compound is the major identified residue and very little is absorbed or translocated. Metabolites result from ester hydrolysis and hydroxylation processes. Exposed residues are subject to isomerisation, presumably by a photolytic process.

Sugar beet

In a sugar beet metabolism study in the USA, Comezoglu and Ly (1996, PC-0251) foliar sprayed sugar beet plants (variety SS-334R) in experimental plots three times at 12, 8 and 3 weeks before harvest with [^{14}C]benzyl ring and [^{14}C]cyclopropyl-labelled cypermethrin (benzyl ring cis:trans 53.6:46.4; cyclopropyl cis:trans 50:50) at the equivalent of 0.22 kg ai/ha. Samples of sugar beet plants were harvested and separated into foliage and roots. The sugar content of harvested beets was 13.8% (commercial typically 14–17%).

The distribution of the residue in foliage and roots and identification of the residue are summarised in Table 2. A substantial part of the residue (77–91%) was identified for foliage and roots for both labels. Parent cypermethrin was the major identified residue constituting 64% and 52% of the residue in foliage and 60% and 41% of the residue in the roots. Metabolite DCVA and its conjugates constituted 35% of the TRR in both foliage and roots. No other metabolite exceeded 20% of TRR.

The conjugates of DCVA were identified as a glucoside, a malonyl glucoside and a glucoside disulphate. The conjugates of 3-phenoxybenzyl alcohol were identified as a glucoside trisulphate and a glucoside disulphate. Other metabolites were conjugated to sugars.

Table 2 Distribution of ^{14}C residue and metabolites in foliage and roots of sugar beet sprayed with [^{14}C]cypermethrin at 0.22 kg ai/ha (Comezoglu and Ly, 1996, PC-0251)

Concentration, mg/kg, expressed as parent					
[^{14}C]benzyl ring label			[^{14}C]cyclopropyl label		
Residue component	Foliage	Roots	Residue component	Foliage	Roots
Total ^{14}C residue (TRR)	7.0	0.48	Total ^{14}C residue (TRR)	9.1	0.68
Extracted residue%	95%	84%	Extracted residue%	92%	91%
Unextractable%	5.0%	16%	Unextractable%	7.6%	8.9%
Cypermethrin	4.45	0.29	Cypermethrin	4.7	0.28
3-phenoxybenzyl alcohol conjugates	0.91	0.035	trans-DCVA		0.008
3-phenoxybenzoic acid conjugates	0.25	0.014	cis-DCVA		0.007
3-phenoxybenzoic acid		0.002	trans-DCVA conjugates	2.2	0.15
4'-hydroxy-3-phenoxybenzoic acid conjugates	0.54	0.029	cis-DCVA conjugates	1.0	0.078
4'-hydroxy-3-phenoxybenzyl alcohol conjugates	0.17				
3-phenoxybenzaldehyde conjugates	0.076				
% of TRR identified	91%	77%		87%	77%

Maize

In a maize metabolism study in the USA, George (1995, RAN-0272) applied [^{14}C]cypermethrin formulated as an EC three times (19 and 15 days intervals) to maize plants (variety Germaine 3114) in a greenhouse by painting their leaves at an application rate each time of 0.44 kg ai/ha. The cypermethrin was labelled in the cyclopropyl ring for one treatment and in the benzyl ring for the other. Stalk, husk and ear were sampled three days after the second treatment to simulate a sweet corn usage. Silage samples were 15 days after the second treatment. Fodder and grain samples were taken 29 days after the third treatment. Samples were extracted with solvents and were then subjected to hydrolysis and enzyme treatments to release the ^{14}C.

The distribution of the residues and the composition of the residues are summarised in Table 3. Little residue reached the ears or the grain. Parent cypermethrin was the major component of the residues in parts of the plant that were directly treated, constituting 64–74% and 67–82% of the TRR in the forage, silage, fodder and husk + stalk for the benzyl ring label and cyclopropyl label respectively.

Table 3 Distribution of ^{14}C residue and metabolites in maize and maize commodities following three applications of [^{14}C]cypermethrin (George, 1995, RAN-0272)

	Concentration, mg/kg, expressed as parent					
Residue component	Forage	Silage	Fodder	Grain[a]	Husk + stalk	Ears[a]
[^{14}C]benzyl ring label						
Total ^{14}C residue (TRR)	4.4	4.2	17	0.006	8.6	0.004
Extracted residue%	90%	90%	105%		90%	
Cypermethrin	2.8	2.8	13		5.8	
4'-OH-3-phenoxybenzyl alcohol	0.053	0.042	0.14		0.060	
2'-OH-3-phenoxybenzyl alcohol	0.070	0.042	0.17		0.060	
4'-hydroxy-3-phenoxybenzoic acid	0.070	0.025	0.17		0.14	
2'-hydroxy-3-phenoxybenzoic acid	0.026	0.025	0.069		0.026	
3-phenoxybenzyl alcohol	0.004	0.013	0.035		0.017	
2-hydroxy-3-phenoxybenzoic acid	nd	0.004	0.17		0.086	
3-phenoxybenzoic acid	0.018	0.025	nd		nd	
3-phenoxybenzaldehyde	0.044	0.034	0.42		0.069	
Cyperamide	0.026	0.017	0.14		0.043	
4'-OH-cypermethrin	0.044	0.046	0.21		0.086	
% of TRR identified	73%	73%	83%		75%	
[^{14}C]cyclopropyl label						
Total ^{14}C residue (TRR)	3.6	4.5	15	0.047	5.4	0.026
Extracted residue%	99%	89%	94%	101%	95%	101%
Cypermethrin	2.9	2.9	11	< 0.001	4.0	< 0.001
trans-DCVA	0.004	0.064	0.092	0.004	0.011	0.003
cis-DCVA	0.007	0.009	0.046	0.001	0.011	0.001
Cyperamide	0.036	0.036	0.21	< 0.001	0.021	nd
4'-OH-cypermethrin	0.043	0.055	0.25	< 0.001	0.032	nd
% of TRR identified	82%	67%	78%		77%	

[a] TRR levels in grain and ears from the [^{14}C]benzyl ring label were too low for identification.

nd: not detectable

In a maize metabolism study in the USA, Curry (2007, P-3934) foliar sprayed maize plants (variety Pioneer 3733) in greenhouse tubs once during the flowering stage with [^{14}C]benzyl ring and [^{14}C]cyclopropyl-labelled zeta-cypermethrin formulated as an EW (benzyl ring cis:trans 49:51; cyclopropyl cis:trans 49.6:50.5) at the equivalent of 0.15 kg ai/ha. Samples of forage were collected 31 days after treatment. The mature crop (ears and stover = maize fodder) was harvested 80 days after treatment. Samples were extracted with solvents and were then subjected to hydrolysis and enzyme treatments to release the ^{14}C.

The distribution of the residue in forage, fodder and grain and identification of the residue are summarised in Table 4. Parent zeta-cypermethrin was the major component of the residue in fodder and forage. Identified metabolites were a small part of the residue. Residues in grain were generally too low to allow identification, but in the case of the [^{14}C]cyclopropyl label, parent cypermethrin was a minor part of the residue.

Table 4 Distribution of ^{14}C residue and metabolites in forage, fodder and grain of maize sprayed with [^{14}C]zeta-cypermethrin at 0.15 kg ai/ha (Curry, 2007, P-3934)

Concentration, mg/kg, expressed as parent						
[^{14}C]benzyl ring label[a]			[^{14}C]cyclopropyl label			
Residue component	Forage	Fodder	Residue component	Forage	Fodder	Grain
Total ^{14}C residue (TRR)	0.40	2.7	Total ^{14}C residue (TRR)	0.58	2.06	0.036
Extracted residue%	91%	79%	Extracted residue%	94%	84%	40%
Unextractable%	9.3%	21%	Unextractable%	6.1%	16%	60%
Zeta-cypermethrin	0.22	1.09	Zeta-cypermethrin	0.31	0.86	0.001
Cyperamide	0.007	0.068	Cyperamide	0.011	0.042	
3-phenoxybenzaldehyde	0.003	0.037	cis-DCVA	0.005	0.021	
3-phenoxybenzoic acid	0.011	0.11	trans-DCVA	0.013	0.041	0.001
3-phenoxybenzyl alcohol	0.003	0.022				
% of TRR identified	60%	48%		58%	47%	

[a] TRR = 0.007 mg/kg for residue in grain from the [^{14}C]benzyl ring label treatment, too low for extraction and identification

A comparison of cis:trans isomer distribution in the zeta-cypermethrin applied to maize and the isomer distribution in the residues on maize fodder and forage showed a small change in the composition, with cis isomer depleting more quickly from the residue (Table 5)

Table 5 Cis-trans isomer distribution changes in residues of zeta-cypermethrin applied to maize (Curry, 2007, P-3934)

	Cis:trans ratio	
	[^{14}C]benzyl ring label	[^{14}C]cyclopropyl label
Zeta-cypermethrin at application	49.0 : 51.0	49.6 : 50.5
Residues, maize forage 30 days after application	43.8 : 56.2	47.8 : 52.2
Residues in maize fodder 80 days after application	43.6 : 56.5	45.7 : 54.3

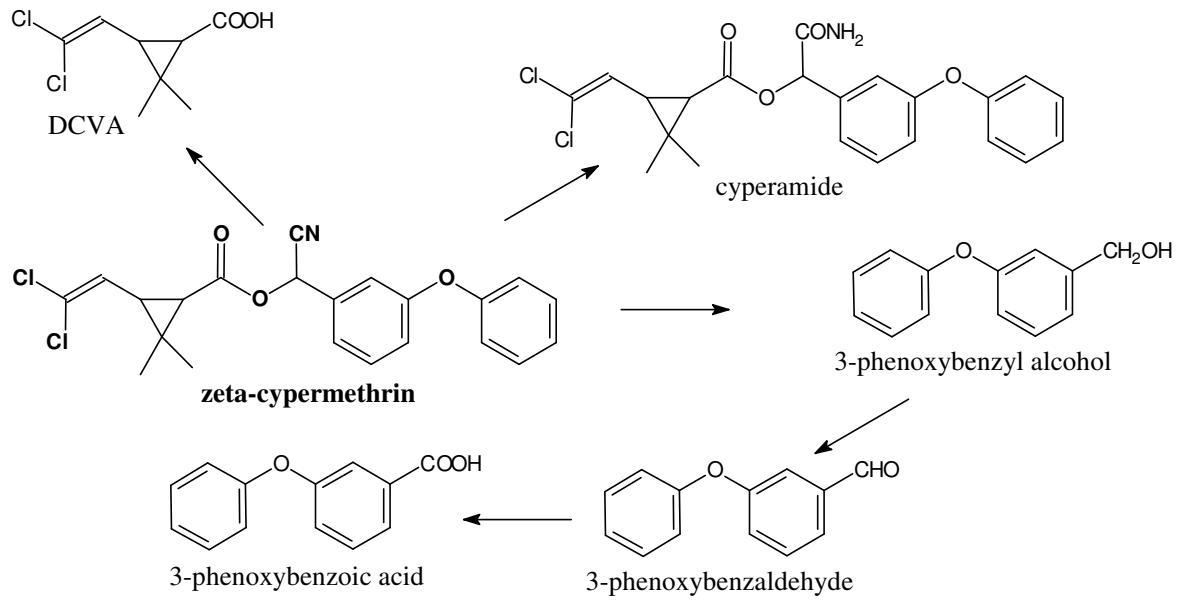


Figure 3 Proposed metabolic pathway for zeta-cypermethrin in maize.

Curry (2007, P-3941) conducted a study with cypermethrin in parallel with the previous one with zeta-cypermethrin (Curry, 2007, P-3934). Curry (2007, P-3941) foliar sprayed maize plants (variety Pioneer 3733) in greenhouse tubs once during the flowering stage with [^{14}C]benzyl ring and [^{14}C]cyclopropyl-labelled cypermethrin formulated as an EW (benzyl ring cis:trans 51.9:48.1; cyclopropyl cis:trans 52.1:48.0) at the equivalent of 0.15 kg ai/ha. Samples of forage were collected 31 days after treatment. The mature crop (ears and stover = maize fodder) was harvested 80 days after treatment. Samples were extracted with solvents and were then subjected to hydrolysis and enzyme treatments to release the ^{14}C.

The distribution of the residue in forage, fodder and grain and identification of the residue are summarised in Table 6. The residue levels and distribution are very similar to those resulting from the use of zeta-cypermethrin.

Table 6 Distribution of ^{14}C residue and metabolites in forage, fodder and grain of maize sprayed with [^{14}C]cypermethrin at 0.15 kg ai/ha (Curry, 2007, P-3941)

Concentration, mg/kg, expressed as parent						
[^{14}C]benzyl ring label[a]			[^{14}C]cyclopropyl label			
Residue component	Forage	Fodder	Residue component	Forage	Fodder	Grain
Total ^{14}C residue (TRR)	0.36	2.3	Total ^{14}C residue (TRR)	0.40	2.4	0.024
Extracted residue%	92%	79%	Extracted residue%	94%	81%	33%
Unextractable%	7.9%	21%	Unextractable%	6.0%	19%	67%
Cypermethrin	0.21	0.96	Cypermethrin	0.22	0.89	
Cyperamide	0.008	0.053	Cyperamide	0.008	0.055	
3-phenoxybenzaldehyde	0.002	0.026	cis-DCVA	0.001	0.023	
3-phenoxybenzoic acid	0.004	0.060	trans-DCVA	0.001	0.033	
3-phenoxybenzyl alcohol		0.008				
% of TRR identified	62%	49%		57%	41%	

[a] TRR = 0.005 mg/kg for residue in grain from the [^{14}C]benzyl ring label treatment, too low for extraction and identification

A comparison of cis:trans isomer distribution in the cypermethrin applied to maize and the isomer distribution in the residues on maize fodder and forage are summarised in Table 7. Again, the cypermethrin results are very comparable with the zeta-cypermethrin results except for the [^{14}C]cyclopropyl cypermethrin on maize forage where the cis:trans ratio has hardly changed for cypermethrin and in the reverse direction.

Table 7 Cis-trans isomer distribution changes in residues of cypermethrin applied to maize (Curry, 2007, P-3941)

	Cis:trans ratio					
	[^{14}C]benzyl ring label			[^{14}C]cyclopropyl label		
Cypermethrin at application	51.9	:	48.1	52.1	:	48.0
Residues, maize forage 30 days after application	47.9	:	52.1	52.8	:	47.2
Residues in maize fodder 80 days after application	44.8	:	55.2	49.0	:	51.0

Cotton

In a cotton metabolism study in the USA, ElNaggar (1993, P-2748) foliar sprayed [^{14}C]cypermethrin (cis:trans approximately 50:50) formulated as an EC once on cotton plants (variety GC510) just prior to boll opening at an application rate of 0.67 kg ai/ha. The cypermethrin was labelled in the cyclopropyl ring for one treatment and in the benzyl ring for the other. Mature cotton bolls were ginned to produce seed and lint following harvest 74 and 88 days after treatment. Samples were

extracted with solvents and were then subjected to hydrolysis and enzyme treatments to release the ^{14}C.

Cypermethrin was the major identified component of the residues, constituting 23–25% of TRR in the forage, 16% of TRR in the cotton seed and 7–10% of TRR in the lint.

Table 8 Distribution of ^{14}C residue and metabolites in forage and cotton seed from cotton sprayed with [^{14}C]cypermethrin at 0.67 kg ai/ha (ElNaggar, 1993, P-2748)

Concentration, mg/kg, expressed as parent							
[^{14}C]benzyl ring label				[^{14}C]cyclopropyl label			
Residue component	Forage	Seed	Lint	Residue component	Forage	Seed	Lint
Total ^{14}C residue (TRR)	3.3	0.089	0.070	Total ^{14}C residue (TRR)	3.1	0.15	0.20
Extracted residue%	89%	35%	50%	Extracted residue%	90%	36%	50%
Cypermethrin	0.74	0.014	0.005	Cypermethrin	0.78	0.024	0.019
3-phenoxybenzyl alcohol	0.41			DCVA	0.97	0.001	0.013
2'-hydroxy-3-phenoxybenzoic acid	0.55	0.011	0.004				
2'-hydroxy-3-phenoxybenzyl alcohol	0.25		0.001				
2'-hydroxy-3-phenoxybenzoic acid Me ester	0.16						
2-hydroxy-3-phenoxybenzoic acid	0.12						
3-hydroxybenzoic acid	0.11						
4'-hydroxy-3-phenoxybenzoic acid + 4'-hydroxy-3-phenoxybenzyl alcohol	0.088		0.001				
3-phenoxybenzoic acid	0.087		0.007				
3-phenoxybenzaldehyde	0.087		0.002				
2/2'-hydroxy-3-phenoxybenzoic acid + 2/2'-hydroxy-3-phenoxybenzyl alcohol	0.023		0.003				
% of TRR identified	80%	28%	33%		57%	17%	16%

Lettuce

Reynolds (1982, P-0540), using a syringe, applied [^{14}C]benzyl ring cypermethrin (cis:trans approximately 55:45) formulated as an EC once on lettuce plants (variety Black Seeded Simpson) at the 6–8 leaf stage at an application rate equivalent to 0.3 kg ai/ha. Lettuce plants were sampled on days 0, 3, 7, 15 and 30 days after treatment. Samples were extracted with solvents and subjected to enzyme hydrolysis to release conjugates.

The decline of residue concentration with time and the nature of the residue in day 30 lettuce are summarised in Table 9. A high percentage of the residue was extractable throughout. Parent cypermethrin constituted the major part of the residue 30 days after treatment.

Table 9 TRR, cypermethrin and metabolites in lettuce sampled at intervals following a single application of [^{14}C]benzyl ring cypermethrin of 0.3 kg ai/ha (Reynolds, 1982, P-0540)

	Concentration, mg/kg, expressed as parent				
Residue component	Day 0	Day 1	Day 7	Day 15	Day 30
Total ^{14}C residue (TRR)	18	16	9.9	7.5	2.1
Extracted residue%	99%	98%	94%	91%	86%
Conjugated residue%	0.7%	1.5%	5.9%	7.3%	9.7%
Unextractable%	0.2%	0.2%	0.6%	1.7%	4.6%
Cypermethrin					1.5
3-phenoxybenzyl alcohol (+ conj)					0.049

	Concentration, mg/kg, expressed as parent				
Residue component	Day 0	Day 1	Day 7	Day 15	Day 30
3-phenoxybenzoic acid (+ conj)					0.064
2'-hydroxy-3-phenoxybenzoic acid (+ conj)					0.013
4'-hydroxy-3-phenoxybenzoic acid (+ conj)					0.026
2'-hydroxy-3-phenoxybenzyl alcohol (+ conj)					0.011
2'-hydroxy-3-phenoxybenzyl alcohol (+ conj)					0.026
Cyperamide					0.023
3-phenoxybenzaldehyde conj					0.064

Wright (1977, 4.C.1/4), using a hypodermic sprayer, applied [^{14}C]benzyl ring cypermethrin or [^{14}C] cyclopropyl cypermethrin formulated as ECs twice (11 and 14 days intervals) on lettuce plants (variety All the year round) at an application rate each time equivalent to 0.3 kg ai/ha. Lettuce plants were sampled 19 and 21 days after the second treatment. Samples were extracted with acetone, acetonitrile + water and then 2M hydrochloric acid at 70 ˚C for eight hours. Parent cypermethrin was the major component of the residue (Table 10).

Residues levels were substantially higher in the outer leaves than in inner leaves. For the benzyl ring label, TRR in outer and inner leaves were 1.49 and 0.32 mg/kg, respectively. For the cyclopropyl label, TRR in outer and inner leaves were 1.46 and 0.13 mg/kg, respectively.

Table 10 TRR and cypermethrin residue levels in lettuce sampled 19 and 21 days after treatments with [^{14}C]cypermethrin formulated as an EC at an application rate each time equivalent to 0.3 kg ai/ha (Wright, 1977, 4.C.1/4)

Concentration, mg/kg, expressed as parent			
[^{14}C]benzyl ring label		[^{14}C]cyclopropyl label	
Residue component	Lettuce	Residue component	Lettuce
Total ^{14}C residue (TRR)	1.0	Total ^{14}C residue (TRR)	0.83
Extracted residue%	96%	Extracted residue%	95%
Unextracted residue%	4%	Unextracted residue%	4.8%
Cypermethrin	0.50	Cypermethrin	0.27
		DCVA conjugates	0.21

Apples

Dutton and Roberts (1978, BLGR.0054.78), using a syringe, applied [^{14}C]cypermethrin in acetone solution to the leaves (80–90 leaves per tree) of apple trees (variety James Grieve) in the UK in the months of May, June and July. Apple fruits on the trees were also directly treated in the same way with [^{14}C]cypermethrin in July and August. The three different treatments were: *cis*-cypermethrin labelled either in the benzyl ring or the cyclopropyl ring and *trans*-cypermethrin labelled in the benzyl ring. Leaves and apples were sampled 26 and 22 days respectively after the final treatment.

Residues were mostly on the surface of the apples—much higher TRR concentrations in peel than in pulp (Table 11). The trans-isomer remained unchanged, but part of the cis-isomer was converted to trans (30% in leaf and 15% in apple peel). Parent cypermethrin was the major component of the residue. Behaviour of the residue in apple leaf was similar to that in apple peel.

Table 11 Distribution of ^{14}C residue and metabolites in apple peel and pulp following two applications of [^{14}C]cypermethrin (Dutton and Roberts, 1978, BLGR.0054.78).

	Concentration, mg/kg, expressed as parent					
Residue component	Benzyl ring label *cis*-cypermethrin		Cyclopropyl label *cis*-cypermethrin		Benzyl ring *trans*-cypermethrin	
	Peel	Pulp	Peel	Pulp	Peel	Pulp
Total ^{14}C residue (TRR)	4.6	0.07	3.56	0.04	4.95	0.03
Unextractable	0.42		0.97	0.01	0.35	
Cis-cypermethrin	3.2	0.05[a]	1.8	0.02[a]		
Trans-cypermethrin	0.57		0.32		3.8	0.02
3-phenoxybenzaldehyde	0.04					
3-phenoxybenzyl alcohol					0.03	
4'-hydroxy-*cis*-cypermethrin	0.02		0.04		0.09	
3-phenoxybenzoic acid	0.02				0.13	
DCVA			0.02			
DCVA			0.03			
Cyperamide			0.02		0.10	

[a] Includes *cis*- and *trans*-cypermethrin.

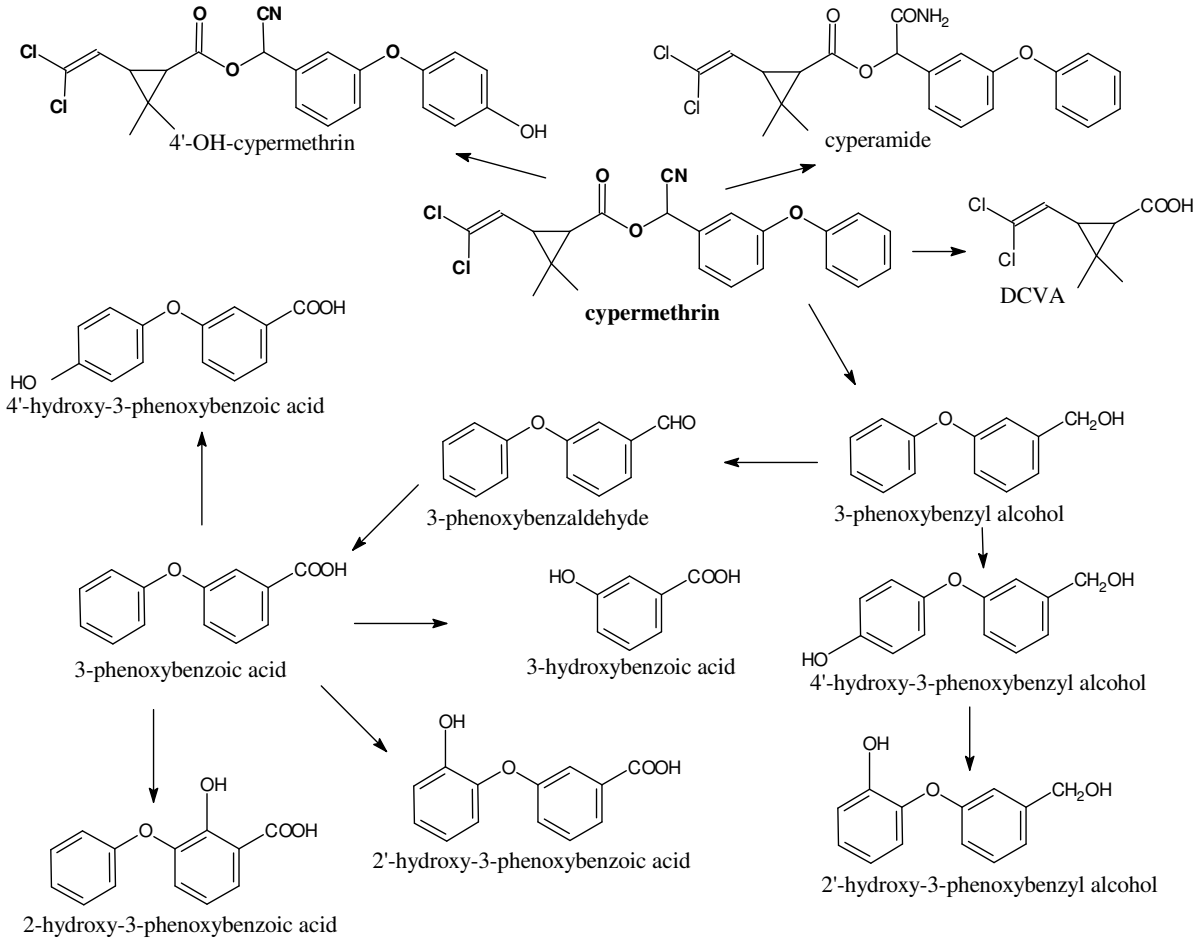


Figure 4 Proposed metabolic pathway for cypermethrin in plants.

Environmental fate in soil

The 2003 JMPR (JMPR, 2003) explained the data requirements for studies of environmental fate. The focus should be on those aspects that are most relevant to MRL setting. For cypermethrin, supervised residue trials data are available for root and tuber vegetables and peanuts, which means that aerobic degradation in soil is relevant, as well as the normal requirements for hydrolysis and rotational crop studies. The 2003 report does not mention soil photolysis studies; however, such studies should be relevant for the same reasons as for aerobic soil degradation–nature and magnitude of residues in soil.

The Meeting received information on soil aerobic metabolism and soil photolysis properties of cypermethrin as well as studies on the behaviour of cypermethrin residues in crop rotations.

Soil metabolism

Aerobic soil metabolism		Ref: Ramsey, 1991, P-2616
Test material: [^{14}C-cyclopropyl]cypermethrin		Dose rate: 3.0 mg ai/kg
Duration: 150 days	Temp: 25 °C	Moisture: 75% max water-holding capacity
Soil: fine sandy loam	pH: 6.9	Organic matter: 1.8%
Half-life (parent): 61 days		^{14}C accountability 76–104%
% cypermethrin remaining, day 150 = 19% of dose		% mineralization, day 150 = 34% of dose
		% unextractable, day 150 = 28% of dose

Metabolites	Max (% of dose)	Day
cis- and *trans*-DCVA	24%	62

Aerobic soil metabolism		Ref: Ramsey, 1991, P-2616
Test material: [^{14}C-benzyl ring]cypermethrin		Dose rate: 3.0 mg ai/kg
Duration: 150 days	Temp: 25 °C	Moisture: 75% max water-holding capacity
Soil: fine sandy loam	pH: 6.9	Organic matter: 1.8%
Half-life (parent): 60 days		^{14}C accountability 89–102%
% cypermethrin remaining, day 150 = 16% of dose		% mineralization, day 150 = 46% of dose
		% unextractable, day 150 = 32% of dose

Metabolites	Max (% of dose)	Day
3-phenoxybenzoic acid	8.4%	30

Soil surface photolysis		Ref: Estigoy *et al*. (1992, PC-0159)
Test material: [^{14}C-cyclopropyl]cypermethrin		Dose rate: 20 mg ai/kg
Duration: 35 days	Temp: 25 °C	Moisture: 75% max water-holding capacity
Soil: fine sandy loam	pH: 6.9	Organic matter: 1.8%
Half-life (parent): 55 days. Dark control 100 days		^{14}C accountability 93–102%
% cypermethrin remaining, day 35 = 64% of dose		% mineralization, day 35 = 4% of dose
Dark control 78%		Dark control 1.3%
		% unextractable, day 35 = 15% of dose
		Dark control 8%

Metabolites and photoproducts	Max (% of dose)	Day
cyperamide	10%	35
Dark control: cyperamide	13%	35

Soil surface photolysis		Ref: Estigoy *et al*. (1992, PC-0159)
Test material: [^{14}C-benzyl ring]cypermethrin		Dose rate: 20 mg ai/kg
Duration: 35 days	Temp: 25 °C	Moisture: 75% max water-holding capacity
Soil: fine sandy loam	pH: 6.9	Organic matter: 1.8%
Half-life (parent): 56 days. Dark control 76 days		^{14}C accountability 95–110%
% cypermethrin remaining, day 35 = 68% of dose		% mineralization, day 35 = 0.5% of dose
Dark control 76%		Dark control 0.6%
		% unextractable, day 35 = 11% of dose
		Dark control 9%

Metabolites and photoproducts	Max (% of dose)	Day
cyperamide	9.2%	35
Dark control: cyperamide	13%	35

In a soil surface photolysis study, Estigoy *et al*. (1992, PC-0159) applied [^{14}C-cyclopropyl]cypermethrin and [^{14}C-benzyl ring]cypermethrin to a sandy soil surface and subjected it to natural sunlight (Jan–March, 1991, 37.45 ˚N) photolysis for 35 days.

After 35 days, parent cypermethrin accounted for 64 and 68% of the dose (dark controls, 78 and 76% of dose), which demonstrated that cypermethrin is reasonably stable to photolysis on the soil surface. A degradation product, cyperamide, accounted for 9–10% of the dose at day 35. The level of cyperamide in the dark controls was higher than the level under photolysis, suggesting that it is produced by metabolism rather than by photolysis.

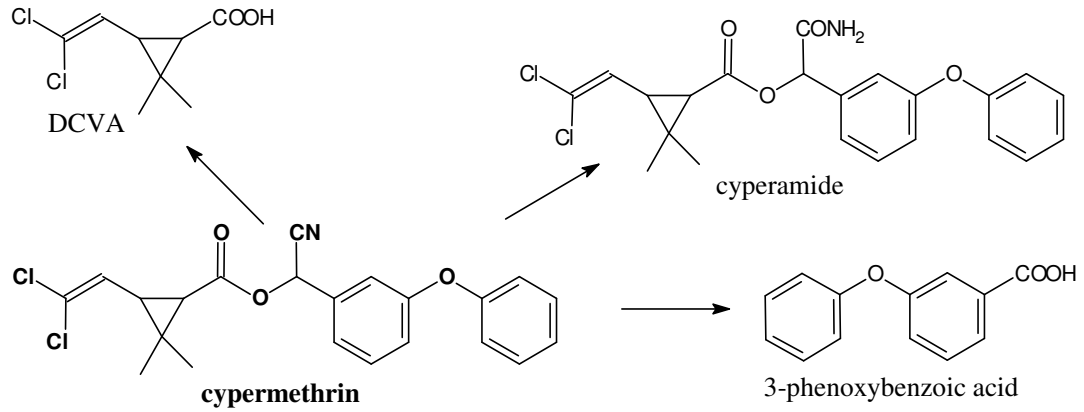


Figure 5 Proposed metabolic pathway for cypermethrin in soils, including soil surface photolysis.

Metabolism in water-sediment systems

Information was provided on the fate of zeta-cypermethrin during aerobic aquatic metabolism.

Curry (2003, P-3592) examined the fate of zeta-cypermethrin in an aerobic water-sediment system for 30 days. The conditions and results are summarised below. When the ^{14}C label was in the benzyl ring, the distribution changed steadily during the experiment from 75% in water at time 0 to 3.9% at day 30. For the [^{14}C]cyclopropyl label, the distribution increased steadily from 22% at day 3 to 44% at day 30. By day 30, for both labelling positions, most of the zeta-cypermethrin had been metabolized with significant quantities mineralized or bound to the soil. Metabolites produced by cleavage of the ester bond were identified.

Lucas (1998, 1462-573-010) examined the fate of zeta-cypermethrin (labelled in the cyclopropyl ring or benzyl ring) in two aerobic water-sediment systems for 99 days. The conditions and results are summarised below. By day 99, for both labelling positions, all or almost all of the zeta-cypermethrin had been metabolized with significant quantities mineralized or bound to the soil. Half-lives for disappearance of parent compound were calculated from data at 24 hours to 29 days (after the initial rapid disappearance and avoiding data at days 62 and 99 that include non-detects). Concentrations of the metabolites produced by cleavage of the ester bond exceeded the concentration of parent compound by day 8.

Aerobic aquatic metabolism	Ref: Curry, 2003, P-3592
Test material: [^{14}C-benzyl ring]zeta-cypermethrin	Dose rate: 0.15 mg/L water, equiv to 0.22 kg ai/ha
Duration: 30 days, Temp: 25 °C	Sediment:water ratio: 1:4
System: water-sediment, clay loam from rice growing, California	Dark conditions
Half-life (parent): 8.9 days.	^{14}C accountability 89–101%
% zeta-cypermethrin remaining, day 30 = 9.3% of dose	% mineralization, day 30 = 47% of dose
	% unextractable, day 30 = 26% of dose

Metabolites	Max (% of dose)	Day
3-phenoxybenzoic acid	22%	7

Aerobic aquatic metabolism	Ref: Curry, 2003, P-3592

Test material: [^{14}C-cyclopropyl]zeta-cypermethrin — Dose rate: 0.15 mg/L water, equiv to 0.22 kg ai/ha

Duration: 30 days, Temp: 25 °C — Sediment:water ratio: 1:4

System: water-sediment, clay loam from rice growing, California — Dark conditions

Half-life (parent): days. 9.8 days — ^{14}C accountability 96–103%

% zeta-cypermethrin remaining, day 30 = 12% of dose — % mineralization, day 30 = 11% of dose

% unextractable, day 30 = 17% of dose

Metabolites	Max (% of dose)	Day
trans-DCVA	42%	21
cis-DCVA	14%	21
DCVA-diCOOH	5.0%	30

Ref: Lucas, 1998, 1462-573-010

Aerobic aquatic metabolism

Test material: [^{14}C-cyclopropyl]zeta-cypermethrin — Dose rate: 0.05 mg/L water, equiv to 0.15 kg ai/ha

Duration: 99 days, Temp: 20 °C — Sediment: 2.5 cm. Water: 6 cm.

System: water-sediment, silty loam. — Dark conditions

Half-life (parent): 8.8 days (data from 24 hours to 29 days) — ^{14}C accountability 88–97%

% zeta-cypermethrin remaining, day 99 = 2.0% of dose — % mineralization, day 99 = 16% of dose

% unextractable, day 99 = 16% of dose

Metabolites	Max (% of dose)	Day
cis-DCVA	19%	62
trans-DCVA	41%	29

Aerobic aquatic metabolism — Ref: Lucas, 1998, 1462-573-010

Test material: [^{14}C-cyclopropyl]zeta-cypermethrin — Dose rate: 0.05 mg/L water, equiv to 0.15 kg ai/ha

Duration: 99 days, Temp: 20 °C — Sediment: 2.5 cm. Water: 6 cm.

System: water-sediment, sand. — Dark conditions

Half-life (parent): 12 days (data from 24 hours to 29 days) — ^{14}C accountability 89–97%

% zeta-cypermethrin remaining, day 99 = 1.4% of dose — % mineralization, day 99 = 21% of dose

% unextractable, day 99 = 22% of dose

Metabolites	Max (% of dose)	Day
cis-DCVA	22%	62
trans-DCVA	50%	14

Ref: Lucas, 1998, 1462-573-010

Aerobic aquatic metabolism

Test material: [^{14}C-benzyl]zeta-cypermethrin — Dose rate: 0.05 mg/L water, equiv to 0.15 kg ai/ha

Duration: 99 days, Temp: 20 °C — Sediment: 2.5 cm. Water: 6 cm.

System: water-sediment, silty loam. — Dark conditions

Half-life (parent): 11 days (data from 24 hours to 29 days) — ^{14}C accountability 85–95%

% zeta-cypermethrin remaining, day 62 = 3.9% of dose — % mineralization, day 99 = 57% of dose

day 99, not detected

% unextractable, day 99 = 26% of dose

Metabolites	Max (% of dose)	Day
3-phenoxybenzoic acid	38%	8

Aerobic aquatic metabolism — Ref: Lucas, 1998, 1462-573-010

Test material: [^{14}C-benzyl]zeta-cypermethrin — Dose rate: 0.05 mg/L water, equiv to 0.15 kg ai/ha

Duration: 99 days, Temp: 20 °C — Sediment: 2.5 cm. Water: 6 cm.

System: water-sediment, sand. — Dark conditions

Half-life (parent): 11 days (data from 24 hours to 29 days) — ^{14}C accountability 84–97%

% zeta-cypermethrin remaining, day 62 = 2.8% of dose — % mineralization, day 99 = 52% of dose

day 99, not detected

% unextractable, day 99 = 27% of dose

Metabolites	Max (% of dose)	Day
3-phenoxybenzoic acid	44%	8

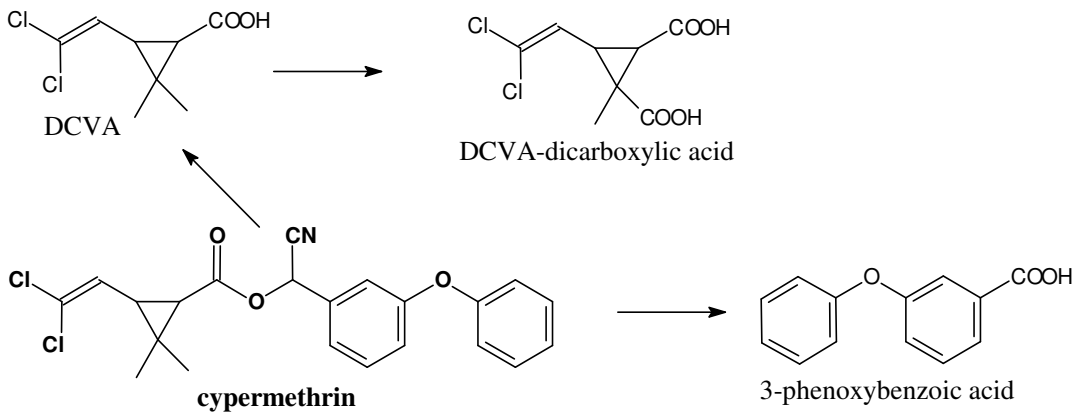


Figure 6 Proposed metabolic pathway for aerobic aquatic metabolism of zeta-cypermethrin.

Crop rotation studies

Information on the fate of radiolabelled cypermethrin in a confined crop rotational study was made available to the meeting.

Woods *et al*. (1980, RJ 0161 B) treated soil in pots with [^{14}C-benzyl ring]cypermethrin and sowed cotton, sugar beet, wheat and lettuce at intervals of 30, 60, 90 and 120 days after treatment. In a parallel experiment, sugar beet seeds were sown in soil previously treated with [^{14}C-cyclopropyl]cypermethrin. Application rates were equivalent to 1 kg ai/ha. The concentrations of ^{14}C radiolabel in the plants and commodities sown into the treated soils are summarised in Table 12. The data for wheat are difficult to interpret because the ^{14}C was found at similar concentrations in wheat from the untreated control plots.

Low levels of ^{14}C residue did enter all the crops. Concentrations were lower as the interval between treatment and sowing increased.

Table 12 Confined rotational crop studies with [^{14}C]cypermethrin

Application country, year, ref.	Rotational crop (variety)	TSI days[a]	THI days[b]	Sample	TRR as cypermethrin mg/kg[c]
Soil in pots, UK, 1979, (Woods *et al*., 1980, RJ 0161 B). [^{14}C-benzyl ring]cypermethrin					
1 kg ai/ha equivalent	wheat	29	46 61 146 146 146	plant plant grain chaff straw	0.043 c 0.014 0.044 c 0.017 0.063 c 0.053 0.07 c 0.06 0.06 c 0.04
1 kg ai/ha equivalent	cotton	29	166 182 329 329 329 329	plant plant lint seed husk foliage	0.023 0.039 0.023 0.031 0.02 0.01
1 kg ai/ha equivalent	lettuce	29	53 61 127	lettuce lettuce lettuce	0.063 0.044 < 0.01
1 kg ai/ha equivalent	sugar beet	29	98 98 166 166	foliage roots foliage roots	0.012 0.023 0.013 0.014 c 0.01

Application country, year, ref.	Rotational crop (variety)	TSI days[a]	THI days[b]	Sample	TRR as cypermethrin mg/kg[c]
1 kg ai/ha equivalent	wheat	60	78 97 193 193 193	plant plant grain chaff straw	0.013 0.015 c 0.014 0.055 c 0.048 0.062 c 0.038 0.043 c 0.062
1 kg ai/ha equivalent	cotton	60	78 97 306 306 306 306	plant plant lint seed husk foliage	0.014 0.04 c 0.013 < 0.01 0.05 0.03 c 0.02 < 0.01
1 kg ai/ha equivalent	lettuce	60	78 97 152	lettuce lettuce lettuce	0.048 0.026 c 0.012 < 0.01
1 kg ai/ha equivalent	sugar beet	60	91 97 97 252 252	plant foliage roots foliage roots	0.02 0.02 0.06 c 0.01 < 0.01 < 0.01
1 kg ai/ha equivalent	wheat	120	134 148 244 244 244	plant plant grain chaff straw	< 0.01 0.014 0.036 c 0.022 0.034 c 0.023 0.024 c 0.025
1 kg ai/ha equivalent	cotton	120	134 160 320 320 320 320	plant plant lint seed husk foliage	< 0.01 0.012 0.016 c 0.019 0.026 c 0.018 0.024 c 0.018 < 0.01
1 kg ai/ha equivalent	lettuce	120	145 160 201	lettuce lettuce lettuce	0.016 0.011 < 0.01
1 kg ai/ha equivalent	sugar beet	120	134 160 160 273 273	plant foliage roots foliage roots	< 0.01 0.01 0.016 < 0.01 < 0.01
Soil in pots, UK, 1979, (Woods *et al*., 1980, RJ 0161 B). [^{14}C-cyclopropyl]cypermethrin					
1 kg ai/ha equivalent	sugar beet	29	75 98 98 166 166	plant foliage roots foliage roots	0.12 0.063 0.15 0.029 0.021 c 0.01
1 kg ai/ha equivalent	sugar beet	60	91 97 97 252 252	plant foliage roots foliage roots	0.048 0.026 0.074 c 0.01 < 0.01 < 0.01
1 kg ai/ha equivalent	sugar beet	120	134 160 160 273 273	plant foliage roots foliage roots	0.017 0.015 0.022 0.01 < 0.01

[a] TSI: interval between treatment on soil and sowing of rotation crop, days.

[b] THI: interval between treatment on soil and harvest of rotation crop (or sampling of soil), days.

[c] c: sample from untreated control plot.

METHODS OF RESIDUE ANALYSIS

Analytical methods

The Meeting received descriptions and validation data for analytical methods for residues of zeta-cypermethrin and cypermethrin in raw agricultural commodities, processed commodities, feed commodities, animal tissues, milk and eggs.

Oilseed rape (Weber, 1993, 95120/92, I 92 RP 08)

Analyte:	cypermethrin	GC-ECD	DFG Method S 19
LOQ:	0.01 mg/kg.		
Description	Shoot and pod material are extracted with acetone with water addition to maintain an acetone:water ratio of 2:1 v/v. The acetone-water extract is saturated with salt and the residues are extracted into dichloromethane. Cleanup is effected by gel permeation chromatography with cyclohexane + ethyl acetate as eluant. The residue-containing fraction is concentrated and further cleaned-up on a small silica gel column before analysis by gas chromatography with electron-capture detector. Seed samples, which contain oil, are extracted by DFG Cleanup Method 5 designed for fatty samples. Cleanup then continues with the gel permeation system.		

Milk and meat (Chen, 1994, P-2901M)

Analyte:	cypermethrin + acid metabolites	GC-ECD	P-2901M
LOQ:	milk 0.01 mg/kg; tissues and cream 0.05 mg/kg		
Description	Milk is diluted with acetone, filtered and the residues are subjected to partition between an alkaline solution and hexane to separate the 3-phenoxybenzoic acid and the substituted cyclopropane carboxylic acids from the parent compound. The hexane phase containing the cypermethrin is cleaned up by solvent partitioning and silica gel chromatography. The acid metabolites are derivatised with pentafluorobenzyl bromide and further cleaned up ready for GLC analysis. Animal tissues are extracted with acetone-hexane and then the extracted residue is cleaned up on a cartridge. An initial reflux of tissues with acetone/0.25M HCl releases the acid metabolites. Cleanup was effected with cartridges before and after derivatization with pentafluorobenzyl bromide.		

Eggs (Nagel, 1995, P-2925M)

Analyte:	cypermethrin + acid metabolites	GC-ECD	P-2925M
LOQ:	eggs 0.005 mg/kg		
Description	Eggs are extracted with acetone. The residues are subjected to partition between an alkaline solution and hexane to separate the 3-phenoxybenzoic acid and the substituted cyclopropane carboxylic acids from the parent compound. The remainder of the method is essentially the same as that for milk and meat (P-2901M).		

Plant material (Class, 2002, P 656 G)

Analyte:	zeta-cypermethrin	GC-ECD GS-MSD	DFG Method S 19
LOQ:	0.01 mg/kg.		
Description	Plant commodities are extracted with water/acetone (1/2 v/v). After addition of sodium chloride, residues are partitioned into the organic phase of ethyl acetate/cyclohexane (1/1 v/v). Cleanup is effected by gel permeation chromatography and silica gel chromatography. Capillary gas chromatography with electron capture detection (GC-ECD) is used for analysis with gas chromatography—mass spectrometric (GC-MSD) detection for confirmation of identity.		

Cereal grain, straw, peas (Doran, Stewart & McGuire, 2000, 17673)

Analyte:	cypermethrin	GC-MSD	6762.01
LOQ:	0.01 mg/kg.		
Description	The test sample is macerated with hexane/acetone (1/1 v/v) and then filtered. The organic phase is retained and evaporated to leave a residue which is taken up with hexane and transferred to a Florisil cleanup column. The residue is eluted with 20% diethyl ether in hexane. The eluate is analysed by GC-MSD		

Sugar beet roots and tops (Zenide, 1999, A-17-98-67)

Analyte:	zeta-cypermethrin	GC-ECD	2.5/4 and 2.5/4a
LOQ:	0.05 mg/kg.		
Description	Samples of sugar beet roots or tops are extracted with hexane/acetone (1/1 v/v). The extraction mixture is treated with Celite, centrifuged and filtered. The filtrate and water are combined in a separating funnel and sodium chloride is added. The organic layer is separated and evaporated to dryness before the residue is taken up in hexane for a Florisil column cleanup. The residue is eluted from the column with a hexane/methyl *t*-butyl ether mixture ready for analysis by GC-ECD.		

Class (2002, FMC-0201V Az G02-0108) subjected DFG Method S19 to independent laboratory validation for the purpose of analysing milk and meat for residues of zeta-cypermethrin. The method was suitable with an LOQ of 0.01 mg/kg for milk and an LOQ of 0.05 mg/kg for meat.

Class (2002, P 656 G) subjected DFG Method S19 to independent laboratory validation for the purpose of analysing tomatoes and oranges as representatives of plant material for residues of zeta-cypermethrin. The method was suitable with an LOQ of 0.01 mg/kg for plant material.

Weber (1993, FMC-9201V, Az 95122/92) subjected DFG Method S19 to laboratory validation for the purpose of analysing cereal, green pant, grain and straw for residues of zeta-cypermethrin. The method was suitable with an LOQ of 0.01 mg/kg for the commodities tested.

Griffin and Perez (1995, ADPEN-911-94-0504) subjected method P-2901M, as applied to milk, to independent laboratory validation. The method for cypermethrin was confirmed, but the method for the acid metabolites was not confirmed because some recoveries were low.

Griffin and Perez (1995, ADPEN-911-94-0610) subjected method P-2901M, as applied to bovine muscle, to independent laboratory validation. The method for cypermethrin was confirmed with an LOQ of 0.05 mg/kg.

Griffin and Perez (1995, ADPEN-911-94-0611) subjected method P-2901M, as applied to bovine fat, to independent laboratory validation. The method for *cis*-DCVA, *trans*-DCVA and 3-phenoxybenzoic acid was confirmed with an LOQ of 0.05 mg/kg. However, successful confirmation of the method for these metabolites did require two consultations with the sponsor.

Griffin and Perez (1995, ADPEN-911-94-0712) subjected method P-2925M, as applied to eggs, to independent laboratory validation. The method for cypermethrin was confirmed with an LOQ of 0.025 mg/kg. The method for *cis*-DCVA, *trans*-DCVA and 3-phenoxybenzoic acid was also confirmed with an LOQ of 0.025 mg/kg. However, successful confirmation of the method for these metabolites did require a consultation with the sponsor.

Zenide (1999, A-17-98-67) subjected method 2.5/4 and 2.5/4a, as applied to sugar beet roots and tops, to independent laboratory validation. The method for zeta-cypermethrin was confirmed with an LOQ of 0.05 mg/kg.

Doran, Stewart & McGuire (2000, 17673) subjected method 6762.01, as applied to cereal straw and grain and peas, to independent laboratory validation. The method for cypermethrin was confirmed with an LOQ of 0.01 mg/kg.

Nagel (1995, P-2994) analysed poultry breast muscle and egg yolk from a [^{14}C]cypermethrin metabolism study to demonstrate that the analytical methods were recovering the incurred residues from the samples. The total radioactive residue (TRR) in the samples was determined by combustion. The analytical method was essentially the same as those described in reports P-2925 and P-2901M. The extraction efficiency of ^{14}C from breast muscle was 90% for the cypermethrin extraction method and 95% for the acid metabolites method. An average of 43% of the ^{14}C was extracted from egg yolk with one extraction of acetone, with an additional 22% from the second extraction. However, no cypermethrin was found in the second extraction. About 27% of the ^{14}C in egg yolk was not extractable. The extraction methods appear suitable for cypermethrin and the acid metabolites.

Recovery data from the internal and independent laboratory validation (ILV) testing are summarised in Table13.

Table 13 Analytical recoveries for spiked zeta-cypermethrin in various substrates

Commodity	Spiked analyte	Spike conc, mg/kg	n	Mean recov%	Range recov%	Method	Ref
whole milk	zeta-cypermethrin	0.01–0.1	10	101	87–110	DFG S19[a]	P/B 635 G
bovine muscle	zeta-cypermethrin	0.05–0.5	10	82	72–93	DFG S19	P/B 635 G
bovine kidney	zeta-cypermethrin	0.05–0.5	10	89	71–110	DFG S19	P/B 635 G
blood (swine)	zeta-cypermethrin	0.05–0.5	10	91	81–111	DFG S19	P/B 635 G
whole egg	zeta-cypermethrin	0.05–0.5	10	93	72–111	DFG S19	P/B 635 G
bovine liver	zeta-cypermethrin	0.05–0.5	10	95	81–108	DFG S19	P/B 635 G
bovine fat	zeta-cypermethrin	0.05–0.5	10	102	76–117	DFG S19	P/B 635 G
milk	zeta-cypermethrin	0.01–0.10	10	83	78–87	DFG S19	FMC-0201V Az G02-0108
meat	zeta-cypermethrin	0.05–0.50	10	91	82–96	DFG S19	FMC-0201V Az G02-0108
milk	cypermethrin	0.01	35	81	70–100	P-2901M	P-2901M
milk	cypermethrin	0.2	4	85	77–90	P-2901M	P-2901M
milk cream	cypermethrin	0.05	4	100	89–106	P-2901M	P-2901M
kidney	cypermethrin	0.05	5	87	71–100	P-2901M	P-2901M
liver	cypermethrin	0.05	4	82	72–91	P-2901M	P-2901M
muscle	cypermethrin	0.05	8	98	89–114	P-2901M	P-2901M
fat	cypermethrin	0.05–0.5	6	89	83–103	P-2901M	P-2901M
milk	DCVA, mPB acid	0.01	66	100	71–132	P-2901M	P-2901M
milk cream	DCVA, mPB acid	0.05	12	103	86–118	P-2901M	P-2901M
kidney	DCVA, mPB acid	0.05	15	106	71–129	P-2901M	P-2901M
liver	DCVA, mPB acid	0.05	12	100	72–111	P-2901M	P-2901M
muscle	DCVA, mPB acid	0.05	12	88	74–114	P-2901M	P-2901M
fat	DCVA, mPB acid	0.05	24	99	73–127	P-2901M	P-2901M
milk	cypermethrin	0.01, 0.05	4	72	63–76	P-2901M	ADPEN-911-94-0504
bovine muscle	cypermethrin	0.05, 0.25	4	94	73–105	P-2901M	ADPEN-911-94-0610
bovine fat	*cis*-DCVA	0.05, 0.25	4	76	62–89	P-2901M	ADPEN-911-94-0611
bovine fat	*trans*-DCVA	0.05, 0.25	4	95	89–98	P-2901M	ADPEN-911-94-0611
bovine fat	mPB acid	0.05, 0.25	4	117	105–128	P-2901M	ADPEN-911-94-0611
tomato	zeta-cypermethrin	0.01, 0.10	10	94	82–103	DFG S19	P 656 G
orange, whole	zeta-cypermethrin	0.01, 0.10	10	98	78–120	DFG S19	P 656 G
wheat green plant	zeta-cypermethrin	0.01, 0.10	6	99	92–103	DFG S19	FMC-9201V, Az 95122/92
wheat grain	zeta-cypermethrin	0.01, 0.10	6	96	92–99	DFG S19	FMC-9201V, Az 95122/92
wheat straw	zeta-cypermethrin	0.01, 0.10	6	102	91–115	DFG S19	FMC-9201V, Az 95122/92
cereal straw	cypermethrin	0.01–1.0	9	93	88–105	6762.01	17673
cereal grain	cypermethrin	0.01–1.0	9	92	81–167[b]	6762.01	17673
peas	cypermethrin	0.01–1.0	9	84	74–124[b]	6762.01	17673
sugar beet root	zeta-cypermethrin	0.05, 0.50	6	97	86–106	164MVL91R1	2.5/4 and 2.5/4a
sugar beet tops	zeta-cypermethrin	0.05, 0.50	6	85	77–93	164MVL91R1	2.5/4 and 2.5/4a
whole eggs	cypermethrin	0.05, 0.025	9	85	23–105	P-2925M	P-2925M
whole eggs	DCVA, mPB acid	0.025	21	93	75–111	P-2925M	P-2925M

Commodity	Spiked analyte	Spike conc, mg/kg	n	Mean recov%	Range recov%	Method	Ref
egg yolk	cypermethrin	0.025, 0.15	5	93	86–113	P-2925M	P-2925M
egg yolk	DCVA, mPB acid	0.025	6	102	93–109	P-2925M	P-2925M
albumin	cypermethrin	0.025	3	70	68–72	P-2925M	P-2925M
albumin	DCVA, mPB acid	0.025	9	100	77–119	P-2925M	P-2925M
whole eggs	cypermethrin	0.025, 0.125	4	94	75–105	P-2925M	ADPEN-911-94-0712
whole eggs	DCVA, mPB acid	0.025, 0.125	12	90	74–115	P-2925M	ADPEN-911-94-0712

[a] DFG S19 is a multi-residue method.

[b] High value excluded from calculations.

Stability of residues in stored analytical samples

Information was received on the freezer storage stability of cypermethrin, zeta-cypermethrin and metabolite residues in plant and animal commodities: apples, bovine fat, bovine liver, bovine muscle, cabbages, cotton seed, dry pea grain, egg, lettuce, milk, molasses, poultry liver, poultry muscle, soya beans, sugar beet dried pulp, sugar beet roots, tomatoes, wheat grain and white sugar. Residues were mostly stable at freezer temperatures for the intervals tested.

Barret and Pearsall (1995, P-2986) spiked bovine tissue and milk samples in small glass vials or jars with cypermethrin and stored them at –18 ˚C. The vials or jars were removed at intervals for analysis. Procedural recoveries on freshly spiked samples provided quality control information on the performance of the analytical method (P-2901M). The results are summarised in Table 14. Parallel storage stability trials were run on the metabolites *cis*-DCVA, *trans*-DCVA and 3-phenoxybenzoic acid (data not shown). These metabolites were also stable under the conditions and temperature tested. Barrett (1994, P-2970) ran similar tests on eggs and poultry tissues (Table 15).

Table 14 Freezer storage stability data for cypermethrin spiked into matrices of milk and bovine tissues (Barrett and Pearsall, 1995, P-2986). Residues are unadjusted for% recovery

Storage interval	Procedural recov%	Cypermethrin, mg/kg	Storage interval	Procedural recov%	Cypermethrin, mg/kg
BOVINE MUSCLE, from intact tissue sections, fortified with cypermethrin at 0.5 mg/kg in small glass vials or jars, storage temperature at approximately –18 ˚C.			BOVINE FAT, from intact tissue sections, fortified with cypermethrin at 0.5 mg/kg in small glass vials or jars, storage temperature at approximately –18 ˚C.		
0	99 101	0.50 0.52 0.53	0	88%,96%	0.47 0.44 0.42
3 months	89%,95%	0.35 0.40 0.39	3 months	86%,94%	0.49 0.45 0.52
6 months	111%,113%	0.48 0.47 0.47	6 months	91%,87%	0.48 0.48 0.49
12 months	89%,96%	0.39 0.38 0.41	12 months	90%,100%	0.49 0.50 0.45
residues apparently stable			residues apparently stable		
BOVINE LIVER, from intact tissue sections, fortified with cypermethrin at 0.5 mg/kg in small glass vials or jars, storage temperature at approximately –18 ˚C.			MILK, fortified with cypermethrin at 0.1 mg/kg in small glass vials or jars, storage temperature at approximately –18 ˚C.		
0	80%,92%	0.47 0.49 0.51	0	92%,90%	0.08 0.10 0.09
1 month	90%,107%	0.49 0.41 0.51	1 month	67%,72%	0.07 0.08 0.07
3 months	108%,107%	0.60 0.49 0.53	3 months	78%,96%	0.08 0.07 0.09
residues apparently stable			residues apparently stable		

Barrett (1994, P-2970) ran freezer storage tests on eggs and poultry tissues (Table 15). Analytical data were rather variable and would have obscured minor losses if they did occur. The results of the storage stability in eggs is inconclusive because of variable data and low procedural recoveries.

Table 15 Freezer storage stability data for cypermethrin spiked into matrices of eggs and poultry tissues (Barret, 1994, P-2970). Residues are unadjusted for % recovery

Storage interval	Procedural recov%	Cypermethrin, mg/kg	Storage interval	Procedural recov%	Cypermethrin, mg/kg
EGG, fortified with cypermethrin at 0.5 mg/kg in small glass vials, storage temperature at approximately –18 ˚C.			POULTRY MUSCLE, fortified with cypermethrin at 0.5 mg/kg in small glass vials, storage temperature at approximately –18 ˚C.		
0	91%,84%	0.39 0.39 0.40	0	104%,100%	0.52 0.55 0.59
3 months	88%,84%	0.47 0.48 0.40	3 months	72%,84%	0.37 0.35 0.30
6 months	64%,68%	0.38 0.32 0.31	6 months	87%,101%	0.39 0.46 0.29
procedural recoveries 6 months, too low——study inconclusive			residues questionable stability		
POULTRY LIVER, fortified with cypermethrin at 0.5 mg/kg in small glass vials, storage temperature at approximately –18 ˚C.					
0	102%,110%	0.60 0.57 0.53			
3 months	82%,95%	0.34 0.31 0.45			
6 months	103%,106%	0.32 0.36 0.43			
residues questionable stability					

Klumpp (2002, 20011151/01-RSS) spiked pea grain and wheat grain samples in small glass jars with zeta-cypermethrin and stored them at –20 ˚C to –30 ˚C. The jars were removed at intervals for analysis. Initiation dates for storage were chosen so that samples stored for different periods were all analysed on the same day. Procedural recoveries on freshly spiked samples provided quality control information on the performance of the analytical method (acetonitrile extraction, GC-MSD determination). The results are summarised in Table 16.

Table 16 Freezer storage stability data for zeta-cypermethrin spiked into dried peas and wheat grain (Klumpp, 2002, 20011151/01-RSS). Residues are unadjusted for analytical recoveries

Storage interval	Procedural recov%	Cypermethrin, mg/kg	Storage interval	Procedural recov%	Cypermethrin, mg/kg
DRY PEA GRAIN, fortified with zeta-cypermethrin at 0.1 mg/kg in wide-neck glass bottle, storage temperature at approximately –20 ˚C to –30 ˚C.			WHEAT GRAIN, fortified with zeta-cypermethrin at 0.1 mg/kg in wide-neck glass bottle, storage temperature at approximately –20 ˚C to –30 ˚C.		
0	77% 81% 82% 84%	0.082 0.085	0	86% 81% 83% 83%	0.083 0.083 0.082
160 days	86%[a]	0.068 0.071	160 days	84%,82%[b]	0.072 0.073
252 days	86%[a]	0.064 0.063	252 days	84%,82%[b]	0.072 0.071
440 days	86%[a]	0.075 0.069 0.067	440 days	84%,82%[b]	0.072 0.071
residues apparently stable			residues apparently stable		

[a] The experiment was designed so that the storage samples for 160 days, 252 days and 440 days would all be analysed on the same day. One procedural recovery (86%) is relevant to these three storage intervals.

[b] The experiment was designed so that the storage samples for 160 days, 252 days and 440 days would all be analysed on the same day. Two procedural recoveries (84 and 82%) are relevant to these three storage intervals.

Chen and Barrett (1999, P-3405) tested the stability of zeta-cypermethrin and DCVA in sugar beet and processed matrices in a freezer at approximately –18 ˚C (Table 17). DCVA (data not shown) was generally stable under the conditions and temperature tested.

Table 17 Freezer storage stability data for zeta-cypermethrin spiked into sugar beet and processed matrices. Residues are unadjusted for analytical recoveries

Storage interval	Procedural recov%	Cypermethrin, mg/kg	Storage interval	Procedural recov%	Cypermethrin, mg/kg
SUGAR BEET ROOTS, fortified with zeta-cypermethrin at 0.5 mg/kg in small glass jars, storage temperature at approximately –18 ˚C (Chen and Barrett, 1999, P-3405).			SUGAR BEET DRIED PULP, fortified with zeta-cypermethrin at 0.5 mg/kg in small glass jars, storage temperature at approximately –18 ˚C (Chen and Barrett, 1999, P-3405).		
0	77% 74%	0.41 0.38 0.40	0	71% 78%	0.38 0.39 0.43
3 months	83% 90%	0.43 0.41 0.38	3 months	82% 79%	0.42 0.44 0.45
6 months	89% 91%	0.39 0.42 0.42	6 months	80% 87%	0.39 0.42 0.24
12 months	78% 74%	0.37 0.45 0.44	12 months	76% 87%	0.36 0.43 0.41
residues apparently stable			residues apparently stable		
WHITE SUGAR, fortified with zeta-cypermethrin at 0.5 mg/kg in small glass jars, storage temperature at approximately –18 ˚C (Chen and Barrett, 1999, P-3405).			MOLASSES, fortified with zeta-cypermethrin at 0.5 mg/kg in small glass jars, storage temperature at approximately –18 ˚C (Chen and Barrett, 1999, P-3405).		
0	78% 82%	0.39 0.40 0.41	0	83% 84%	0.45 0.44 0.45
3 months	88% 92%	0.44 0.44 0.44	3 months	88% 94%	0.46 0.43 0.44
6 months	91% 89%	0.43 0.40 0.44	6 months	82% 87%	0.43 0.44 0.44
12 months	94% 101%	0.47 0.46 0.50	12 months	99% 100%	0.50 0.49 0.48
residues apparently stable			residues apparently stable		

Freezer storage data from a number of studies on cypermethrin are summarised inTable 18.

Table 18 Freezer storage stability data for cypermethrin spiked into various matrices. Residues are unadjusted for analytical recoveries

Storage interval	Procedural recov%	Cypermethrin, mg/kg	Storage interval	Procedural recov%	Cypermethrin, mg/kg
LETTUCE, fortified with cypermethrin at 0.5 mg/kg in small sample bottles, storage temperature at approximately –18 ˚C (Markle, 1985, RAN-0147).			TOMATOES, fortified with cypermethrin at 0.5 mg/kg in small sample bottles, storage temperature at approximately –18 ˚C (Markle, 1985, RAN-0147).		
0	89% 93%	0.49 0.47 0.48	0	96% 104%	0.47 0.50 0.48
3 months	92% 92%	0.47 0.48 0.49	3 months	95% 92%	0.47 0.46 0.47
6 months	100% 95%	0.48 0.48 0.49	6 months	97% 97%	0.45 0.49 0.49
12 months	100% 104%	0.47 0.49 0.52	12 months	91% 100%	0.49 0.53 0.49
18 months	94% 90%	0.44 0.45 0.48	18 months	99% 97%	0.44 0.46 0.47
residues apparently stable			residues apparently stable		
APPLES, fortified with cypermethrin at 0.5 mg/kg in small sample bottles, storage temperature at approximately –18 ˚C (Markle, 1985, RAN-0147).			SOYBEANS, fortified with cypermethrin at 0.5 mg/kg in small sample bottles, storage temperature at approximately –18 ˚C (Markle, 1985, RAN-0147).		
0	85% 93%	0.45 0.46 0.47	0	94% 101%	0.45 0.46 0.50
3 months	97% 98%	0.46 0.44 0.46	3 months	83% 80%	0.42 0.43 0.42
6 months	88% 93%	0.46 0.51 0.50	6 months	88% 86%	0.38 0.39 0.41
12 months	94% 91%	0.46 0.47 0.45	12 months	95% 101%	0.48 0.56 0.48
18 months	77% 87%	0.44 0.40 0.43	18 months	81% 76%	0.43 0.39 0.40
residues apparently stable			residues apparently stable		
LETTUCE, frozen macerated matrix, sprayed with cypermethrin solution and then stored in small plastic bags, storage temperature at approximately –18 ˚C (Starner, 1993, RAN-0251).					
0	110% 121%	3.28 3.20 2.86 3.00			

Storage interval	Procedural recov%	Cypermethrin, mg/kg	Storage interval	Procedural recov%	Cypermethrin, mg/kg
		3.23 3.24			
6 months	98% 101%	2.82 3.05 3.03			
18 months	98% 96%	3.45 3.36 3.14			
24 months	99% 96%	3.62 3.60 2.96			
36 months	99% 70%	2.26 2.14 2.96			
residues apparently stable					
APPLE, matrix with incurred residues of cypermethrin was stored at approximately –18 ˚C and analysed at intervals up to 12 months (Swaine *et al*., 1981, RJ 0128B)			CABBAGE, matrix with incurred residues of cypermethrin was stored at approximately –18 ˚C and analysed at intervals up to 12 months (Swaine *et al*., 1981, RJ 0128B)		
0	procedural	0.09 0.09 0.07 0.08 0.08	0	procedural	0.03 0.02 0.06 0.03 0.05
1 month	recoveries	0.10 0.06 0.08 0.08 0.06	1 month	recoveries	0.09 0.08 0.05 0.05 0.04
2 months	not available	0.07 0.08 0.09 0.07 0.06	2 months	not available	
6 months		0.10 0.08 0.09 0.11 0.10	6 months		0.04 0.02 0.06 0.04 0.03
12 months		0.04 0.08 0.06 0.10 0.09	12 months		0.06 0.05 0.07 0.04 0.03
residues apparently stable			residues apparently stable		
LETTUCE, matrix with incurred residues of cypermethrin was stored at approximately –18 ˚C and analysed after an interval of 8 months(Tilker, 1982, RAN-0065)			TOMATO, matrix with incurred residues of cypermethrin was stored at approximately –18 ˚C and analysed after an interval of 8 months (Tilker, 1982, RAN-0065)		
0	90%	1.88	0	85%	0.240
8 months	100%	2.11 2.10 1.94 1.98 1.89 1.87	10 months	84%	0.238 0.258 0.219 0.191 0.222 0.278
residues apparently stable			residues apparently stable		

COTTON SEED, matrix with incurred residues of cypermethrin was stored at approximately –18 ˚C and analysed after an interval of 18 months(Tilker, 1982, RAN-0065)—six samples							
0	82%	0.142	0.132	0.078	0.081	0.130	0.094
18 months	73%	0.109	0.131	0.078	0.071	0.117	0.076
residues apparently stable							

USE PATTERN

Zeta-cypermethrin is a non-systemic broad spectrum insecticide. It is used to control a broad spectrum of chewing, sucking and flying insects, but requiring different application rates. It is effective by contact and ingestion and has wide usage in field crops and horticulture.

Table 19 Registered uses of zeta-cypermethrin. Labels or translations of labels for the following uses were available to the Meeting

Crop	Country	Application						PHI days
		Form	Type	Max rate kg ai/ha	Conc kg ai/hL	Spray vol, L/ha	Max number, or max seasonal applic	
Alfalfa	Spain	EW	Foliar	0.04		1000		14
Alfalfa	USA	EC	foliar, air or ground	0.056			0.17 kg ai/ha	3 cutting, grazing 7 for seed harvest
Alfalfa	USA	EW	foliar, air or ground	0.056			0.17 kg ai/ha	3 cutting, grazing 7 for seed harvest
Barley	Germany	EW	foliar, ground	0.015		200–400	1	35

Crop	Country	Application						PHI days
		Form	Type	Max rate kg ai/ha	Conc kg ai/hL	Spray vol, L/ha	Max number, or max seasonal applic	
Barley	UK	EW	foliar, ground,	0.015			2	use before flowering complete (Stage GS 69)
Beans	UK	EW	foliar, ground	0.015			2	14
Beans	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1 succulent, 21 dried
Broccoli	Italy	EC	foliar, ground		0.00075–0.0026			7
Broccoli	USA	EC	foliar, air or ground	0.056			0.34 kg ai/ha	1
Broccoli	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1
Cantaloupe	USA	EC	foliar, air and ground	0.028			0.17 kg ai/ha	1
Cantaloupe	USA	EW	foliar, air and ground	0.056			0.34 kg ai/ha	1
Coffee	Brazil	EC	foliar, backpack or air application	0.015				15
Coffee	Brazil	EC	foliar, backpack or air application	0.014 kg ai/1000 plants				30
Coffee	Brazil	EW	foliar, backpack or air application		0.0063			15
Cotton	Brazil	EC	foliar, air or ground	0.060				20
Cotton	Brazil	EC	foliar, air or ground	0.05				15
Cotton	Brazil	EW	foliar, air or ground	0.05				15
Cotton	Spain	EW	foliar, ground	0.04		400		Not applicable
Cotton	USA	EC	foliar, air or ground, banded or in-furrow spray for cutworms	0.056			0.34 kg ai/ha	14
Cotton	USA	EW	foliar, air or ground, banded or in-furrow spray for cutworms	0.056			0.34 kg ai/ha	14
Cucumber	Italy	EC	foliar, ground		0.00075–0.0026			3
Cucumber	USA	EC	foliar, air and ground	0.028			0.17 kg ai/ha	1
Cucumber	USA	EW	foliar, air and ground	0.056			0.34 kg ai/ha	1
Endive	Italy	EC	foliar, ground		0.00075–0.0026			7
Endive	USA	EC	foliar application	0.028			0.17 kg ai/ha	1
Endive	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1
Lettuce	Italy	EC	foliar, ground		0.00075–0.0026			7
Lettuce	USA	EC	foliar, air or ground	0.056			0.34 kg ai/ha	5 (head)
Lettuce	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1
Maize (Field corn)	Brazil	EC	foliar, air or ground		0.0040–0.0060			5
Maize (Field corn)	Brazil	EW	foliar, air or ground	0.020				20
Maize (Field corn)	France	EW	foliar, ground	0.0375		150–400		60

Crop	Country	Application						PHI days
		Form	Type	Max rate kg ai/ha	Conc kg ai/hL	Spray vol, L/ha	Max number, or max seasonal applic	
Maize (Field corn)	USA	EC	foliar, air or ground Includes furrow at-planting application	0.056			0.22 kg ai/ha	30 grain 30 stover (fodder) 60 forage (silage)
Maize (Field corn)	USA	EW	foliar, air or ground Includes furrow at-planting application	0.056			0.22 kg ai/ha	30 grain 30 stover (fodder) 60 forage (silage)
Mustard greens	USA	EC	foliar, air or ground	0.056			0.34 kg ai/ha	1
Mustard greens	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1
Onions	Brazil	EW	foliar, backpack or air application		0.0036			5
Onions	USA	EC	foliar, air or ground	0.056			0.28 kg ai/ha	7
Onions	USA	EW	foliar, air or ground	0.056			0.28 kg ai/ha	7
Peanut	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	7
Peas	France	EW	foliar, ground	0.018		150–400		7
Peas	UK	EW	foliar, ground	0.015			2	14
Peas	USA	EC	foliar application	0.028			0.18 kg ai/ha	1 succulent, 21 dried
Peas	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1 succulent, 21 dried
Peppers	Italy	EC	foliar, ground		0.00075–0.0026			3
Peppers	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1
Pome fruit	USA	EW	foliar application	0.056			0.34 kg ai/ha	14
Rapeseed	Germany	EW	foliar, ground, before flowering complete	0.01		200–400	2	56
Rapeseed	UK	EW	foliar, ground,	0.01			2	use before flowering complete
Rice	Brazil	EC	foliar, backpack or air application	0.01–0.015				10
Rice	USA	EC	foliar, air or ground	0.056			0.22 kg ai/ha	14
Rice	USA	EW	foliar, air or ground	0.056			0.22 kg ai/ha	14
Soybeans	Brazil	EC	foliar, backpack or air application	0.015				15
Soybeans	Brazil	EC	foliar, backpack or air application	0.05				30
Soybeans	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	21
Spinach	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1
Stone fruit	USA	EW	foliar application	0.056			0.34	14
Sugar beet	Spain	EW	foliar	0.04		1000		21
Sugar beet	UK	EW	broadcast, at egg hatch	0.013			2	60
Sugar beet	USA	EW	foliar, air or ground	0.056			0.17 kg ai/ha	50

Crop	Country	Application						PHI days
		Form	Type	Max rate kg ai/ha	Conc kg ai/hL	Spray vol, L/ha	Max number, or max seasonal applic	
Sugar beet	USA	EW	3–7 inch T-band or broadcast over open furrow	0.056			0.17 kg ai/ha	50
Sugarcane	USA	EC	foliar, air or ground, banded or in-furrow spray for cutworms	0.056			0.22 kg ai/ha	21
Sugarcane	USA	EW	foliar, air or ground, banded or in-furrow spray for cutworms	0.056			0.22 kg ai/ha	21
Sweet corn	France	EW	foliar, ground	0.0375		150–400		14
Sweet corn	USA	EC	foliar, air or ground	0.056			0.34 kg ai/ha	3
Sweet corn	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	3
Tomato	Brazil	EC	foliar, air or ground		0.0032–0.0060			10
Tomato	Brazil	EW	foliar, air or ground		0.01–0.02			5
Tomato	Italy	EC	foliar, ground		0.00075–0.0026			14
Tomato	Spain	EW	foliar	0.04		1000		2
Tomato	USA	EW	foliar, air or ground	0.056			0.34 kg ai/ha	1
Triticale	USA	EW	foliar, air or ground	0.056			0.28 kg ai/ha	14 grain, forage, hay
Wheat	France	EW	foliar, ground	0.015		150–400		21
Wheat	Germany	EW	foliar, ground	0.015		200–400	1	35
Wheat	UK	EW	foliar, ground,)	0.015			2	use before flowering complete (Stage GS 69
Wheat	USA	EW	foliar, air or ground	0.056			0.28 kg ai/ha	14 grain, forage, hay

RESIDUES RESULTING FROM SUPERVISED TRIALS

The Meeting received information on supervised field trials for zeta-cypermethrin uses that produced residues on the following commodities.

Commodity	Group	Table No.
Pome fruits	Pome fruits	Table 20
Stone fruits	Stone fruits	Table 21
Onion	Bulb vegetables	Table 22
Broccoli	Brassica vegetables	Table 23
Cucurbits	Cucurbit fruiting vegetables	Table 24
Peppers	Fruiting vegetables	Table 25
Tomatoes	Fruiting vegetables	Table 26
Sweet corn	Fruiting vegetables	Table 27
Endive	Leafy vegetables	Table 28
Lettuce	Leafy vegetables	Table 29
Lettuce	Leafy vegetables	Table 30

Commodity	Group	Table No.
Spinach	Leafy vegetables	Table 31
Mustard greens	Leafy vegetables	Table 32
Peas	Legume vegetables	Table 33
Field beans	Legume vegetables	Table 34
Soybean seed	Pulses	Table 35
Sugar beet	Root and tuber vegetables	Table 36
Sugar beet	Root and tuber vegetables	Table 37
Maize	Cereal grains	Table 38
Maize	Cereal grains	Table 39
Maize	Cereal grains	Table 40
Barley	Cereal grains	Table 41
Wheat	Cereal grains	Table 42
Oats and triticale	Cereal grains	Table 43
Rice	Cereal grains	Table 44
Sugar cane	Grasses for sugar production	Table 45
Peanuts	Oilseeds	Table 46
Oilseed rape	Oilseeds	Table 47
Cotton seed	Oilseeds	Table 48
Coffee	Seed for beverages	Table 49
Alfalfa	Legume animal feeds	Table 50
Pea fodder and forage	Legume animal feeds	Table 51
Bean fodder and forage	Legume animal feeds	Table 52
Barley fodder and forage	Fodder and forage of cereal grains	Table 53
Sweet corn fodder and forage	Fodder and forage of cereal grains	Table 54
Maize fodder and forage	Fodder and forage of cereal grains	Table 55
Maize fodder and forage	Fodder and forage of cereal grains	Table 56
Maize fodder and forage	Fodder and forage of cereal grains	Table 57
Oats and triticale straw	Fodder and forage of cereal grains	Table 58
Wheat fodder and forage	Fodder and forage of cereal grains	Table 59
Rice straw	Fodder and forage of cereal grains	Table 60
Sugar beet tops	Miscellaneous fodder and forage	Table 61
Sugar beet tops	Miscellaneous fodder and forage	Table 62

Trials were generally well documented with laboratory and field reports. Trials where field reports are missing are noted in the summary tables. Laboratory reports included method validation with procedural recoveries from spiking at residue levels similar to those occurring in samples from the supervised trials. Dates of analyses or duration of residue sample storage were also provided. Although trials included control plots, no control data are recorded in the tables except where residues in control samples exceeded the LOQ. Control samples are indicated in the summary tables with a "c". Residue data are recorded unadjusted for recovery.

In trials where replicate field samples from an unreplicated plot were taken at each sampling time and analysed separately, each analysis is recorded in the tables. Residue values from samples from replicate plots are also recorded separately. The mean is recorded for replicate analyses on a field sample.

In many of the zeta-cypermethrin studies, undetected residues were reported as < LOD (below the limit of detection). Residues that were detected but below the limit of quantification (LOQ) were reported as 'trace' or as an approximate value in parentheses, e.g., (0.02). For many commodities, the LOD was 0.01 mg/kg and the LOQ was 0.05 mg/kg.

In the residue tables, residues below LOD are recorded as < LOD with a footnote to the table providing a value for the LOD. Residues reported as 'trace', i.e., detected but below LOQ are recorded as < 0.05 mg/kg or whatever the LOQ for that analysis was.

Residues, application rates and spray concentrations have generally been rounded to two significant figures or, for residues near the LOQ, to one significant figure. Residue values from the trials conducted according to maximum GAP have been used for the estimation of maximum residue levels. Those results included in the evaluation are double underlined.

Conditions of the supervised residue trials were generally well reported in detailed field reports. Most trial designs used non-replicated plots. Most field reports provided data on the sprayers used, plot size, field sample size and sampling date.

Table 20 Zeta-cypermethrin residues in pome fruits resulting from supervised trials with zeta-cypermethrin in the USA.

POME FRUITS	Application				PHI	Commodity	Residue, mg/kg [a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (NY), 2001 (Jonagolds)	EC	0.056	190	6	14	apple	0.11	P-3559 Trial 01
USA (NY), 2001 (Jonagolds)	EC	0.056	940	6	14	apple	0.13	P-3559 Trial 01
USA (NY), 2001 (McIntosh)	EW	0.056	190	6	7 14 21 28	apple apple apple apple	0.12 0.11 0.11 0.11	P-3559 Trial 02
USA (NY), 2001 (McIntosh)	EW	0.056	950	6	7 14 21 28	apple apple apple apple	0.13 0.13 0.13 0.14	P-3559 Trial 02
USA (PA), 2001 (Red Delicious and Red Chief)	EC	0.056	175–195	6	14	apple	0.12	P-3559 Trial 03
USA (PA), 2001 (Red Delicious and Red Chief)	EC	0.056	910–940	6	14	apple	0.15	P-3559 Trial 03
USA (VA), 2001 (Law Roane)	EW	0.056	185–205	6	14	apple	0.13	P-3559 Trial 04
USA (VA), 2001 (Law Roane)	EW	0.056	910–950	6	14	apple	0.13	P-3559 Trial 04
USA (MI), 2001 (Mutsu)	EC	0.056	190	6	14	apple	0.21	P-3559 Trial 05
USA (MI), 2001 (Mutsu)	EC	0.056	940	6	14	apple	0.25	P-3559 Trial 05
USA (MI), 2001 (Golden Delicious)	EW	0.056	190	6	14	apple	0.31	P-3559 Trial 06
USA (MI), 2001 (Golden Delicious)	EW	0.056	940	6	14	apple	0.22	P-3559 Trial 06
USA (CO), 2001 (Red Delicious)	EC	0.056	190	6	14	apple	0.14	P-3559 Trial 07
USA (CO), 2001 (Red Delicious)	EC	0.056	940	6	14	apple	0.12	P-3559 Trial 07
USA (CA), 2001 (Granny Smith)	EW	0.056	170–190	6	14	apple	0.24 0.23	P-3559 Trial 08
USA (CA), 2001 (Granny Smith)	EW	0.056	900–1000	6	14	apple	0.21 0.29	P-3559 Trial 08
USA (OR), 2001 (Pacific Gala)	EC	0.056	190	6	14	apple	0.13	P-3559 Trial 09

POME FRUITS	Application				PHI	Commodity	Residue, mg/kg [a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (OR), 2001 (Pacific Gala)	EC	0.056	900–940	6	14	apple	0.11	P-3559 Trial 09
USA (OR), 2001 (Fuji)	EW	0.056	190	6	14	apple	0.25	P-3559 Trial 10
USA (OR), 2001 (Fuji)	EW	0.056	940	6	14	apple	0.28	P-3559 Trial 10
USA (WA), 2001 (Fuji)	EC	0.056	190	6	14	apple	0.23	P-3559 Trial 11
USA (WA), 2001 (Fuji)	EC	0.056	940	6	14	apple	0.20	P-3559 Trial 11
USA (WA), 2001 (Basin Beauty)	EW	0.056	190	6	14 14 14 14 14 14 14 14	apple, field apple, unwashed apple, washed wet pomace (juice) wet pomace (sauce) apple juice canned apples apple sauce	0.10 0.15 < 0.05 (2) < 0.05 0.41 0.19 < 0.05 < LOD < LOD	P-3559 Trial 12
USA (WA), 2001 (Basin Beauty)	EW	0.056	940	6	14 14 14 14 14 14 14 14	apple, field apple, unwashed apple, washed wet pomace (juice) wet pomace (sauce) apple juice canned apples apple sauce	0.13 0.15 < 0.05 (2) < 0.05 0.36 0.14 < LOD < LOD < LOD	P-3559 Trial 12
USA (NY), 2001 (Bartlett)	EC	0.056	190	6	14	pear	0.24	P-3559 Trial 13
USA (NY), 2001 (Bartlett)	EC	0.056	940	6	14	pear	0.39	P-3559 Trial 13
USA (CA), 2001 (Bosc)	EW	0.056	190	6	14	pear	0.05 0.05	P-3559 Trial 14
USA (CA), 2001 (Bosc)	EW	0.056	870–890	6	14	pear	0.07 0.07	P-3559 Trial 14
USA (CA), 2001 (Shinko)	EC	0.056	170–200	6	7 14 21 28	pear pear pear pear	< 0.05 (2) < 0.05 0.05 0.05 < 0.05 0.05 0.05	P-3559 Trial 15
USA (CA), 2001 (Shinko)	EC	0.056	890–920	6	7 14 21 28	pear pear pear pear	0.06 0.07 0.06 0.06 0.06 0.06 0.05 0.07	P-3559 Trial 15
USA (WA), 2001 (Bartlett)	EW	0.056	190	6	14	pear	0.29	P-3559 Trial 16
USA (WA), 2001 (Bartlett)	EW	0.056	940	6	14	pear	0.33	P-3559 Trial 16
USA (WA), 2001 (Bartlett)	EC	0.056	190	6	14	pear	0.31	P-3559 Trial 17
USA (WA), 2001 (Bartlett)	EC	0.056	940	6	14	pear	0.43	P-3559 Trial 17
USA (OR), 2001 (Bartlett)	EW	0.056	190	6	14	pear	0.56	P-3559 Trial 18

POME FRUITS	Application				PHI	Commodity	Residue, mg/kg [a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (OR), 2001 (Bartlett)	EW	0.056	940	6	14	pear	0.49	P-3559 Trial 18

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg

Table 21 Zeta-cypermethrin residues in stone fruits resulting from supervised trials with zeta-cypermethrin in the USA

STONE FRUITS	Application				PHI	Commodity	Residue, mg/kg [a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (NY), 2001 Montmorency) tart cherry	EC	0.056	190	6	14	cherry	0.58	P-3558 Trial 01
USA (NY), 2001 Montmorency) tart cherry	EC	0.056	950	6	14	cherry	0.80	P-3558 Trial 01
USA (MI), 2001 Montmorency) tart cherry	EW	0.056	190	6	14	cherry	0.52	P-3558 Trial 02
USA (MI), 2001 Montmorency) tart cherry	EW	0.056	950	6	14	cherry	0.86	P-3558 Trial 02
USA (MI), 2001 (Gold) sweet cherry	EC	0.056	190	6	14	cherry	0.57	P-3558 Trial 03
USA (MI), 2001 (Gold) sweet cherry	EC	0.056	950	6	14	cherry	0.64	P-3558 Trial 03
USA (CO), 2001 (Montmorency) tart cherry	EW	0.056	190	6	14	cherry	0.53	P-3558 Trial 04
USA (CO), 2001 (Montmorency) tart cherry	EW	0.056	950	6	14	cherry	0.58	P-3558 Trial 04
USA (CA), 2001 (Brooks) sweet cherry	EC	0.056	190	6	14	cherry	0.49 <u>0.52</u>	P-3558 Trial 05
USA (CA), 2001 (Brooks) sweet cherry	EC	0.056	950	6	14	cherry	<u>0.77</u> 0.67	P-3558 Trial 05
USA (WA), 2001 (Van) sweet cherry	EW	0.056	190	6	7 14 21 28	cherry	0.43 0.54 0.49 <u>0.60</u>	P-3558 Trial 06
USA (WA), 2001 (Van) sweet cherry	EW	0.056	950	6	7 14 21 28	cherry	0.58 0.61 0.89 <u>0.94</u>	P-3558 Trial 06
USA (PA), 2001 (Fayette) peach	EC	0.056	190	6	14	peach	0.14	P-3558 Trial 07
USA (PA), 2001 (Fayette) peach	EC	0.056	950	6	14	peach	0.09	P-3558 Trial 07

STONE FRUITS	Application				PHI	Commodity	Residue, mg/kg [a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (SC), 2001 (June Gold) peach	EW	0.056	190	6	14	peach	0.10	P-3558 Trial 08
USA (SC), 2001 (June Gold) peach	EW	0.056	950	6	14	peach	0.09	P-3558 Trial 08
USA (GA), 2001 (SG91-7) peach	EC	0.056	190	6	14 14	peach, field peach, processor canned peach pureed peach peach nectar	0.09 0.07 < LOD < LOD < LOD	P-3558 Trial 09
USA (GA), 2001 (SG91-7) peach	EC	0.056	1000	6	14 14	peach, field peach, processor canned peach pureed peach peach nectar	0.14 0.06 < LOD < LOD < LOD	P-3558 Trial 09
USA (GA), 2001 (June Gold) peach	EW	0.056	190	6	14	peach	0.15	P-3558 Trial 10
USA (GA), 2001 (June Gold) peach	EW	0.056	950	6	14	peach	0.11	P-3558 Trial 10
USA (MI), 2001 (Baby Gold) peach	EC	0.056	190	6	14	peach	0.14	P-3558 Trial 11
USA (MI), 2001 (Baby Gold) peach	EC	0.056	950	6	14	peach	0.10	P-3558 Trial 11
USA (TX), 2001 (Florida King) peach	EW	0.056	190	6	14	peach	0.13	P-3558 Trial 12
USA (TX), 2001 (Florida King) peach	EW	0.056	950	6	14	peach	0.10	P-3558 Trial 12
USA (CA), 2001 (Flavorcrest) peach	EC	0.056	190	6	7 14 21 28	peach peach peach peach	0.08 0.09 0.09 0.10 0.16 0.13 0.12 0.16	P-3558 Trial 13
USA (CA), 2001 (Flavorcrest) peach	EC	0.056	950	6	7 14 21 28	peach peach peach peach	0.12 0.11 0.13 0.12 0.08 0.07 0.08 0.07	P-3558 Trial 13
USA (CA), 2001 (September Sun) peach	EW	0.056	190	6	14	peach	0.08 0.09	P-3558 Trial 14
USA (CA), 2001 (September Sun) peach	EW	0.056	950	6	14	peach	0.08 0.06	P-3558 Trial 14
USA (CA), 2001 (Loadel) peach	EC	0.056	190	6	14	peach	0.09 0.08	P-3558 Trial 15
USA (CA), 2001 (Loadel) peach	EC	0.056	950	6	14	peach	0.10 0.09	P-3558 Trial 15
USA (OR), 2001 (Italian) plum	EW	0.056	190	6	14	plum	0.18	P-3558 Trial 16
USA (OR), 2001 (Italian) plum	EW	0.056	180–190	6	14	plum	0.07	P-3558 Trial 16
USA (MI), 2001 (Stanley) plum	EC	0.056	190	6	7 14 21 28	plum plum plum plum	0.31 0.24 0.14 0.27	P-3558 Trial 17

STONE FRUITS	Application				PHI	Commodity	Residue, mg/kg [a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (MI), 2001 (Stanley) plum	EC	0.056	950	6	7 14 21 28	plum plum plum plum	0.05 0.07 0.08 0.06	P-3558 Trial 17
USA (CA), 2001 (Angelino) plum	EW	0.056	195	6	14	plum	0.15 0.13	P-3558 Trial 18
USA (CA), 2001 (Angelino) plum	EW	0.056	950	6	14	plum	0.06 0.05	P-3558 Trial 18
USA (CA), 2001 (French) plum	EC	0.056	190	6	14	plum	0.15 0.18	P-3558 Trial 19
USA (CA), 2001 (French) plum	EC	0.056	950	6	14	plum	0.06 0.05	P-3558 Trial 19
USA (CA), 2001 (Friar) plum	EW	0.056	190	6	14	plum	0.21 0.11	P-3558 Trial 20
USA (CA), 2001 (Friar) plum	EW	0.056	950	6	14	plum	0.05 0.06	P-3558 Trial 20
USA (CA), 2001 (d'Agan) plum	EC	0.056	195	6	14 14 14	plum, pitted, field plum, pitted, proc prune, pitted	0.21 0.20 0.15 0.075 0.40 0.32	P-3558 Trial 21
USA (CA), 2001 (d'Agan) plum	EC	0.056	950	6	14	plum	0.05 0.06	P-3558 Trial 21

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 22 Zeta-cypermethrin residues in onions resulting from supervised trials with zeta-cypermethrin in Brazil and the USA

ONIONS	Application					PHI	Commod	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
Brazil (SP), 1995 (Baia Piriforme)	EW	0.014	0.0036		1	5	bulbs	< 0.05[d]	na[c]	na	na	DB-ONI-1[e]
Brazil (SP), 1995 (Baia Piriforme)	EW	0.029	0.0072		1	5	bulbs	< 0.05[d]	na	na	na	DB-ONI-1[e]
USA (CA), 1993 (Southport White Globe)	EW	0.056		190	5	7	onion bulb[b]	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0051
USA (CA), 1993 (Southport White Globe)	EW	0.056		190	5	7	green onions	0.40 0.57	< 0.05 (2)	< 0.05 (2)	< 0.05 (2)	RC-0051
USA (MI), 1993 (Extra)	EW	0.056		190	5	7	onion bulb[b]	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0051
USA (TX), 1994 (New Mex)	EW	0.056		190	5	7	green onions	0.18 0.19	< 0.05 (2)	< 0.05 (2)	< 0.05 (2)	RC-0051

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Field sampling: trimmed off top portion, stems, roots and outer sheaths.

[c] na: no analysis.

[d] LOQ = 0.05 mg/kg.

[e] No field report. Summary of field information provided.

Table 23 Zeta-cypermethrin residues in broccoli resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

BROCCOLI	Application					PHI	Commod	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1993 (Green Belt)	EW	0.056		187	6	1	flower head	< 0.05 (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0047
USA (TX), 1993 (Southern Comet)	EW	0.056		107	6	1	flower head	0.55 0.57	< 0.05 (2)	< 0.05 (2)	< LOD (2)	RC-0047
USA (CA), 1991 (Emperor)	EC	0.11		✈ 47	6	1	flower head	0.13 0.14	< 0.05 (2)	< 0.05 (2)	< LOD (2)	P-2762 trial 1
USA (CA), 1991 (Emperor)	EC	0.11		190	6	1	flower head	0.52 0.65	< 0.05 (2)	0.05 0.05	< LOD (2)	P-2762 trial 2
USA (CA), 1991 (Atlantic)	EC	0.11		94	6	3	flower head	0.38 0,46	< 0.05 (2)	0.05 0.05	< LOD (2)	P-2762 trial 3
USA (OR), 1990 (Gem)	EC	0.11		190	6	1	flower head	0.71 0.23	< 0.05 < LOD	< 0.05 (2)	0.05 < 0.05	P-2762 trial 4
USA (TX), 1990 (Southern Comet)	EC	0.11		✈ 28	6	1	flower head	0.29 0.14	< 0.05 < LOD	< 0.05 < LOD	< LOD (2)	P-2762 trial 5
USA (TX), 1990 (Southern Comet)	EC	0.11		190	6	1	flower head	0.10 0.12	< LOD (2)	< LOD (2)	< LOD (2)	P-2762 trial 6

[a] Abbreviations: zeta = zeta-cypermethrin; DCVA = 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid; MPB = 3-phenoxybenzoic acid

Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 24 Zeta-cypermethrin residues in cucurbits resulting from supervised trials with zeta-cypermethrin in the USA and Italy. Replicate values arise from replicate plots or replicate field samples

CUCURBITS	Application				PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
CANTALOUPE								
USA (GA), 2001 (Athena)	EC	0.056	90–100	6	1	whole cantaloupe cantaloupe pulp cantaloupe rind	< 0.05 (2) < LOD (2) < 0.05 (2)	P-3549 Trial 01
USA (IL), 2001 (Hales Best)	EW	0.056	94	6	1	whole cantaloupe cantaloupe pulp cantaloupe rind	< 0.05 (2) < LOD (2) < 0.05 0.06	P-3549 Trial 02
USA (TX), 2001 (MRS #45)	EC	0.056	94	6	1	whole cantaloupe cantaloupe pulp cantaloupe rind	< 0.05 (2) < LOD (2) < 0.05 0.07	P-3549 Trial 03
USA (AZ), 2001 (Durange)	EW	0.056	95	6	1	whole cantaloupe cantaloupe pulp cantaloupe rind	< 0.05 (2) < LOD (2) 0.05 0.06	P-3549 Trial 04
USA (CA), 2001 (Hale's Best Jumbo)	EC	0.056	95	6	1	whole cantaloupe cantaloupe pulp cantaloupe rind	< LOD (2) < LOD (2) < 0.05 < LOD	P-3549 Trial 05
USA (CA), 2001 (Magnum 45)	EW	0.056	100	6	1	whole cantaloupe cantaloupe pulp cantaloupe rind	< 0.05 (2) < LOD (2) 0.08 0.10	P-3549 Trial 06
CUCUMBER								
Italy, 1994 (Sensation F1 70F)	EC	0.025	1000	1	3	cucumber	< 0.05 (2)	A-17-94-18
Italy, 1994 (Sensation F1 70F)	EC	0.050	1000	1	3	cucumber	< 0.05 (2)	A-17-94-18
USA (FL), 2001 (Lightning)	EC	0.056	90–100	6	1	cucumber washed cucumber	< 0.05 (2) < 0.05 (2)	P-3549 Trial 09
USA (GA), 2001 (Lightning)	EW	0.056	100	6	1	cucumber washed cucumber	< 0.05 (2) < 0.05 (2)	P-3549 Trial 08
USA (MN), 2001 (Straight Eight)	EC	0.056	100	6	1	cucumber washed cucumber	< LOD < 0.05 < LOD < 0.05	P-3549 Trial 11
USA (TX), 2001 (Straight Eight)	EW	0.056	100	6	1	cucumber washed cucumber	< 0.05 (2) < LOD (2)	P-3549 Trial 12
USA (VA), 2001 (Poinsett)	EC	0.056	100	6	1	cucumber washed cucumber	< 0.05 (2) < 0.05 (2)	P-3549 Trial 07
USA (WI), 2001 (Marketmore 86)	EW	0.056	100	6	1	cucumber washed cucumber	< 0.05 (2) < 0.05 (2)	P-3549 Trial 10
SQUASH								
USA (NJ), 2001 (Sunray)	EC	0.056	100	6	1	yellow squash washed yellow squash	< LOD (2) < LOD (2)	P-3549 Trial 13
USA (GA), 2001 (Crookneck Early)	EW	0.056	95	6	1	yellow squash washed yellow squash	< LOD (2) < LOD (2)	P-3549 Trial 14
USA (FL), 2001 (Senator)	EC	0.056	100	6	1	zucchini washed zucchini	< 0.05 (2) < 0.05 (2)	P-3549 Trial 15

CUCURBITS	Application				PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (IL), 2001 (Black Beauty)	EW	0.056	94	6	1	zucchini washed zucchini	< 0.05 (2) < 0.05 (2)	P-3549 Trial 16
USA (CA), 2001 (Ambassador)	EC	0.056	95	6	1	zucchini washed zucchini	< LOD (2) < LOD (2)	P-3549 Trial 17

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 25 Zeta-cypermethrin residues in peppers resulting from supervised trials with zeta-cypermethrin in the USA and Italy. Replicate values arise from replicate plots or replicate field samples

PEPPERS	Application				PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
Italy, 1993 (Quadrato d'Asti)	EW	0.025	1000	1	3	peppers	0.05 < 0.05	A-17-93-17
Italy, 1993 (Quadrato d'Asti)	EW	0.050	1000	1	3	peppers	0.08 0.08	A-17-93-17
USA (CA), 1999 (Sorano)	EC	0.056	85–95	6	1	chilli peppers	0.10 0.19	P-3449 Trial 09
USA (FL), 1999 (Capistrano)	EC	0.056	95	6	1	bell peppers	< LOD < 0.05	P-3449 Trial 03
USA (FL), 1999 (Capistrano)	EW	0.056	90–95	6	1	bell peppers	< LOD (2)	P-3449 Trial 04
USA (NC), 1999 (California Wonder)	EC	0.056	90–95	6	1	bell peppers bell peppers, washed	< 0.05 (2) < 0.05 (2)	P-3449 Trial 01
USA (NM), 1999 (Big Jim)	EC	0.056	70–90	6	1	chilli peppers	< 0.05 < LOD	P-3449 Trial 07
USA (NM), 1999 (Sandia)	EW	0.056	70–85	6	1	chilli peppers chilli peppers, washed	< LOD (2) < LOD (2)	P-3449 Trial 08
USA (OH), 1999 (King Arthur)	EW	0.056	80–100	6	1	bell peppers	0.07 0.07	P-3449 Trial 06
USA (VA), 1999 (Keystone)	EW	0.056	94	6	1	bell peppers	< 0.05 < LOD	P-3449 Trial 02
USA (WI), 1999 (Jupiter)	EC	0.056	85–95	6	1	bell peppers	< LOD (2)	P-3449 Trial 05

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.02–0.03 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 26 Zeta-cypermethrin residues in tomatoes resulting from supervised trials with zeta-cypermethrin in Brazil and the USA. Replicate values arise from replicate plots or replicate field samples

TOMATOES	Application				PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
Brazil (SP), 1993 (Santa Clara)	EW	0.018		1	0 5 10	tomatoes	0.04 0.02 < 0.02	DB-TOM-2[b]
Brazil (SP), 1993 (Santa Clara)	EW	0.036		1	0 5 10	tomatoes	0.06 0.05 < 0.02	DB-TOM-2[b]
Brazil (SP), 1993 (Santa Clara)	EW	0.072		1	0 5 10	tomatoes	0.10 0.07 0.03	DB-TOM-2[b]
Brazil (SP), 1993 (Santa Clara)	EW	0.018		1	0 5 10	tomatoes	0.05 0.04 0.02	DB-TOM-3[b]
Brazil (SP), 1993 (Santa Clara)	EW	0.036		1	0 5 10	tomatoes	0.08 0.07 0.05	DB-TOM-3[b]
Brazil (SP), 1993 (Santa Clara)	EW	0.072		1	0 5 10	tomatoes	0.20 0.10 0.09	DB-TOM-3[b]
Brazil (SP), 1993 (Santa Clara) staked tomato	EC	0.05		1	10	tomatoes	< 0.02	DB-TOM-1[b]
Brazil (SP), 1993 (Santa Clara) staked tomato	EC	0.10		1	10	tomatoes	< 0.02	DB-TOM-1[b]
Brazil (SP), 1993 (Santa Clara) staked tomato	EC	0.05		1	10	tomatoes	< 0.02	DB-TOM-4[b]
Brazil (SP), 1993 (Santa Clara) staked tomato	EC	0.10		1	10	tomatoes	< 0.02	DB-TOM-4[b]
Brazil (SP), 1997 (Zenete)	EW	0.02	500	1	0 2 5	tomatoes	0.03 0.02 < 0.02	2303/97[b]
Brazil (SP), 1997 (Zenete)	EW	0.04	500	1	0 2 5	tomatoes	0.05 0.02 < 0.02	2303/97[b]
Brazil, 1997 (Jumbo Agroceres) staked tomato	EW	0.02	500	1	0 10 20	tomatoes	< 0.04 < 0.02 < 0.02	2342/97[b]
Brazil, 1997 (Jumbo Agroceres) staked tomato	EW	0.04	500	1	0 10 20	tomatoes	< 0.07 < 0.02 < 0.02	2342/97[b]
USA (AZ), 1999 (Champion VFNT)	EW	0.056	80	6	1	tomatoes	< 0.05 (2)	P-3451 Trial 06
USA (CA), 1999 (Ace 55 VF)	EW	0.056	85–95	6	1	tomatoes	< 0.05 (2)	P-3451 Trial 10
USA (CA), 1999 (Ace 55 VF)	EW	0.056	90–95	6	1	tomatoes	< 0.05 0.06	P-3451 Trial 11

TOMATOES	Application				PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
USA (CA), 1999 (Heinz 8892)	EW	0.056	75–95	6	1	tomatoes	0.08 0.06	P-3451 Trial 12
USA (CA), 1999 (Heinz)	EC	0.056	75	6	1	tomatoes	0.08 0.08	P-3451 Trial 09
USA (CA), 1999 (Rio Grande)	EC	0.056	94	6	1	tomatoes	0.05 < 0.05	P-3451 Trial 07
USA (CA), 1999 (Rio Grande)	EC	0.056	85–90	6	1	tomatoes	< 0.05 (2)	P-3451 Trial 08
USA (FL), 1999 (Mountain Spring)	EC	0.056	90–100	6	1	tomatoes	< 0.05 (2)	P-3451 Trial 03
USA (FL), 1999 (Santa)	EW	0.056	90–100	6	1	tomatoes	< 0.05 (2)	P-3451 Trial 04
USA (NY), 1999 (Mountain Pride)	EC	0.056	94	6	1	tomatoes tomatoes unwashed tomatoes cooked tomatoes washed	0.07 0.07 < LOD < 0.05 < LOD (2) < LOD (2)	P-3451 Trial 01
USA (OH), 1999 (Heinz H9423)	EC	0.056	80–100	6	1	tomatoes	0.06 0.08	P-3451 Trial 05
USA (VA), 1999 (Super Sweet)	EW	0.056	94	6	1	tomatoes tomatoes unwashed tomatoes cooked tomatoes washed	< 0.05 (2) < LOD < 0.05 < LOD (2) < LOD < 0.05	P-3451 Trial 02

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] No field report. Summary of field information provided.

Table 27 Zeta-cypermethrin residues in sweet corn resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

SWEET CORN	Application				PHI	Commod[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (FL), 1993 (Super Sweet 7210)	EW	0.056	420	6	3	ears	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	P-2923 trial 01
USA (CA), 1993 (Sweety 80–82)	EW	2 x 0.11	190	2	3	ears	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	P-2923 trial 02
USA (MN), 1993 (Crisp & Sweet 710)	EW	0.056	190	6	3	ears	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	P-2923 trial 03
USA (WI), 1999 (Kandy King)	EC	0.056	180-190	6	3	ears	< LOD (2)	< LOD (2)	< LOD (2)		P-3421 trial 01
USA (WA), 1999 (Legend)	EW	0.056	190	6	3	ears	< 0.05 (2)	< LOD (2)	< LOD (2)		P-3421 trial 02
USA (CA), 1994 (Sweet Treat)	EC	0.056	190	6	3 30	ears grain	< LOD < LOD	< LOD < LOD	< LOD < LOD	< LOD < LOD	RC-0050 trial 02

SWEET CORN	Application				PHI	Commod[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (MN), 1994 (Code 40)	EC	0.056	190	6	3 80	ears grain	< LOD < LOD	< LOD < LOD	< LOD < LOD	< LOD < LOD	RC-0050 trial 03
USA (PA), 1995 (Stars-N-Stripes)	EC	0.056	190	6	3	ears 76	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0054 trial 01
USA (FL), 1995 (Super Sweet 7210)	EC	0.056	190	6	3 3	ears	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0054 trial 02
USA (FL), 1995 (Abbott & Cobb 7630)	EC	0.056	190	6	3	ears	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0054 trial 03

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Commodities with% moisture where available.

Table 28 Zeta-cypermethrin residues in endives resulting from supervised trials with zeta-cypermethrin in Italy. Replicate values arise from replicate plots or replicate field samples

ENDIVES	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Italy, 1993 (St Laurent)	EW	0.025	0.0025	1000	1	3 7	heads	0.45 0.51 0.26 0.27	A-17-93-15
Italy, 1993 (St Laurent)	EW	0.05	0.005	1000	1	3 7	heads	0.71 0.69 0.35 0.34	A-17-93-15
Italy, 1994 (Elisée 176F)	EW	0.025	0.0025	1000	1	0 3 7	heads	1.1 0.96 0.64 0.85 0.36 0.36	A-17-94-13
Italy, 1994 (Elisée 176F)	EW	0.05	0.005	1000	1	0 3 7	heads	2.9 3.1 0.88 1.1 0.43 0.56	A-17-94-13
Italy, 1994 (Elisée 176F)	EC	0.025	0.0025	1000	1	0 3 7	heads	1.6 1.0 0.68 0.68 0.35 0.38	A-17-94-13
Italy, 1994 (Elisée 176F)	EC	0.05	0.005	1000	1	0 3 7	heads	3.3 3.2 1.1 1.1 0.61 0.44	A-17-94-13

Table 29 Zeta-cypermethrin residues in lettuce resulting from supervised trials with zeta-cypermethrin in Italy and the USA. Replicate values arise from replicate plots or replicate field samples

LETTUCE	Application					PHI	Commod	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Italy, 1994 (Audrian 285 F)	EW	0.025	0.0025	1000	1	0 3 7	lettuce leaves	0.83 0.91 0.88 0.91 0.18 0.18	A-17-94-14

LETTUCE	Application					PHI	Commod	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Italy, 1994 (Audrian 285 F)	EW	0.05	0.005	1000	1	0 3 7	lettuce leaves	1.7 1.4 1.2 1.1 0.46 0.48	A-17-94-14
Italy, 1994 (Audrian 285 F)	EC	0.025	0.0025	1000	1	0 3 7	lettuce leaves	0.74 0.73 0.57 0.61 0.28 0.26	A-17-94-14
Italy, 1994 (Audrian 285 F)	EC	0.05	0.005	1000	1	0 3 7	lettuce leaves	1.6 1.6 1.1 1.1 0.37 0.37	A-17-94-14
Italy, 1993 (Audran 285 F)	EW	0.025	0.0025	1000	1	0 3 7 14	lettuce leaves	0.59 0.44 0.27 0.26 0.18 0.17 0.11 0.12	A-17-93-13
Italy, 1993 (Audran 285 F)	EW	0.05	0.005	1000	1	0 3 7 14	lettuce leaves	1.4 1.3 0.65 0.68 0.53 0.48 0.17 0.18	A-17-93-13
USA (FL), 1981 (FL 7424)	EC	0.11		47 ✈	15	0 3 7	heads[b]	0.38 0.44 0.23 0.28 0.34 0.33	RAN-0045
USA (CA), 1981 (Salinas)	EC	0.11		374	15	0 3 7	heads[b]	0.62 2.4 0.86 2.8 0.49 1.1	RAN-0045
USA (FL), 1981 (Montello)	EC	0.11		560	15	0 0 3 7	heads[b]	0.08 1.0 c0.17 0.11 0.16 0.05 0.04	RAN-0045
USA (AZ), 1980 (Empire MT)	EC	0.11		330	15	0 3 7	heads[b]	2.4 2.1 2.4 1.9 2.0 2.3	RAN-0045
USA (FL), 1981 (FL 49015)	EC	0.11		940	15	0 3 7	heads[b]	1.5 1.1 0.37 0.48 0.22 0.09	RAN-0045
USA (AZ), 1981 (GL-61)	EC	0.11		190	15	0 0 3 7	heads[b]	1.9 1.8 c0.09 1.6 1.4 1.4 1.3	RAN-0045
USA (FL), 1980 (FL 7424)	EC	0.11		300	15	0 3 7	heads[b]	0.86 0.73 0.77 0.95 0.15 0.07	RAN-0045
USA (CA), 1981 (Empire)	EC	0.11		47 ✈	15	0 3 7	heads[b]	2.7 1.5 1.9 0.78 1.1 1.5	RAN-0045
USA (TX), 1981 (Green Lake)	EC	0.11		47 ✈	15	0 0 3 3 7 7	heads[b]	0.33 0.32 c0.10 0.22 0.29 c0.14 0.25 0.64 c0.19	RAN-0045
USA (CA), 1981 (Empire)	EC	0.11		150	15	0 3 7	heads[b]	2.1 2.4 1.3 1.4 1.0 1.1	RAN-0045

LETTUCE	Application					PHI	Commod	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (NY), 1981 (Iceburg)	EC	0.11		470	15	0 3 7	heads[b]	2.9 1.6 0.20 0.29 0.14 0.14	RAN-0045
USA (FL), 1981 (FL 74-24)	EC	0.11		940	15	0 3 7	heads[b]	1.6 1.3 0.69 0.58 0.42 0.75	RAN-0045
USA (CA), 1981 (Salinas)	EC	0.11		370	15	0 3 3 7	heads[b]	1.6 2.4 2.5 1.9 c0.06 0.61 0.95	RAN-0045

[a] c: sample from control plot.

[b] Heads were minimally trimmed; only rotten wrapper leaves were removed at harvest.

Table 30 Zeta-cypermethrin residues in lettuce resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

LETTUCE	Application				PHI	Com	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1993 (Romaine Darkland COS) leaf lettuce	EW	0.056	94	6	1	leaf-lettuce heads[b]	2.3 1.8	< LOD (2)	< 0.05 (2)	< 0.05 (2)	RC-0048
USA (FL), 1994 (Slobolt) leaf lettuce	EW	0.056	100	6	1	leaf-lettuce heads[b]	2.4 2.2	< 0.05 (2)	0.05 0.07	< 0.05 (2)	RC-0048
USA (OR), 1993 (Waldmann's Green) leaf lettuce	EW	0.056	94	6	1	leaf-lettuce heads[b]	2.3 2.2	< 0.05 (2)	< 0.05 (2)	< 0.05 (2)	RC-0048
USA (CA), 1993 (Hacienda) leaf lettuce	EW	0.056	94	6	1	leaf-lettuce heads[b]	2.1 2.4	< 0.05 (2)	0.06 0.07	< LOD < 0.05	RC-0048
USA (NJ), 1993 (Slo Bolt M.I.) leaf lettuce	EW	0.056	94	6	1	untrim-med leaves[b]	3.1 3.3	< 0.05 (2)	0.05 0.06	< LOD (2)	RC-0048
USA (CO), 1993 (Black Seeded Simpson) leaf lettuce	EW	0.056	140	6	1	leaf-lettuce heads[b]	1.4 1.5	< LOD (2)	< 0.05 (2)	< LOD (2)	RC-0048
USA (AZ), 1990 (Empire) head lettuce	WP	0.11	94	6	0 3 7 14	head with outer leaves	1.8 0.88 1.8 1.1 1.9 1.2 0.22 0.14	< 0.05 < LOD < 0.05 < LOD < 0.05 < LOD < LOD < 0.05	< 0.05 (2) < 0.05 (2) < 0.05 (2) < LOD < 0.05	< 0.05 (2) < 0.05 (2) < 0.05 (2) < LOD < 0.05	RAN-0227

LETTUCE	Application				PHI	Com	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1990 (Winterhaven MOR 109) head lettuce	WP	0.11	390	6	0 3 7 14	head with outer leaves	1.5 2.5 2.4 1.6 1.3 1.4 1.2 0.94	< 0.05 < LOD < LOD < 0.05 < LOD < 0.05 < 0.05 (2)	< 0.05 (2) < 0.05 (2) < 0.05 < LOD < 0.05 (2)	< LOD < 0.05 < 0.05 (2) < 0.05 (2) < 0.05 (2)	RAN-0227
USA (CA), 1989 (Great Lakes Mesa 659) head lettuce	WP	0.11	330	6	0 3 7 14	head with outer leaves	1.4 1.4 2.1 1.2 1.9 1.2 2.4 2.1	< 0.05 < LOD < 0.05 (2) < 0.05 < LOD < 0.05 (2)	< 0.05 (2) < 0.05 (2) < 0.05 (2) < 0.05 (2)	< 0.05 < LOD < 0.05 (2) < 0.05 < LOD < 0.05 (2)	RAN-0227
USA (FL), 1990 (Southbay) head lettuce	WP	0.11	400	6	0 3 7 14	head with outer leaves	0.23 0.23 < 0.05 0.14 0.12 0.07 < 0.05 (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	RAN-0227
USA (NY), 1989 (Ithaca) head lettuce	WP	0.11	230	6	0 3 7 14	head with outer leaves	0.08 0.14 0.12 < 0.05 0.07 0.09 0.21 0.18	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	RAN-0227
USA (MI), 1989 (South Bay) head lettuce	WP	0.15	146	6	0 3 7 14	head with outer leaves	< 0.05 (2) 0.05 < 0.05 < 0.05 < LOD < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	RAN-0227
USA (AZ) 1995 (Royal Green) leaf lettuce	EW	0.056	94	6	1	leaf-lettuce heads[b]	1.6	< 0.05	< 0.05	< 0.05	RC-0056
USA (AZ) 1995 (Crisp and Green, MI) leaf lettuce	EW	0.056	94	6	1	leaf-lettuce heads[b]	2.7	< 0.05	< 0.05	< 0.05	RC-0056

[a] Abbreviations:zeta = zeta-cypermethrin; DCVA = 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid; MPB = 3-phenoxybenzoic acid
Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Only visibly rotted outer leaves were removed in the field.

Table 31 Zeta-cypermethrin residues in spinach resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

SPINACH	Application					PHI	Com[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1993 (St Helens)	EW	0.056		94	6	1	leaf	5.0 5.0	< 0.05 (2)	< 0.05 0.05	< 0.05 (2)	RAN-0263 trial 1
USA (TX), 1993 (Fall Green)	EW	0.056		107	6	1	leaf	2.6 3.1	< 0.05 (2)	< 0.05 (2)	< 0.05 (2)	RAN-0263 trial 2

SPINACH	Application					PHI	Com[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (NJ), 1993 (Olympia)	EW	0.056		94	6	1	leaf	3.2 3.4	< 0.05 (2)	< 0.05 (2)	0.06 0.05	RAN-0263 trial 3
USA (VA), 1993 (Long-Standing Bloomsdale)	EW	0.056		95	6	1	leaf	2.8 2.8	< 0.05 (2)	0.08 < 0.05	< 0.05 (2)	RAN-0263 trial 4
USA (CO), 1993 (Semi Savoy)	EW	0.056		96	6	1	leaf	3.3 3.4	< 0.05 (2)	< 0.05 (2)	< 0.05 (2)	RAN-0263 trial 5
USA (AZ), 1995 (Bolero)	EW	0.056		94	6	1	leaf	5.7 5.3	0.03 0.02	0.07 0.04	0.08 0.05	RC-0055
USA (CA), 1998 (St Helens)	EW	0.056		95	5 6	7 0 1 3 7 14	leaf	2.5 2.7 4.6 2.5 4.1 4.5 3.1 3.3 3.2 2.7 0.55 0.60	0.23 0.21 0.23 0.19 0.19 0.26 0.19 0.24 0.17 0.22 0.09 0.10	0.43 0.40 0.45 0.38 0.36 0.36 0.33 0.40 0.26 0.39 0.18 0.17		P-3324
USA (AZ), 1998 (Bolero)	EW	0.056		94	5 6	7 0 1 3 7 14	leaf	1.1 1.5 2.2 2.0 1.7 1.9 3.6 2.7 0.93 0.97 0.68 0.82	0.06 0.12 0.08 0.08 0.05 0.04 0.10 0.06 0.04 0.04 0.04 0.06	0.12 0.20 0.17 0.16 0.13 0.11 0.21 0.11 0.08 0.09 0.08 0.14		P-3324

[a] Abbreviations:zeta = zeta-cypermethrin; DCVA = 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid; MPB = 3-phenoxybenzoic acid
Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Only visibly rotted outer leaves were removed in the field.

Table 32 Zeta-cypermethrin residues in mustard greens resulting from supervised trials with zeta-cypermethrin in Italy and the USA. Replicate values arise from replicate plots or replicate field samples

MUSTARD GREENS	Application					PHI	Commod	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1990 (Giant Curled)	EC	0.11		✈ 47	4	1	leaves from mature plants	11.1, 11.2	< LOD (2)	< 0.05 (2)	< LOD (2)	RAN-0241 trial 1
USA (CA), 1990 (Giant Curled)	EC	0.11		210	4	1	leaves from mature plants	9.7 9.5	< 0.05 0.06	0.07 0.11	< 0.05 (2)	RAN-0241 trial 2
USA (TX), 1990 (Southern Giant Curled)	EC	0.11		✈ 28	4	1	leaves from mature plants	2.2 3.6	< LOD	< 0.05 (2)	< LOD (2)	RAN-0241 trial 3
USA (TX), 1990 (Southern Giant Curled)	EC	0.11		190	4	1	leaves from mature plants	4.9 5.6	< 0.05 (2)	< 0.05 (2)	< LOD < 0.05	RAN-0241 trial 4
USA (FL), 1990 (Florida Broadleaf)	EC	0.11		140	4	1	leaves from mature plants	13.5 6.0	< 0.05 (2)	0.06 < 0.05	< 0.05 (2)	RAN-0241 trial 5

MUSTARD GREENS	Application					PHI	Commod	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (LA), 1990 (Florida Broadleaf)	EC	0.11		110	4	1	leaves from mature plants	4.8 3.7	< 0.05 (2)	0.06 0.05	< 0.05 < LOD	RAN-0241 trial 6
USA (OH), 1990 (Southern Giant Curled)	EC	0.11		150	4	1	leaves from mature plants	6.5 8.1	< 0.05 (2)	< 0.05 (2)	< LOD (2)	RAN-0241 trial 7

[a] Abbreviations:zeta = zeta-cypermethrin; DCVA = 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid; MPB = 3-phenoxybenzoic acid
Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

✈ Aerial application

Table 33 Zeta-cypermethrin residues in peas resulting from supervised trials with zeta-cypermethrin in France, Italy, the UK and the USA. Replicate values arise from replicate plots or replicate field samples

PEAS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 1993 (Fresca) canning peas	EW	0.013	0.0031	400	2	0 0 3 3 7 7	pods shelled peas pods shelled peas pods shelled peas	0.04 < 0.01 0.03 < 0.01 0.03 < 0.01	FMC-9304 Trial C-93505
France, 1993 (Minarette) canning peas	EW	0.013	0.0031	400	2	0 0 3 3 7 7	pods shelled peas pods shelled peas pods shelled peas	0.05 < 0.01 0.03 < 0.01 0.02 < 0.01	FMC-9304 Trial C-93506
France, 1993 (Satin) canning peas	EW	0.013	0.0031	400	2	0 0 3 3 7 7	pods shelled peas pods shelled peas pods shelled peas	0.04 < 0.01 0.03 < 0.01 0.02 < 0.01	FMC-9304 Trial C-93504
France, 1993 (Velours) canning peas	EW	0.013	0.0031	400	2	0 0 3 3 7 7	pods shelled peas pods shelled peas pods shelled peas	0.04 < 0.01 0.03 < 0.01 0.02 < 0.01	FMC-9304 Trial C-93503
France, 1994 (Ascona)	EW	0.015	0.0038	400	1	0 0 14 14 21 21 28 28	shelled peas pods shelled peas pods shelled peas pods shelled peas pods	< 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	A-17-94-06 Trial RA91
France, 1994 (Messire)	EW	0.015	0.0041	360	1	21 21	shelled peas pods	< 0.05 < 0.05	A-17-94-06 Trial LA14

PEAS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 1994 (Messire)	EW	0.015	0.0038	390	1	0 0 14 14 21 21 28 28	shelled peas pods shelled peas pods shelled peas pods shelled peas pods	< 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	A-17-94-06 Trial LD80
France, 1994 (Messire)	EW	0.015	0.0038	400	1	26 26	shelled peas pods	< 0.05 < 0.05	A-17-94-06 Trial TP92
France, 2001 (Austin)	EW	0.014	0.0046	310	2	0 1 3 7 7 22	pods pods pods shelled green peas pods shelled dry peas	< LOD < LOD < LOD < LOD < LOD < LOD	20011151/E1-FPPS
France, 2001 (Innovert)	EW	0.014	0.0046	310	2	7 7 30	shelled green peas pods shelled dry peas	< LOD[b] < LOD < LOD	20011151/E1-FPPS
France, 2002 (Baccara)	EW	0.015	0.0038	400	2	0 1 3 7 7 10 10 21	pods pods pods shelled peas green pods shelled peas green pods shelled peas dry	0.02[b] < 0.02 < 0.02 < LOD < LOD < LOD < LOD < LOD	20021160/E1-FPPS
France, 2002 (Sydne)	EW	0.015	0.0038	410	2	14	shelled peas dry	< LOD[b]	20021160/E1-FPPS
Italy, 2001 (Regina)	EW	0.014	0.0035	420	2	7	shelled dry peas	< LOD[b]	20011151/E1-FPPS
Italy, 2001 (Resal)	EW	0.014	0.0035	410	2	7	shelled dry peas	< LOD[b]	20011151/E1-FPPS
Italy, 2002 (Regina)	EW	0.015	0.0037	405	2	14	shelled peas, dry	< LOD[b]	20021160/E1-FPPS
Italy, 2002 (Resal)	EW	0.015	0.0038	405	2	7 7 14	shelled peas green pods shelled peas dry	< LOD[b] < LOD < LOD	20021160/E1-FPPS
UK, 1994 (Sancho) vining peas	EW	0.015		200	2	0 5 5 7 11 11	pods pods peas pods pods peas	0.06 0.03 < 0.01 0.02 0.01 < 0.01	AG-95-0180 FD 6681

PEAS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
UK, 1994 (Scout) vining peas	EW	0.015		200	2	0 5 7 7 15 15	pods pods pods peas pods peas	0.10 0.04 0.03 < 0.01 0.01 < 0.01	AG-95-0180 FD 6657
UK, 1996 (Kalomo) vining peas	EW	0.015		300	2	12 12	pods peas	< 0.01 < 0.01	AG-96-0224 FD 6733
UK, 1996 (Tacoma) vining peas	EW	0.015		300	2	12 12	pods peas	0.01 < 0.01	AG-96-0224 FD 6732
UK, 1999 (Bikini) vining pea, Meigle	EW	0.015		200	2	14	fresh shelled peas whole pods	< 0.01 < 0.01	17787
UK, 1999 (Bikini) vining pea, Milton of Collace	EW	0.015		200	2	14	fresh shelled peas whole pods	< 0.01 0.011	17787
UK, 2000 (Espace)	EW	0.016		300	2	14	seeds	< 0.01	EU-GLP/219 GB/00/PS-BN-1
UK, 2000 (Espace)	EW	0.017		310	2	14	seeds	< 0.01	EU-GLP/219 GB/00/PS-BN-3
UK, 2000 (Eyel)	EW	0.016		290	2	14	seeds	< 0.01	EU-GLP/219 GB/00/PS-BN-2
USA (ID), 1999 (Early Alaska)	EC	0.056		94	6	22	dry shelled peas	< 0.05 (2)	P-3441 trial 02
USA (ID), 1999 (Knight)	EW	0.056		94	6	21	dry shelled peas	< 0.05 (2)	P-3441 trial 01
USA (ID), 1999 (Scepter)	EW	0.056		94	6	1	succulent shelled peas	< LOD (2)	P-3441 trial 10
USA (MI), 1999 (Oregon Sugar Pod II)	EC	0.056		94	6	1	edible-podded unwashed washed cooked microwaved steamed	0.23 0.35 0.21 0.20 0.17 0.17 0.14 0.14 0.15 0.18 0.17 0.16	P-3441 trial 12
USA (MI), 1999 (Progress #9)	EW	0.056		94	6	1	succulent shelled peas	0.05 0.05	P-3441 trial 08
USA (MN), 1999 (Mako)	EC	0.056		90	6	1	succulent shelled peas	< LOD (2)	P-3441 trial 07
USA (NY), 1999 (Bolero)	EW	0.056		94	6	1	succulent shelled unwashed peas washed peas canned peas pea puree	< 0.05 (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3441 trial 06
USA (OR), 1999 (Columbian)	EW	0.056		94	6	1	dry shelled peas	0.34 0.43	P-3441 trial 03
USA (OR), 1999 (Misty)	EC	0.056		94	6	1	succulent shelled peas	0.06 < 0.05	P-3441 trial 11

PEAS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (OR), 1999 (Oregon Sugar Pod II)	EW	0.056		94	6	1	edible-podded unwashed washed cooked microwaved steamed	0.16 0.20 0.10 0.12 0.09 0.12 0.09 0.11 0.09 0.12 0.10 0.09	P-3441 trial 14
USA (WA), 1999 (Columbian)	EC	0.056		94	6	1	dry shelled peas	0.43 0.34	P-3441 trial 04
USA (WA), 1999 (Columbian)	EW	0.056		94	6	1	dry shelled peas	0.08 0.11	P-3441 trial 05
USA (WI), 1999 (Knight)	EC	0.056		94	6	1	succulent shelled peas	< LOD (2)	P-3441 trial 09
USA (WI), 1999 (Oregon Sugar Pod II)	EW	0.056		94	6	1	edible-podded peas	0.17 0.12	P-3441 trial 13

[a]Residues reported as undetected are listed as < LOD (limit of detection, 0.03 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b]Residues reported as undetected are listed as < LOD (limit of detection, 0.006 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.02 mg/kg), are listed as < 0.02 mg/kg.

Table 34 Zeta-cypermethrin residues in field beans resulting from supervised trials with zeta-cypermethrin in the UK and the USA. Replicate values arise from replicate plots or replicate field samples

FIELD BEANS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
UK, 1994 (Alfred) spring field beans	EW	0.015		300	2	0 14	whole bean	0.52 0.45	AG-95-0179[b] FD 6697
UK, 1994 (Bourdon) winter field beans	EW	0.015		300	2	0 7	whole bean	0.44 c0.10 0.25 c0.15	AG-95-0179 FD 6698
UK, 1994 (Bourdon) winter field beans	EW	0.015		300	2	0 4 7 11	whole bean	0.47 0.36 0.28 0.31	AG-95-0179 FD 6699
UK, 1994 (Troy) spring field beans	EW	0.015		300	2	0 3 7 14	whole bean	0.46 0.42 0.33 0.32	AG-95-0179 FD 6696
UK, 1994 (Vasco) spring field beans	EW	0.015		300	2	0 7	whole bean	0.34 0.28	AG-95-0179 FD 6695
UK, 1995 (Marisbead) spring field beans	EW	0.015		300	2	13	whole bean	0.22	AG-96-0225 6734
UK, 1995 (Punch) winter field beans	EW	0.015		300	2	14	whole bean	0.26	AG-96-0225 6735
UK, 1995 (Punch) winter field beans	EW	0.015		300	2	14	whole bean	0.30	AG-96-0225 6736
UK, 1999 (Punch) winter beans	EW	0.017		200	2	14 14	whole pod shelled beans	0.22 < 0.01	BKA-656-99-RES

FIELD BEANS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
UK, 1999 (Victor) spring beans	EW	0.017		200	2	14 14	whole pod shelled beans	0.41 < 0.01	BKA-656-99-RES
UK, 2000 (Klipper) winter beans	EW	0.017		300	2	13	seeds	< 0.01	EU-GLP/219 GB/00/PS-BN-4
UK, 2000 (Listra) broad beans	EW	0.017		300	2	14 14	green pods green seeds	0.02 < 0.01	BKA-685-00-RES GB/00/BN-2
UK, 2000 (Manita)	EW	0.016		300	2	14 14	green pods green seeds	0.02 < 0.01	BKA-685-00-RES GB/00/BN-1
UK, 2000 (Mars) spring beans	EW	0.016		290	2	14	seeds	< 0.01	EU-GLP/219 GB/00/PS-BN-6
UK, 2000 (Narbonne)	EW	0.017		310	2	14 62	green pods dry seeds	< 0.01 < 0.01	BKA-685-00-RES GB/00/BN-4
UK, 2000 (Paulista)	EW	0.017		310	2	14 75	green pods dry seeds	< 0.01 < 0.01	BKA-685-00-RES GB/00/BN-4
UK, 2000 (Piccadilly) spring beans	EW	0.017		310	2	14	seeds	< 0.01	EU-GLP/219 GB/00/PS-BN-5
UK, 2000 (Roma)	EW	0.016		290	2	14 42	green pods dry seeds	< 0.01 < 0.01	BKA-685-00-RES GB/00/BN-3
USA (CA), 1999 (Baby Lima)	EW	0.056		94	6	1	succulent shelled	< LOD (2)	PC-0301 trial 11
USA (CA), 1999 (Pinto Beans)	EW	0.056		94	6	21	dried shelled	< 0.05 < LOD	PC-0301 trial 20
USA (CO), 1999 (Bill Z)	EC	0.056		94	6	1	dried shelled	< 0.05 (2)	PC-0301 trial 19
USA (CO), 1999 (UI 196)	EW	0.056		94	6	1	dried shelled	< 0.05 (2)	PC-0301 trial 18
USA (FL), 1999 (Hialeah) snap beans	EW	0.056		94	6	1	whole pods	0.21 0.29	PC-0301 trial 03
USA (GA), 1999 (Henderson Bush) lima bean	EC	0.056		94	6	1	succulent shelled	< LOD (2)	PC-0301 trial 08
USA (ID), 1999 (Othello Pintos)	EC	0.056		94	6	21	dried shelled	< LOD (2)	PC-0301 trial 21
USA (ID), 1999 (Tendergreen) succulent beans	EC	0.056		94	6	1	whole pods unwashed beans washed beans canned cut bean bean puree	< LOD < 0.05 < 0.05 < 0.05 0.05 < 0.05	PC-0301 trial 06
USA (IL), 1999 (Field Pinto)	EC	0.056		94	6	21	dried shelled	< LOD (2)	PC-0301 trial 15
USA (IL), 1999 (Seed West #8825) lima bean	EC	0.056		94	6	1	succulent shelled	< LOD (2)	PC-0301 trial 10

FIELD BEANS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (IN), 1999 (Provider) snap beans	EW	0.056		94	6	1	whole pods whole pods unwashed beans washed beans cooked beans microwaved steamed beans	0.20 0.20 0.23 0.27 0.30 0.18 0.11 0.20 0.24 0.24 0.27	PC-0301 trial 05
USA (MI), 1999 (Bronco) snap beans	EC	0.056		94	6	1	whole pods	0.21 0.10	PC-0301 trial 04
USA (MI), 1999 (Othello Pinto Beans)	EW	0.056		94	6	21	dried shelled	< 0.05 (2)	PC-0301 trial 16
USA (MN), 1999 (GTS 900 Pinto Beans)	EW	0.056		94	6	22	dried shelled	< LOD (2)	PC-0301 trial 14
USA (NC), 1999 (Blue Lake 274) snap beans	EC	0.056		94	6	1	whole pods	0.07 0.05 < 0.05 (2)	PC-0301 trial 02
USA (ND), 1999 (Maverick Pinto Beans)	EC	0.056		94	6	21	dried shelled	< LOD (2)	PC-0301 trial 17
USA (NY), 1999 (Improved Tendergreen) green bush beans	EW	0.056		94	6	1	whole pods whole pods unwashed beans washed beans cooked beans microwaved steamed beans	0.08 0.09 0.05 0.05 < 0.05 < 0.05 < 0.05 0.05 0.06	PC-0301 trial 01
USA (SC), 1999 (Fordhook 242) lima bean	EW	0.056		94	6	1	succulent shelled	< LOD (2)	PC-0301 trial 07
USA (VA), 1999 (Burpee Improved) lima beans	EW	0.056		94	6	1	succulent shelled	< LOD (2)	PC-0301 trial 09
USA (WA), 1999 (Moffei 15) lima beans	EC	0.056		94	6	1	succulent shelled	< LOD (2)	PC-0301 trial 12
USA (WI), 1999 (Field Pinto)	EW	0.056		94	6	21	dried shelled	< LOD (2)	PC-0301 trial 13

[a]Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b]Study AG-94-017-02 contains the same sets of data as study AG-95-0179

Table 35 Zeta-cypermethrin residues in soya bean seed resulting from supervised trials with zeta-cypermethrin in the USA and Brazil. Replicate values arise from replicate plots or replicate field samples

SOYBEAN	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Brazil,	EC	0.030				0 15 30	soya beans	< 0.05 < 0.05 < 0.05	3181/00[c]
Brazil,	EC	0.060				0 15 30	soya beans	< 0.05 < 0.05 < 0.05	3181/00[c]
Brazil, 1998 (FT 107)	EC	0.030		200	1[b]	0 15 30	soya beans	< 0.05 < 0.05 < 0.05	2451/98[c]
Brazil, 1998 (FT 107)	EC	0.015		200	1[b]	0 15 30	soya beans	< 0.05 < 0.05 < 0.05	2451/98[c]
Brazil, 1998 (FT Estrela)	EC	0.030		200	1[b]	0 15 30	soya beans	< 0.05 < 0.05 < 0.05	2450/98[c]
Brazil, 1998 (FT Estrela)	EC	0.015		200	1[b]	0 15 30	soya beans	< 0.05 < 0.05 < 0.05	2450/98[c]
USA (AR), 1999 (Asgrow AG5602)	EW	0.056		90–100	6	30	soya bean seed	< LOD (2)	P-3446 Trial 05
USA (AR), 1999 (Garst 472RR)	EC	0.056		170	6	30	soya bean seed	< LOD (2)	P-3446 Trial 04
USA (GA), 1999 (Hartz 7550)	EC	0.056		130–180	6	30	soya bean seed	< LOD (2)	P-3446 Trial 01
USA (GA), 1999 (S73-Z5)	EW	0.056		140–160	6	28	soya bean seed	< LOD (2)	P-3446 Trial 02
USA (IA), 1999 (Pioneer 93B53)	EC	0.056		130–170	6	20 25 30 35 40	soya bean seed	< LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3446 Trial 07
USA (IA), 1999 (RT2301)	EC	0.056		140	6	30	soya bean seed	< LOD (2)	P-3446 Trial 06
USA (IL), 1999 (DeKalb CX283RR)	EW	0.056		160–170	6	30	soya bean seed	< LOD (2)	P-3446 Trial 09
USA (IL), 1999 (Pioneer 9363)	EW	0.056		100–160	6	20 25 29 35 40	soya bean seed	< LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3446 Trial 08
USA (KS), 1999 (Asgrow 3002 RR)	EW	0.056		160–170	6	30	soya bean seed	< LOD (2)	P-3446 Trial 11
USA (MI), 1999 (Pioneer 93B45)	EC	0.056		130–170	6	30	soya bean seed	< LOD (2)	P-3446 Trial 12
USA (MI), 1999 (Pioneer 93B51 RR)	EW	0.056		160–190	6	30	soya bean seed	< LOD (2)	P-3446 Trial 13
USA (MN), 1999	EC	0.056		130	6	30	soya bean seed	< LOD (2)	P-3446 Trial 14

SOYBEAN	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (MN), 1999 (Novartis RUR)	EW	0.056		130	6	30	soya bean seed	< LOD (2)	P-3446 Trial 15
USA (NY), 1999 (Dunbar)	EC	0.056		100	6	35	soya bean seed	< LOD (2)	P-3446 Trial 10
USA (OH), 1999 (SC9388RR)	EC	0.056		130–150	6	33	soya bean seed	< LOD (2)	P-3446 Trial 16
USA (OH), 1999 (Surgrow 378 STS)	EW	0.056		160–170	6	29	soya bean seed	< LOD (2)	P-3446 Trial 17
USA (VA), 1999 (Hutcheson)	EC	0.056		100	6	30	soya bean seed	< LOD (2)	P-3446 Trial 03

[a]US trials:Residues reported as undetected are listed as < LOD (limit of detection, 0.03 mg/kg). Brazil trials:Residues reported below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b]Trial 2450/98 and 2451/98. Plots were sprayed on three separate occasions so that the mature soya beans could be harvested on the same day for different PHIs.

[c]No field report. Summary of field information provided.

Table 36 Zeta-cypermethrin residues in sugar beets resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

SUGAR BEET	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (WI), 2002 (Beta 6600)	EW	0.084 +0.028 +0.056		88 +92 +95	3	7 14 21 28 35	roots	< LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 3
USA (ID), 2002 (Beta Seeds 4490R)	EW	0.085 +0.030 +0.056		94 +86 +87	3	7 14 21 28 35	roots	< LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 4
USA (MN), 2003 (Holy HH 811)	EC	0.084 +0.028 +0.056		94 +94 +94	3	3 7 14 21	roots	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 5
USA (MN), 2003 (Holy HH 811)	EW	0.083 +0.028 +0.056		94 +94 +94	3	3 7 14 21	roots	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 5
USA (ID), 2003 (Beta Seed 8450)	EC	0.084 +0.029 +0.056		88 +89 +89	3	3 7 14 21	roots	< LOD < 0.05 < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 6
USA (ID), 2003 (Beta Seed 8450)	EW	0.083 +0.028 +0.056		88 +89 +89	3	3 7 14 21	roots	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 6

SUGAR BEET	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (ND), 2003 (Holy HH811)	EC	0.083 +0.029 +0.056		94 +94 +94	3	3 7 14 21	roots	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 7
USA (ND), 2003 (Holy HH811)	EW	0.083 +0.029 +0.056		94 +94 +94	3	3 7 14 21	roots	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 7

[a]Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 37 Zeta-cypermethrin residues in sugar beets resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

SUGAR BEET	Application				PHI	Commod	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (MI), 1995 (Monogerm Hybrid HME17)	EW	0.056	180	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0289
USA (CA), 1995 (H89778)	EW	0.056	180	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0289
USA (MN), 1996 (Mono Hi Kari) Wheaton	EW	0.056	94	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (MN), 1996 (Mono Hi Kari) Campbell	EW	0.056	94	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (ND), 1996 (Mono Hi Kari)	EW	0.056	94	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (ND), 1996 (Mono Hi Kari)	EW	0.056	94	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (OH), 1996 (Rupp Seed Co, Lot 1531)	EW	0.056	94	3	54	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (NE), 1996 (Monohy 55)	EW	0.056	140	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (TX), 1996 (Monohy 9155)	EW	0.045	80	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (CO), 1996 (Monahakaii)	EW	0.056	140	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (CA), 1996 (Spreckles NB3)	EW	0.056	190	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (ID), 1996 (WS PM-9) Jerome	EW	0.056	190	3	49	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (ID), 1996 (WS PM-9) Rupert	EW	0.056	180	3	50	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302

SUGAR BEET	Application				PHI	Commod	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (OR), 1996 (PS 951010-22 D)	EW	0.056	100	3	49	sugar beet roots	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302

[a]Abbreviations:zeta = zeta-cypermethrin, DCVA = 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid. Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 38 Zeta-cypermethrin residues in maize resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

MAIZE	Application				PHI	Commod[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.[d].	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1994 (Pioneer 3183)	EW	0.056	94	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 01
USA (CO), 1994 (Pioneer 8751)	EW	0.056	[c]	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 02
USA (NE), 1994 (Jacques 7770)	EW	0.056	[c]	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 03
USA (IA), 1994 (Pioneer 3394)	EW	0.056	94	4	30	grain	< 0.05 < LOD	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 04
USA (MN), 1994 (Dekalb 291)	EW	0.056	95	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 05
USA (TX), 1994 (NC+ 7117)	EW	0.056	480 +100 +130 +120	4	30	grain	< 0.05 < LOD	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 06
USA (GA), 1994 (Pioneer 3320)	EW	0.056	25 +100 +100 +100	4	29	grain	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 07
USA (OH), 1994 (GL 262)	EW	0.056	90–105	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 08
USA (IL), 1994 (Pioneer 3245)	EW	1×0.56 +3×0.056	100–110	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	< LOD (2)	RC-0052 Trial 09

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg. Exceptions: cypermethrin LOD in plant and forage 0.02 mg/kg and stover 0.1 mg/kg.

[b] Commodities and% moisture, where measured.

[c] Application by chemigation, overhead sprinkler.

[d] Except for trials 2 and 3 (chemigation), the first application was a band application during seedling emergence and the remaining three were foliar applications.

Table 39 Zeta-cypermethrin residues in maize resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

MAIZE	Application				PHI	Commod[b]	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (SD), 1996 (Dekalb DK401)	EC	0.056	94	4	30	grain 30	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 01
USA (MO), 1996 (Northrup King NK7070)	EC	0.056	90–95	4	30	grain 34	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 02
USA (WI), 1996 (Renk RK714)	EC	0.056	95–100	4	30	grain 38	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 03
USA (MN), 1996 (Cargill 809)	EC	0.056	100	4	30	grain 34	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 05
USA (OH), 1996 (Madison GL226)	EC	0.056	90–95	4	29	grain 32	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 06
USA (IL), 1996 (Pioneer 3394)	EC	0.056	90–97	4	30	grain 30	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 07
USA (NE), 1996 (Pioneer 3394)	EC	0.056	94	4	30	grain 26	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 08
USA (IA), 1996 (Pioneer 3279)	EC	0.056	90–100	4	30	grain 33	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0305 Trial 09
USA (PA), 1995 (Pioneer 3769)	EC	0.056	90–100	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0292 Trial 01
USA (IA), 1995 (Patriot 6155)	EC	0.056	95	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0292 Trial 02
USA (IL), 1995 (Pioneer 3394)	EC	0.056	95–100	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0292 Trial 03
USA (NE), 1995 (Pioneer 3489)	EC	0.056	94	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0292 Trial 04
USA (IN), 1995 (Pioneer 3394)	EC	0.056	95–100	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0292 Trial 05
USA (TX), 1995 (DK 668)	EC	0.056	80–110	4	30	grain	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0292 Trial 06

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Commodities and % moisture, where measured.

Table 40 Zeta-cypermethrin residues in maize resulting from supervised trials with zeta-cypermethrin in Brazil, France, Germany and the USA. Replicate values arise from replicate plots or replicate field samples

MAIZE	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Brazil (SP), 1998 (Z-9052)	EC	0.032		200	1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2452/98[b]
Brazil (SP), 1998 (Z-9052)	EC	0.064		200	1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2452/98[b]
Brazil, 1997 (BR 201)	EW	0.020			1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2275/97[b]
Brazil, 1997 (BR 201)	EW	0.064			1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2275/97[b]
Brazil, 1997 (BR 201)	EW	0.064			1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2275/97[b]
Brazil, 1997 (BR 201)	EW	0.016			1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2275/97[b]
Brazil, 1997 (C-333)	EW	0.020			1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2257/97[b]
Brazil, 1997 (C-333)	EW	0.064			1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2257/97[b]
Brazil, 1997 (C-333)	EW	0.016			1	0 10 20	grain	< 0.05 < 0.05 < 0.05	2257/97[b]
France, 1994 (DK 240)	EW	0.030		400	1	76	grain	< 0.05	A-17-94-05 Trial KJ93
France, 1994 (DK 300)	EW	0.030		400	1	76	grain	< 0.05	A-17-94-05 Trial LA12
France, 1994 (Furio)	EW	0.030		400	1	74	grain	< 0.05	A-17-94-05 Trial AC15
France, 1994 (Volga)	EW	0.030		600	1	74	grain	< 0.05	A-17-94-05 Trial LD81
France, 1995 (Cecilia)	EW	0.03	0.0075	400	1	77	grain	< 0.05	A-17-96-11
France, 1995 (Cesar)	EW	0.03	0.0075	400	1	75	grain	< 0.05	A-17-96-11
France, 1995 (Furio)	EW	0.03	0.0075	400	1	74	grain	< 0.05	A-17-96-11
France, 1995 (Pactol)	EW	0.03	0.0075	400	1	75	grain	< 0.05	A-17-96-11
France, 1995 (Raphaela)	EW	0.03	0.0078	380	1	100	grain	< 0.05	A-17-96-10
France, 1995 (Volga)	EW	0.03	0.0078	380	1	100	grain	< 0.05	A-17-96-10
France, 1996 (Alvina)	EW	0.03	0.075	400	1	84	grain	< 0.05	A-17-96-23 1MB96R01M

MAIZE	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 1996 (Cecilia)	EW	0.03	0.075	400	1	91	grain	< 0.05	A-17-96-23 2MB96R01M
France, 1996 (Magdalena)	EW	0.03	0.075	400	1	80	grain	< 0.05	A-17-96-23 4MB96R01M
France, 1996 (Volga)	EW	0.03	0.075	400	1	87	grain	< 0.05	A-17-96-23 3MB96R01M
France, 2002 (DK 312)	EW	0.038	0.0094	400	1	52 74	cobs grain	< 0.02 < 0.02	20021160/F1-FPMA F02N019R
France, 2002 (DK 312)	EW	0.035	0.0094	380	1	54 75	cobs grain	< 0.02 < 0.02	20021160/F1-FPMA F02N020R
Germany, 2001 (Banguy)	EW	0.035	0.0087	400	1	50 74	cobs grain	< 0.02 < 0.02	20011151/G1-FPMA G01N046R
Germany, 2001 (Büko)	EW	0.038	0.0089	430	1	51 76	cobs grain	< 0.02 < 0.02	20011151/G1-FPMA G01N045R
USA (IL), 2002 (Pioneer 37H24)	EC	0.056		22 +94 +102 +94	4	1 7 14 21	grain	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 1
USA (NE), 2002 (Pioneer 33B50)	EW	0.056		94	4	1 7 14 21	grain	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3630 trial 2

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] No field report. Summary of field information provided.

Table 41 Zeta-cypermethrin residues in barley resulting from supervised trials with zeta-cypermethrin in France, Germany, Italy, Spain and the UK. Replicate values arise from replicate plots or replicate field samples.

BARLEY	Application					PHI	Commodity	Residue, mg/kg	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2001 (Express) winter barley	EW	0.015	0.0047	320	2	31	grain	0.03	20011151/F1-FPCE F01N043R
France, 2001 (Intro) winter barley	EW	0.014	0.0047	300–310	2	0 8 15 21 30	ears ears ears ears grain	0.22 0.08 0.06 0.08 0.04	20011151/F1-FPCE F01N042R
France, 2002 (Intro) winter barley	EW	0.016	0.0037	420–440	2	35	grain	< 0.02	20021160/E1-FPWC F02N022R
Germany, 1992 (Erfa) winter barley	EW	0.010		400	1	64	grain	< 0.01 (2)	94083/92

BARLEY	Application					PHI	Commodity	Residue, mg/kg	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Germany, 1992 (Gaulois) winter barley	EW	0.010		400	1	45	grain	< 0.01 (2)	94083/92
Germany, 1993 (Magie) winter barley	EW	0.015		400	2	20 20 35 35 49	ears grain ears grain grain	0.07 0.01 0.04 0.01 < 0.01	14055/93 C-13 WW-WG No 8
Germany, 1993 (Magie) winter barley	EW	0.015		400	2	22 22 34 34 53	ears grain ears grain grain	0.12 0.02 0.07 0.02 0.01	14055/93 C-13 WW-WG No 9
Germany, 1993 (Noveta) winter barley	EW	0.015		400	2	23 23 36 36 52	ears grain ears grain grain	0.05 0.02 0.04 c0.01 0.02 0.02	14055/93 C-13 WW-WG No 5
Germany, 1993 (Venus) winter barley	EW	0.015		400	2	21 21 35 35 53	ears grain ears grain grain	0.08 0.02 0.10 0.02 0.02	14055/93 C-13 WW-WG No 3
Italy, 2002 (Rondo) spring barley	EW	0.015	0.0038	390–410	2	0 14 21 28 34	ears ears ears ears grain	0.27 < 0.02 < 0.01 < 0.01 < 0.01	20021160/E1-FPSC I02N008R
Italy, 2002 (Sonora) winter barley	EW	0.015	0.0037	410	2	0 13 27 34 41	ears ears ears grain grain	0.38 0.03 < 0.01 < 0.01 < 0.01	20021160/E1-FPWC I02N006R
Spain, 2002 (Albacete) spring barley	EW	0.015	0.0075	190–210	2	0 15 22 27 34	ears ears ears ears grain	0.29 0.09 0.08 0.12 0.02	20021160/E1-FPSC S02N003R
UK, 1994 (Pipkin) winter barley	EW	0.015	0.005	300	2	33	grain	0.17	AG-95-0183
UK, 1994 (Puffin) winter barley	EW	0.015	0.005	300	2	21 29	ear grain	0.76 0.19	AG-95-0183
UK, 1999 (Melanie) winter barley	EW	0.017	0.0088	200	2	45	grain	0.03	17788
UK, 1999 (Melanie) winter barley	EW	0.017	0.0087	200	2	53	grain	< 0.01	17788

Table 42 Zeta-cypermethrin residues in wheat resulting from supervised trials with zeta-cypermethrin in France, Germany, Italy, Spain, the UK and the USA. Replicate values arise from replicate plots or replicate field samples

WHEAT	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2001 (Brindur) winter wheat	EW	0.014	0.0045	310	2	35	grain	< 0.01	20011151/F1-FPCE F01N045R
France, 2001 (Nefer) winter wheat	EW	0.014	0.0047	300	2	0 7 13 22 31	ears ears ears ears grain	0.14 0.09 0.07 0.04 < 0.01	20011151/F1-FPCE F01N044R
France, 2002 (Soisson) winter wheat	EW	0.015	0.0037	410	2	42	grain	< 0.01	20021160/E1-FPWC F02N021R
Germany, 1992 (Asteron) winter wheat	EW	0.010		400	1	28 35	grain grain	< 0.01 (2) < 0.01 (2)	94083/92
Germany, 1992 (Borenos) winter wheat	EW	0.010		400	1	28 35 49	grain grain grain	< 0.01 < 0.01 (2) < 0.01 (2)	94083/92
Germany, 1992 (Consul) winter wheat	EW	0.010		400	1	72	grain	< 0.01 (2)	94083/92
Germany, 1992 (Consul) winter wheat	EW	0.010		400	1	28 35	grain grain	< 0.01 (2) < 0.01 (2)	94083/92
Germany, 1992 (Orestis) winter wheat	EW	0.010		400	1	71	grain	< 0.01 (2)	94083/92
Germany, 1992 (Orestis) winter wheat	EW	0.010		400	1	40 46	grain grain	< 0.01 (2) < 0.01 (2)	94083/92
Germany, 1993 (Orestis) winter wheat	EW	0.015		400	2	21 21 35 35 72	ears grain ears grain grain	0.09 0.01 0.02 < 0.01 < 0.01	14055/93 C-13 WW-WG No 1
Germany, 1993 (Orestis) winter wheat	EW	0.015		400	2	21 21 35 35 63	ears grain ears grain grain	0.03 0.02 0.03 < 0.01 < 0.01	14055/93 C-13 WW-WG No 6
Germany, 1993 (Orestis) winter wheat	EW	0.015		400	2	22 22 35 35 52	ears grain ears grain grain	0.04 0.01 0.02 < 0.01 < 0.01	14055/93 C-13 WW-WG No 7
Germany, 1993 (Ritmo) winter wheat	EW	0.015		400	2	21 21 35 35 70	ears grain ears grain grain	0.04 0.02 0.03 0.02 < 0.01	14055/93 C-13 WW-WG No 4

WHEAT	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Germany, 1993 (Slejpner) winter wheat	EW	0.015		400	2	21 21 35 35 60	ears grain ears grain grain	0.06 0.03 0.04 0.01 < 0.01	14055/93 C-13 WW-WG No 2
Italy, 2002 (Svevo) spring wheat	EW	0.015	0.0038	400–410	2	0 14 21 28 35	ears ears ears ears grain	0.38 0.06 0.03 0.04 < 0.01	20021160/E1-FPSC I02N009R
Italy, 2002 (Violet) winter wheat	EW	0.015	0.0038	410	2	0 14 28 35 42	ears ears ears grain grain	0.18 0.02 < 0.02 < 0.01 < 0.01	20021160/E1-FPWC I02N005R
Spain, 2002 (Chamorro) spring wheat	EW	0.015	0.0075	200–210	2	0 15 20 27 35	ears ears ears ears grain	0.34 0.10 0.08 0.07 < 0.01	20021160/E1-FPSC S02N004R
UK, 1994 (Riband) winter wheat	EW	0.015	0.005	300	2	32	grain	0.01	AG/95/0182 FD 6679
UK, 1994 (Riband) winter wheat	EW	0.015	0.005	300	2	21 46	ear grain	0.11 < 0.01	AG/95/0182 FD 6680
UK, 1999 (Haven) winter wheat	EW	0.017	0.0087	200	2	52	grain	< 0.01	17788
UK, 1999 (Riband) winter wheat	EW	0.017	0.0084	200	2	63	grain	0.01	17788
USA (AR), 1999 (Pioneer 2684) wheat	EC	0.056		100	5	21	grain	< 0.05 0.05	P-3452 trial 02
USA (CO), 1999 (Ogallala) wheat	EW	0.056		94	5	21	grain	< LOD < 0.05	P-3452 trial 13
USA (IA), 1999 (Willcross 738) wheat	EC	0.056		95	5	21	grain	< LOD < 0.05	P-3452 trial 06
USA (ID), 1999 (Penewawa) wheat	EW	0.056		95	5	20	grain	0.05 < 0.05	P-3452 trial 16
USA (IN), 1999 (Pioneer 25R57) wheat	EC	0.056		94	5	18	grain	< 0.05 (2)	P-3452 trial 03
USA (KS), 1999 (2137) wheat	EW	0.056		94	5	21	grain	< 0.05 (2)	P-3452 trial 12
USA (MT), 1999 (2371) wheat	EC	0.056		94	5	21	grain	0.12 0.06	P-3452 trial 09
USA (MT), 1999 (926) wheat	EW	0.056		90–95	5	21	grain	< 0.05 (2)	P-3452 trial 11
USA (NB), 1999 (Nekota) wheat	EW	0.056		95	5	21	grain	< LOD (2)	P-3452 trial 10
USA (ND), 1999 (2375) wheat	EC	0.056		94	5	21	grain	< LOD (2)	P-3452 trial 08

WHEAT	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (NY), 1999 (Nekota) wheat	EW	0.056		95–100	5 5 5 5 5	15 18 21 24 27	grain grain grain grain grain	< 0.05 (2) < LOD (2) < 0.05 < LOD < LOD (2) < LOD (2)	P-3452 trial 05
USA (OH), 1999 (Terra SR 204) wheat	EW	0.056		90–100	5 5 5 5 5	14 17 21 25 27	grain grain grain grain grain	0.05 < 0.05 0.05 0.08 < 0.05 (2) < 0.05 (2) < 0.05 (2)	P-3452 trial 04
USA (OK), 1999 (Custer) wheat	EC	0.056		95–100	5	21	grain	0.05 0.05	P-3452 trial 14
USA (OK), 1999 (Jagger) wheat	EW	0.056		94	5	21	grain	< LOD (2)	P-3452 trial 07
USA (TX), 1999 (TAM-200) wheat	EC	0.056		85–90	5	21	grain	< 0.05 < LOD	P-3452 trial 15
USA (VA), 1999 (Pioneer 2684) wheat	EC	0.056		94	5	21	grain	< 0.05 (2)	P-3452 trial 01

[a] US trials. Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 43 Zeta-cypermethrin residues in oats and triticale resulting from supervised trials with zeta-cypermethrin in Europe

OATS, TRITICALE	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2002 (Zeus) triticale	EW	0.015	0.0038	390, 410	2	28	grain	< 0.02	20021160/E1-FPOT
Italy, 2002 (Rokorotta) oats	EW	0.015	0.0050	310	2	35	grain	< 0.02	20021160/E1-FPOT
Spain, 2002 (Prevision) oats	EW	0.015	0.0075	200	2	35	grain	< 0.02	20021160/E1-FPOT
Spain, 2002 (Galgo) triticale	EW	0.015	0.0075	200	2	35	grain	< 0.02	20021160/E1-FPOT

Table 44 Zeta-cypermethrin residues in rice resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

RICE	Application				PHI	Commod[b]	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (AR), 1997 (Cypress)	EC	0.056	80–110	4	16	grain	0.47 0.54	< LOD (2)	< LOD (2)	P-3332 trial 01
USA (AR), 1997 (Cypress)	EC	0.056	85–105	4	14	grain	0.45 0.57	< LOD (2)	< LOD (2)	P-3332 trial 02
USA (AR), 1997 (Cypress)	EC	0.056	90–95	4	14	grain	0.54 0.63	< 0.05 (2)	< 0.05 (2)	P-3332 trial 03

RICE	Application				PHI	Commod[b]	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (AR), 1997 (Bengal)	EC	0.056	80–90	4	14	grain	0.70 0.73	< 0.05 (2)	< 0.05 (2)	P-3332 trial 04
USA (AR), 1997 (Kaybonnet)	EC	0.056	94	4	14	grain	0.68 0.74	< LOD (2)	< 0.05 (2)	P-3332 trial 05
USA (AR), 1997 (Cypress)	EC	0.056	94	4	14	grain	0.44 0.45	< LOD (2)	< 0.05 < LOD	P-3332 trial 06
USA (MO), 1997 (Kaybonnet)	EC	0.056	95	4	14	grain	0.51 0.75	< LOD (2)	< LOD (2)	P-3332 trial 07
USA (LA), 1997 (Cypress)	EC	0.056	94	4	14	grain	0.38 0.39	< LOD (2)	< 0.05 (2)	P-3332 trial 08
USA (LA), 1997 (Cypress)	EC	0.056	90	4	17	grain	0.11 0.15	< LOD (2)	< 0.05 (2)	P-3332 trial 09
USA (LA), 1997 (Cypress)	EC	0.056	70–90	4	14	grain	0.41 0.38	< 0.05 (2)	< 0.05 (2)	P-3332 trial 10
USA (LA), 1997 (Cypress)	EC	0.056	70–80	4	14	grain	0.48 0.59	< 0.05 (2)	< 0.05 (2)	P-3332 trial 11
USA (MS), 1997 (Lemont)	EC	0.056	75–90	4	14	grain	0.42 0.41	< LOD (2)	< LOD (2)	P-3332 trial 12
USA (MS), 1997 (Lemont)	EC	0.056	95	4	14	grain	0.47 0.63	< LOD (2)	< LOD (2)	P-3332 trial 13
USA (TX), 1997 (Kaybonnet)	EC	0.056	60–70	4	14	grain	0.87 0.86	< LOD (2)	< LOD (2)	P-3332 trial 14
USA (TX), 1997 (Kaybonnet)	EC	0.056	60–75	4	14	grain	1.0 1.1	< LOD (2)	< 0.05 < LOD	P-3332 trial 15
USA (TX), 1997 (Cypress)	EC	0.056	70–80	4	14	grain	0.35 0.39	< LOD (2)	< LOD (2)	P-3332 trial 16
USA (CA), 1997 (M204)	EC	0.056	85–90	4	14	grain	0.49 0.48	< LOD (2)	< LOD (2)	P-3332 trial 17
USA (CA), 1997 (M202)	EC	0.056	85–90	4	14	grain	0.56 0.52	< LOD (2)	< LOD (2)	P-3332 trial 18
USA (CA), 1997 (M202)	EC	0.056	94	4	14	grain	0.40 0.32	< LOD (2)	< LOD (2)	P-3332 trial 19
USA (CA), 1997 (M204)	EW	0.056	85–90	4	14	grain	0.53 0.59	< LOD (2)	< LOD (2)	P-3332 trial 20
USA (CA), 1997 (M202)	EW	0.056	85–90	4	14	grain	0.57 0.56	< LOD (2)	< LOD (2)	P-3332 trial 21
USA (CA), 1997 (M202)	EW	0.056	94	4	14	grain	0.61 0.56	< LOD (2)	< LOD (2)	P-3332 trial 22

[a]Residues reported as undetected are listed as < LOD (limit of detection). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg. LOD rice grain zeta-cypermethrin 0.02 mg/kg, cis- and trans-DCVA 0.01 mg/kg.

Table 45 Zeta-cypermethrin residues in sugar cane resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

SUGAR CANE	Application				PHI	Commod[b]	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (FL), 1996 (CP80-1827)	EC	3×0.056 +0.067	165–185	4	20 20	stems burned stems	0.18 0.23 < 0.05 (2)	< 0.05 < LOD < LOD (2)	< 0.05 (2) < LOD (2)	RAN-0303 trial 01

SUGAR CANE	Application				PHI	Commod[b]	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (FL), 1996 (CL61-620)	EC	0.056	155–190	4	21 21	stems burned stems	0.26 < LOD	< 0.05 < LOD	< 0.05 < LOD	RAN-0303 trial 02
USA (FL), 1996 (CP78-1628)	EC	0.056	150–180	4	20 20	stems burned stems	0.10 0.07 < LOD (2)	< LOD (2) < LOD (2)	< LOD (2) < LOD (2)	RAN-0303 trial 03
USA (LA), 1996 (CP 321)	EC	0.056	155–175	4	21 21	stems burned stems	0.16 0.16 < 0.05 (2)	< LOD (2) < LOD (2)	< LOD < 0.05 < LOD < 0.05	RAN-0303 trial 04
USA (LA), 1996 (CP65-357)	EC	0.056	150	4	21 21	stems burned stems	0.51 0.30 0.16 0.17	< 0.05 < LOD < LOD (2)	< 0.05 (2) < LOD (2)	RAN-0303 trial 05
USA (LA), 1996 (CP 321)	EC	0.056	160–170	4	21 21	stems burned stems	0.13 0.11 < 0.05 0.05	< LOD (2) < LOD (2)	< LOD (2) < LOD (2)	RAN-0303 trial 06
USA (TX), 1996 (CP 321)	EC	0.056	95	4	21 21	stems burned stems	0.25 0.14 < LOD (2)	< LOD (2) < LOD (2)	< 0.05 < LOD < LOD (2)	RAN-0303 trial 07
USA (HI), 1996 (74-4527)	EC	0.056	190	4	21	stems	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0303 trial 08
USA (LA), 1995 (321)	EC	0.056	165–190	4	21	stems moisture 72–75%	< 0.05 0.09	< LOD (2)	< LOD (2)	RAN-0288

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Sugar cane with leaves is listed as 'stems'. For 'burned stems' the leaves were removed by burning or mechanical means.

Table 46 Zeta-cypermethrin residues in peanuts resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

PEANUTS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (GA), 2001 (Georgia Green)	EC	5×0.056 +1×0.28		90–100	6	7 7	kernel kernel (at process) meal oil	< LOD (4) < LOD (2) < LOD (2) < LOD (2)	P-3551 Trial 01
USA (GA), 2001 (AT201)	EC	0.056		90–100	6	7	kernel	< LOD (2)	P-3551 Trial 02
USA (AL), 2001 (Georgia Green)	EW	0.056		95	6	7	kernel	< LOD (2)	P-3551 Trial 03
USA (GA), 2001 (Georgia Green)	EW	0.056		95	6	2 7 12 17	kernel kernel kernel kernel	< LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3551 Trial 04
USA (AL), 2001 (Georgia Green)	EC	0.056		95	6	7	kernel	< LOD (2)	P-3551 Trial 05
USA (NC), 2001 (NVV11)	EW	0.056		95–100	6	7	kernel	< LOD (2)	P-3551 Trial 06
USA (SC), 2001 (Georgia Green)	EC	0.056		90	6	7	kernel	< LOD (2)	P-3551 Trial 07

PEANUTS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (VA), 2001 (VAC98R)	EW	0.056		95–100	6	7	kernel	< LOD (2)	P-3551 Trial 08
USA (FL), 2001 (Georgia Green)	EC	0.056		95	6	6	kernel	< LOD (2)	P-3551 Trial 09
USA (TX), 2001 (Okrun)	EW	0.056		95	6	7	kernel	< LOD (2)	P-3551 Trial 10
USA (OK), 2001 (Tamspan)	EC	0.056		95	6	7	kernel	< LOD (2)	P-3551 Trial 11
USA (TX), 2001 (GK7)	EW	0.056		90–100	6	8	kernel	< LOD (2)	P-3551 Trial 12

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 47 Zeta-cypermethrin residues in rapeseed resulting from supervised trials with zeta-cypermethrin in the UK and Germany. Replicate values arise from replicate plots or replicate field samples

RAPESEED	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Germany, 1992	EW	0.01		400	1	56	rapeseed	< 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992	EW	0.01		400	1	0 21 35	shoot shoot pod	0.10 < 0.01 < 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992	EW	0.01		400	1	0 21 32	shoot shoot pod	0.14 0.01 0.01 < 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992	EW	0.01		400	1	48	rapeseed	< 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992	EW	0.01		400	1	0 21 35	shoot shoot pod	0.20 0.02 < 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992 (Ceres)	EW	0.01		400	1	56	rapeseed	< 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992 (Ceres)	EW	0.01		400	1	0 21 35	shoot shoot pod	0.10 < 0.01 < 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992 (Ceres)	EW	0.01		400	1	48	rapeseed	< 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992 (Ceres)	EW	0.01		400	1	0 21 35	shoot shoot pod	0.20 0.02 < 0.01 (2)	95120/92, I 92 RP 08
Germany, 1992 (Falcon)	EW	0.01		400	1	0 21 32	shoot shoot pod	0.14 0.01 0.01 < 0.01 (2)	95120/92, I 92 RP 08
UK, 1994 (Dublo)	EW	0.01	0.003	300	2	51	rapeseed	< LOD	AG-95-0181
UK, 1994 (Dublo)	EW	0.01	0.003	300	2	0 29 42	head with pods head with pods head with pods	0.40 0.03 0.03	AG-95-0181

RAPESEED	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
UK, 1994 (Falcon)	EW	0.01	0.003	300	2	0 29 42	head with pods head with pods head with pods	0.35 < LOD < LOD	AG-95-0181
UK, 1994 (Falcon)	EW	0.01	0.003	300	2	50	rapeseed	< LOD	AG-95-0181

[a]Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 48 Zeta-cypermethrin residues in cotton seed resulting from supervised trials with zeta-cypermethrin in Brazil and Spain. Replicate values arise from replicate plots or replicate field samples

COTTON SEED	Application					PHI	Commodity	Residue, mg/kg	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Brazil (SP), 1994 (IAC 20)	EW	0.029		500	1	0 10 15	cotton seed cotton seed cotton seed	0.02 < 0.02 < 0.02	DB-COT-01[a]
Brazil (SP), 1994 (IAC 20)	EW	0.058		500	1	0 10 15	cotton seed cotton seed cotton seed	0.05 < 0.02 < 0.02	DB-COT-01[a]
Brazil (SP), 1994 (IAC 20)	EW	0.029		500	1	0 10 15	cotton seed cotton seed cotton seed	0.03 < 0.02 < 0.02	DB-COT-02[a]
Brazil (SP), 1994 (IAC 20)	EW	0.058		500	1	0 10 15	cotton seed cotton seed cotton seed	0.05 < 0.02 < 0.02	DB-COT-02[a]
Brazil (SP), 1992 (IAC 20)	EW	0.025		330	3	15 30	cotton seed cotton seed	< 0.05 (2) < 0.05 (2)	DB-COT-03[a]
Brazil (SP), 1992 (IAC 20)	EW	0.05		330	3	15 30	cotton seed cotton seed	< 0.05 (2) < 0.05 (2)	DB-COT-03[a]
Brazil (SP), 1997 (IAC 22)	EC	0.04 0.05 0.10			1 1 1	0 7 15 0 7 15 0 7 15	cotton seed cotton seed cotton seed cotton seed cotton seed cotton seed cotton seed cotton seed cotton seed	< 0.02 < 0.02 < 0.02 < 0.02 < 0.02 < 0.02 < 0.02 < 0.02 < 0.02	2256/97[a]
Brazil, 1998 (Delta Pine)	EC	0.05 0.10		200	1 1	0 7 15 0 7 15	cotton seed cotton seed cotton seed cotton seed cotton seed cotton seed	< 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	2453/98[a]
Brazil, 1998 (Delta Pine Acala 90)	EC	0.05 0.10		200	1 1	0 7 15 0 7 15	cotton seed cotton seed cotton seed cotton seed cotton seed cotton seed	< 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	2454/98[a]

COTTON SEED	Application					PHI	Commodity	Residue, mg/kg	Ref
country, year (variety)	Form	kg ai/ha	kg ai/ hL	water (L/ha)	no.	days		zeta	
Brazil, 1998 (IAC-22)	EC	0.04		200	1	0	cotton seed	< 0.02 (2)	2274/97[a]
						7	cotton seed	< 0.02 (2)	
						15	cotton seed	< 0.02 (2)	
		0.05			1	0	cotton seed	< 0.02 (2)	
						7	cotton seed	< 0.02 (2)	
						15	cotton seed	< 0.02 (2)	
		0.10			1	0	cotton seed	< 0.02 (2)	
						7	cotton seed	< 0.02 (2)	
						15	cotton seed	< 0.02 (2)	
Spain, 1995 (Akala)	EW	0.04	0.01	400	2	90	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/117
Spain, 1995 (Akala)	EC	0.04	0.01	400	2	90	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/117
Spain, 1995 (Akala)	EW	0.04	0.01	400	2	90	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/118
Spain, 1995 (Akala)	EC	0.04	0.01	400	2	90	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/118
Spain, 1995 (Akala)	EW	0.04	0.01	400	2	89	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/119
Spain, 1995 (Akala)	EC	0.04	0.01	400	2	89	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/119
Spain, 1995 (Akala)	EW	0.04	0.01	400	2	89	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/120
Spain, 1995 (Akala)	EC	0.04	0.01	400	2	89	cotton seed	< 0.05	A-17-96-08 Trial A/SP/I/95/120

[a] No field report. Summary of field information provided.

Table 49 Zeta-cypermethrin residues in coffee resulting from supervised trials with zeta-cypermethrin in coffee. Replicate values arise from replicate plots or replicate field samples

COFFEE	Application					PHI	Commodity[b]	Residue, mg/kg	Ref
country, year (variety)	Form	kg ai/ha	kg ai/ hL	water (L/ha)	no.	days		zeta	
Brazil, 1998 (Arabica)	EC	0.02			1	0	coffee beans	< 0.05	2507/98[a]
						10	coffee beans	< 0.05	
						15	coffee beans	< 0.05	
		0.04			1	0	coffee beans	< 0.05	
						10	coffee beans	< 0.05	
						15	coffee beans	< 0.05	
Brazil, 1999 (Arabica)	EC	0.02			1	0	coffee beans	< 0.05	2759/99[a]
		0.04			1	0	coffee beans	< 0.05	

COFFEE	Application					PHI	Commodity[b]	Residue, mg/kg	Ref
country, year (variety)	Form	kg ai/ha	kg ai/ hL	water (L/ha)	no.	days		zeta	
Brazil, 1991 (New World)	EW	0.007 0.014			1 1	15 30 15 30	coffee beans coffee beans coffee beans coffee beans	< 0.05 < 0.05 < 0.05 < 0.05	DB-COFFEE-1 Trial 1[a]
Brazil, 1991 (New World)	EW	0.007 0.014			1 1	15 30 15 30	coffee beans coffee beans coffee beans coffee beans	< 0.05 < 0.05 < 0.05 < 0.05	DB-COFFEE-1 Trial 2[a]
Brazil, 1985	EC	0.01 0.02			3 3	5 12 31 5 12 31	coffee beans coffee beans coffee beans coffee beans coffee beans coffee beans	< 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	DB-COFFEE-2[a]

[a] No field report. Summary of field information provided.

[b] Coffee cherries were harvested and delivered to the laboratory. The cherries were placed in the sun to dry (e.g., for 12–20 days) after which the hulls were removed to leave the 'coffee bean' or seed.

Table 50 Zeta-cypermethrin residues in alfalfa hay and forage resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples

ALFALFA	Application				cut	PHI	Commod	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.		days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1993 (CUF 101)	EC	0.056	94	1 +1 +1	1 2 3	3 3 3	forage forage forage	2.8 3.5 2.5 1.7 1.3 1.5	< 0.05 (2) 0.12 0.06 0.09 0.13	0.11 0.15 0.50 0.20 0.29 0.36	< 0.05 (2) 0.08 0.05 0.07 0.09	P-2961 Trial 01
USA (CA), 1993 (CUF 101)	EC	0.056	94	1 +1 +1	1 2 3	3 3 3	hay hay hay	9.5 11 7.0 8.9 6.2 7.1	0.05 0.07 0.21 0.26 0.30 0.39	<LOD <0.05 0.16 0.34 0.18 0.20	0.11 0.11 0.18 0.26 0.26 0.24	P-2961 Trial 01
USA (CA), 1993 (CUF 101)	EW	0.056	94	1 +1 +1	1 2 3	3 3 3	forage forage forage	4.5 2.4 3.0 3.8 2.0 2.1	< 0.05 < LOD 0.05 < 0.05 0.06 0.05	0.05 < 0.05 0.18 0.14 0.18 0.14	< 0.05 (2) 0.05 < 0.05 0.05 0.05	P-2961 Trial 02
USA (CA), 1993 (CUF 101)	EW	0.056	94	1 +1 +1	1 2 3	3 3 3	hay hay hay	10 12 12 14 6.1 6.3	< 0.05 (2) 0.14 0.19 0.14 0.17	< 0.05 0.16 0.09 0.05 0.72 0.62	0.08 0.07 0.16 0.11 0.10 0.09	P-2961 Trial 02
USA (KS), 1993 (Northrup King)	EC	0.056	94	1 +1 +1	1 2 3	3 3 3	forage forage forage	1.2 2.3 1.0 0.96 1.8 2.2	< 0.05 (2) 0.09 0.08 0.05 < 0.05	0.08 0.10 0.25 0.21 0.18 0.16	< 0.05 (2) 0.06 0.05 < 0.05 (2)	P-2961 Trial 03
USA (KS), 1993 (Northrup King)	EC	0.056	94	1 +1 +1	1 2 3	3 3 3	hay hay hay	5.1 4.8 2.6 2.9 8.2 7.9	< 0.05 (2) < 0.05 (2) < 0.05 (2)	0.25 0.24 0.68 0.72 0.67 0.65	0.08 0.07 0.26 0.36 0.09 0.10	P-2961 Trial 03
USA (KS), 1993 (Northrup King)	EW	0.056	94	1 +1 +1	1 2 3	3 3 3	forage forage forage	2.8 2.5 1.2 1.5 2.6 2.8	< 0.05 (2) < 0.05 (2) < 0.05 (2)	< 0.05 0.05 0.10 0.10 0.07 0.08	< 0.05 (2) < 0.05 (2) < 0.05 (2)	P-2961 Trial 04
USA (KS), 1993 (Northrup King)	EW	0.056	94	1 +1 +1	1 2 3	3 3 3	hay hay hay	5.9 5.7 3.4 3.5 9.5 9.4	< 0.05 (2) 0.18 0.18 0.07 < 0.05	0.11 0.08 0.46 0.46 0.23 0.14	0.07 0.05 0.29 0.31 0.08 0.05	P-2961 Trial 04
USA (WI), 1993 (WL312)	EC	0.056	94	1 +1 +1	1 2 3	3 3 3	forage forage forage	2.8 2.2 6.3 11 5.4 3.6	0.09 0.06 0.16 0.23 < 0.05 < LOD	0.27 0.18 0.45 0.67 < 0.05 (2)	< 0.05 (2) 0.10 0.14 < 0.05 (2)	P-2961 Trial 05

ALFALFA	Application				cut	PHI	Commod	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.		days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (WI), 1993 (WL312)	EC	0.056	94	1 +1 +1	1 2 3 2	3 3 3	hay hay hay hay	4.1 2.5 18 13 1.2 2.0	0.26 0.16 0.52 0.51 < 0.05 0.06 c 0.09	0.93 0.55 1.3 1.3 0.07 0.13 c 0.19	0.89 0.20 0.21 0.23 < 0.05 0.06 c 0.05	P-2961 Trial 05
USA (WI), 1993 (WL312)	EW	0.056	94	1 +1 +1	1 2 3	3 3 3	forage forage forage	2.4 1.2 3.1 2.2 3.8 0.37	0.10 0.07 0.39 0.26 < LOD (2)	0.24 0.16 0.93 0.63 < 0.05 < LOD	< 0.05 (2) 0.19 0.14 < 0.05 < LOD	P-2961 Trial 06
USA (WI), 1993 (WL312)	EW	0.056	94	1 +1 +1	1 2 3	3 3 3	hay hay hay	6.5 9.0 2.4 2.9 2.0 1.4	0.34 0.40 0.49 0.39 < 0.05 (2)	0.87 1.3 1.1 0.89 0.12 0.11	0.73 1.1 0.22 0.18 0.07 0.05	P-2961 Trial 06

[a]Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 51 Zeta-cypermethrin residues in pea fodder and forage resulting from supervised trials with zeta-cypermethrin in France and Italy. Relates to Table 33

PEA FODDER AND FORAGE	Application					PHI	Commodity[b]	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2001 (Austin)	EW	0.014	0.0046	310	2	0 1 3 7 22	haulms haulms haulms haulms straw	0.11 0.12 0.16 0.08 0.39	20011151/E1-FPPS
France, 2001 (Innovert)	EW	0.014	0.0046	310	2	7 30	haulms straw	0.04 0.10	20011151/E1-FPPS
France, 2002 (Baccara)	EW	0.015	0.0038	400	2	0 1 3 7 10 21	haulms haulms haulms haulms haulms straw	0.12 0.09 0.06 0.03 0.04 0.17	20021160/E1-FPPS
France, 2002 (Sydne)	EW	0.015	0.0038	410	2	14	straw	1.0	20021160/E1-FPPS
Italy, 2001 (Regina)	EW	0.014	0.0035	420	2	7	straw	< 0.02	20011151/E1-FPPS
Italy, 2001 (Resal)	EW	0.014	0.0035	410	2	7	straw	0.30	20011151/E1-FPPS
Italy, 2002 (Regina)	EW	0.015	0.0037	405	2	14	straw	< 0.05	20021160/E1-FPPS
Italy, 2002 (Resal)	EW	0.015	0.0038	405	2	7 14	haulms straw	0.03 < LOD	20021160/E1-FPPS
UK, 1994 (Sancho) vining peas	EW	0.015		200	2	0 5 7 11	haulm haulm haulm haulm	0.66 0.64 0.34 0.11	AG-95-0180 FD 6681
UK, 1994 (Scout) vining peas	EW	0.015		200	2	0 5 7 15	haulm haulm haulm haulm	0.99 0.66 0.60 0.57	AG-95-0180 FD 6657

PEA FODDER AND FORAGE	Application					PHI	Commodity[b]	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
UK, 1996 (Kalomo) vining peas	EW	0.015		300	2	12	haulms	0.33	AG-96-0224 FD 6733
UK, 1996 (Tacoma) vining peas	EW	0.015		300	2	12	haulm	0.50	AG-96-0224 FD 6732
UK, 1999 (Bikini) vining pea, Meigle	EW	0.015		200	2	14	haulm	0.41	17787
UK, 1999 (Bikini) vining pea, Milton of Collace	EW	0.015		200	2	14	haulm	0.19	17787
UK, 2000 (Espace)	EW	0.016		300	2	14	straw	0.28	EU-GLP/219 GB/00/PS-BN-1
UK, 2000 (Espace)	EW	0.017		310	2	14	straw	0.22	EU-GLP/219 GB/00/PS-BN-3
UK, 2000 (Eyel)	EW	0.016		290	2	14	straw	0.13	EU-GLP/219 GB/00/PS-BN-2

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.03 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Haulm: dried plant without pod.

Table 52 Zeta-cypermethrin residues in field bean fodder and forage resulting from supervised trials with zeta-cypermethrin in the UK. Replicate values arise from replicate plots or replicate field samples. Relates to Table 34

BEAN FODDER AND FORAGE	Application					PHI	Commodity[a]	Residue, mg/kg[b]	Ref
country, year (variety)	Form	kg ai/ ha	kg ai/ hL	water (L/ha)	no.	days		zeta	
UK, 1999 (Punch) winter beans	EW	0.017		200	2	14	haulm	0.30	BKA-656-99-RES
UK, 1999 (Victor) spring beans	EW	0.017		200	2	14	haulm	0.69 c 0.10	BKA-656-99-RES
UK, 2000 (Klipper) winter beans	EW	0.017		300	2	13	straw	0.26	EU-GLP/219 GB/00/PS-BN-4
UK, 2000 (Piccadilly) spring beans	EW	0.017		310	2	14	straw	0.13	EU-GLP/219 GB/00/PS-BN-5
UK, 2000 (Mars) spring beans	EW	0.016		290	2	14	straw	0.47	EU-GLP/219 GB/00/PS-BN-6

[a] Haulm: dried plant without pod.

[b] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 53 Zeta-cypermethrin residues in barley fodder and forage resulting from supervised trials with zeta-cypermethrin in France, Germany, Italy, Spain and the UK. Replicate values arise from replicate plots or replicate field samples. Relates to Table 41

BARLEY FODDER AND FORAGE	Application					PHI[b]	Commodity	Residue, mg/kg[a c]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2001 (Express) winter barley	EW	0.015	0.0047	320	2	31	straw	0.17	20011151/F1-FPCE F01N043R
France, 2001 (Intro) winter barley	EW	0.014	0.0047	300–310	2	0 8 15 21 30	plant plant plant plant straw	0.15 0.14 0.14 0.15 0.13	20011151/F1-FPCE F01N042R
France, 2002 (Intro) winter barley	EW	0.016	0.0037	420–440	2	35	straw	0.08	20021160/E1-FPWC F02N022R
Germany, 1992 (Erfa) winter barley	EW	0.010		400	1	0 35 64	plant plant straw	0.23 0.03 0.02 0.06 0.06	94083/92
Germany, 1992 (Gaulois) winter barley	EW	0.010		400	1	0 35 45 45	plant plant straw straw	0.24 0.21 0.11 0.11 < 0.01 (3) c0.05 c0.06	94083/92
Germany, 1993 (Magie) winter barley	EW	0.015		400	2	0 20 35 49	plant plant straw straw	0.33 0.20 0.20 0.19	14055/93 C-13 WW-WG No 8
Germany, 1993 (Magie) winter barley	EW	0.015		400	2	0 22 34 53	plant plant straw straw	0.29 0.10 0.14 0.09	14055/93 C-13 WW-WG No 9
Germany, 1993 (Noveta) winter barley	EW	0.015		400	2	0 23 36 52	plant plant straw straw	0.75 0.17 0.18 0.19	14055/93 C-13 WW-WG No 5
Germany, 1993 (Venus) winter barley	EW	0.015		400	2	0 21 35 53	plant plant straw straw	0.33 0.25 0.52 0.42 c0.01	14055/93 C-13 WW-WG No 3
Italy, 2002 (Rondo) spring barley	EW	0.015	0.0038	390–410	2	0 14 21 28 34	plants plants plants plants straw	0.08 0.02 < 0.02 0.03 < 0.05	20021160/E1-FPSC I02N008R
Italy, 2002 (Sonora) winter barley	EW	0.015	0.0037	410	2	0 13 27 34 41	plants plants plants straw straw	0.11 < 0.02 0.03 < 0.05 < 0.05	20021160/E1-FPWC I02N006R
Spain, 2002 (Albacete) spring barley	EW	0.015	0.0075	190–210	2	0 15 22 27 34	plants plants plants plants straw	0.46 0.43 0.23 0.59 0.67	20021160/E1-FPSC S02N003R

BARLEY FODDER AND FORAGE	Application					PHI[b]	Commodity	Residue, mg/kg[a c]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
UK, 1994 (Pipkin) winter barley	EW	0.015	0.005	300	2	0 33	plant straw	1.4 2.1	AG-95-0183
UK, 1994 (Puffin) winter barley	EW	0.015	0.005	300	2	0 14 21 29	plant plant stems straw	0.94 2.6dw 1.2 2.3dw 1.5 2.4dw 1.8 2.1dw	AG-95-0183
UK, 1999 (Melanie) winter barley	EW	0.017	0.0088	200	2	45	straw	0.32	17788
UK, 1999 (Melanie) winter barley	EW	0.017	0.0087	200	2	53	straw	0.25	17788

[a]US trials. Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b]Note that PHI for hay may include the interval between cutting and sampling, e.g., 3 days drying in the field.

[c]dw: expressed on dry weight

Table 54 Zeta-cypermethrin residues in sweet corn fodder and forage resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 27

SWEET CORN FORAGE, FODDER	Application				PHI	Commod[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (FL), 1993 (Super Sweet 7210)	EW	0.056	420	6	3 3	husks stalks	0.12 0.11 1.2 1.3	< 0.06 (2) < 0.1 (2)	< 0.06 (2) 0.14 0.18	< 0.06 (2) < 0.1 (2)	P-2923 trial 01
USA (CA), 1993 (Sweety 80-82)	EW	2 × 0.11 +4 × 0.056	190	2 +4	3 3	husks stalks	0.63 0.62 5.1 7.6	< 0.06 (2) 0.17 0.14	< 0.06 (2) 0.39 0.33	< 0.06 (2) 0.21 0.20	P-2923 trial 02
USA (MN), 1993 (Crisp & Sweet 710)	EW	0.056	190	6	3 3	husks stalks	0.68 0.72 12 4.1 c0.62	< 0.06 (2) 0.97 0.47	< 0.06 (2) 2.2 1.1	< 0.06 (2) 0.70 0.28	P-2923 trial 03
USA (WI), 1999 (Kandy King)	EC	0.056	180–190	6	3 40	forage stover	1.7 1.6 1.5 1.1	0.09 0.08 0.09 0.06	0.20 0.19 0.18 0.14		P-3421 trial 01
USA (WA), 1999 (Legend)	EW	0.056	190	6	3 3	forage stover	2.9 3.6 1.5 3.3	0.09 0.06 < 0.05 0.05	0.18 0.12 0.05 0.12		P-3421 trial 02
USA (CA), 1994 (Sweet Treat)	EC	0.056	190	6	3 30	forage fodder	4.3 4.7	0.05 0.20	0.10 0.51	0.10 0.40	RC-0050 trial 02
USA (MN), 1994 (Code 40)	EC	0.056	190	6	3 80	forage fodder	2.9 1.7	< 0.05 0.07	0.06 0.14	< 0.05 0.06	RC-0050 trial 03
USA (PA), 1995 (Stars-N-Stripes)	EC	0.056	190	6	3 49	forage 85 fodder 57	0.83 0.84 < 0.5 (2)	< 0.05 (2) 0.05 < 0.05	< 0.05 (2) 0.14 0.07	< 0.05 0.05 0.10 0.05	RC-0054 trial 01
USA (FL), 1995 (Super Sweet 7210)	EC	0.056	190	6	3	forage	0.77 0.59	< LOD (2)	< 0.05 (2)	< LOD (2)	RC-0054 trial 02

SWEET CORN FORAGE, FODDER	Application				PHI	Commod[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (FL), 1995 (Abbott & Cobb 7630)	EC	0.056	190	6	3 45	forage fodder	1.3 0.82 < 0.1 (2)	< LOD (2) < LOD (2)	< 0.05 < LOD < LOD (2)	< 0.05 (2) < 0.05 (2)	RC-0054 trial 03

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Commodities with % moisture where available.

Table 55 Zeta-cypermethrin residues in maize fodder and forage resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 38

MAIZE FODDER FORAGE	Application				PHI	Commod[b]	Residues, mg/kg[a]				Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.[d]	days		zeta	cis-DCVA	trans-DCVA	MPB	
USA (CA), 1994 (Pioneer 3183)	EW	0.056	94	2 2 4	33 59 30	plant forage 71 stover 14	< 0.05 (2) < LOD (2) 0.98 1.5	< LOD (2) < LOD (2) < LOD < 0.05	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD (2) 0.09 0.13	RC-0052 Trial 01
USA (CO), 1994 (Pioneer 8751)	EW	0.056	[c]	2 2 4	16 51 30	plant forage stover	0.05 0.05 < LOD (2) 1.3 0.89	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD (2) 0.05 0.06	< LOD (2) < LOD (2) 0.05 < 0.05	RC-0052 Trial 02
USA (NE), 1994 (Jacques 7770)	EW	0.056	[c]	2 2 4	35 56 30	plant forage 67 stover 68	< 0.05 (2) < LOD (2) < LOD < 0.5	< LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2)	RC-0052 Trial 03
USA (IA), 1994 (Pioneer 3394)	EW	0.056	94	2 2 4	24 69 30	plant forage stover	< LOD < 0.05 < LOD (2) 0.85 0.95	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD (2) < 0.05 (2)	RC-0052 Trial 04
USA (MN), 1994 (Dekalb 291)	EW	0.056	95	2 4	62 30	forage stover	< 0.05 (2) 2.0 2.4	< LOD (2) < 0.05 (2)	< 0.05 (2) 0.10 0.09	< 0.05 < LOD 0.07 0.09	RC-0052 Trial 05
USA (TX), 1994 (NC+ 7117)	EW	0.056	480 +100 +130 +120	2 2 4	27 65 30	plant forage stover	0.06 < 0.05 < 0.1 (2) 0.60 0.64	< LOD (2) < LOD (2) < 0.05 (2)	< 0.05 < LOD < LOD (2) 0.05 0.06	< 0.05 < LOD < LOD (2) < 0.05	RC-0052 Trial 06
USA (GA), 1994 (Pioneer 3320)	EW	0.056	25 +100 +100 +100	2 2 4	27 48 29	plant forage 75 stover 47	< LOD (2) < LOD (2) 1.1 0.95	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD < 0.05 < 0.05 (2)	< LOD (2) < LOD (2) < 0.05 (2)	RC-0052 Trial 07
USA (OH), 1994 (GL 262)	EW	0.056	90–105	2 2 4	19 56 30	plant forage stover	< 0.05 0.05 < LOD (2) 1.5 1.0	< LOD (2) < LOD (2) < LOD < 0.05	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD (2) < 0.05 (2)	RC-0052 Trial 08
USA (IL), 1994 (Pioneer 3245)	EW	1×0.56 +3×0.056	100–110	2 2 4	20 48 30	plant forage 67 stover 27	0.16 0.11 < 0.1 (2) 3.0 2.5	< 0.05 < LOD < 0.05 < LOD < 0.05 (2)	< 0.05 (2) < 0.05 (2) 0.07 0.05	< 0.05 (2) < 0.05 (2) < 0.05 (2)	RC-0052 Trial 09

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg. Exceptions: cypermethrin LOD in plant and forage 0.02 mg/kg and stover 0.1 mg/kg.

[b] Commodities and % moisture, where measured.

[c] Application by chemigation, overhead sprinkler.

[d] Except for trials 2 and 3 (chemigation), the first application was a band application during seedling emergence and the remaining three were foliar applications.

Table 56 Zeta-cypermethrin residues in maize fodder and forage resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 39

MAIZE FODDER FORAGE	Application				PHI	Commod[b]	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (SD), 1996 (Dekalb DK401)	EC	0.056	94	4	30	stover 43	1.9 1.8	< LOD (2)	< 0.05 (2)	RAN-0305 Trial 01
USA (MO), 1996 (Northrup King NK7070)	EC	0.056	90–95	4 2	30 59	stover 54 forage 74	< 0.05 (2) < 0.05 < LOD	< 0.05 (2) < LOD (2)	< 0.05 (2) < LOD (2)	RAN-0305 Trial 02
USA (WI), 1996 (Renk RK714)	EC	0.056	95–100	4 2	30 68	stover 71 forage 69	0.96 2.4 < LOD (2)	< LOD (2) < LOD (2)	< LOD < 0.05 < LOD (2)	RAN-0305 Trial 03
USA (MN), 1996 (Cargill 809)	EC	0.056	100	4 2	30 64	stover 42 forage 68	2.4 0.97 < LOD (2)	< LOD (2) < LOD (2)	< 0.05 (2) < LOD (2)	RAN-0305 Trial 05
USA (OH), 1996 (Madison GL226)	EC	0.056	90–95	4 2	29 50	stover 57 forage 64	0.73 0.77 < LOD (2)	< LOD (2) < LOD (2)	< 0.05 (2) < LOD (2)	RAN-0305 Trial 06
USA (IL), 1996 (Pioneer 3394)	EC	0.056	90–97	4 2	30 64	stover 54 forage 78	1.4 1.3 < LOD (2)	< 0.05 (2) < LOD (2)	< 0.05 (2) < LOD (2)	RAN-0305 Trial 07
USA (NE), 1996 (Pioneer 3394)	EC	0.056	94	4 2	30 62	stover 59 forage 69	1.7 1.2 < LOD < 0.05	< 0.05 (2) < LOD (2)	0.06 0.05 < LOD (2)	RAN-0305 Trial 08
USA (IA), 1996 (Pioneer 3279)	EC	0.056	90–100	4 2	30 63	stover 65 forage 71	1.2 1.1 < LOD (2)	< 0.05 (2) < LOD (2)	< 0.05 (2) < LOD (2)	RAN-0305 Trial 09
USA (PA), 1995 (Pioneer 3769)	EC	0.056	90–100	2 2 4	11 41 30	plant 79 forage 64 stover 62	0.30 0.36 < 0.05 (2) 0.73 0.65	< LOD (2) < LOD < 0.05 < 0.05 (2)	< 0.05 (2) < 0.05 (2) 0.07 < 0.05	RAN-0292 Trial 01
USA (IA), 1995 (Patriot 6155)	EC	0.056	95	2 2 4	22 52 30	plant 80 forage 67 stover 52	0.06 < LOD < LOD < 0.05 0.91 0.77	< 0.05 < LOD < LOD (2) < LOD (2)	0.11 < 0.05 < 0.05 < LOD < 0.05 (2)	RAN-0292 Trial 02
USA (IL), 1995 (Pioneer 3394)	EC	0.056	95–100	2 2 4	20 40 30	plant 79 forage 67 stover 21	0.11 < 0.05 < LOD (2) 1.4 1.7	< LOD (2) < LOD (2) < 0.05 (2)	< 0.05 (2) < LOD (2) < 0.05 (2)	RAN-0292 Trial 03
USA (NE), 1995 (Pioneer 3489)	EC	0.056	94	2 3 4	19 2 30	plant 82 forage 72 stover 42	0.17 0.10 0.52 0.50 1.6 1.7	< 0.05 (2) < LOD (2) < 0.05 (2)	< 0.05 (2) < LOD (2) 0.07 0.06	RAN-0292 Trial 04
USA (IN), 1995 (Pioneer 3394)	EC	0.056	95–100	2 2 4	24 60 30	plant 81 forage 59 stover 31	0.07 0.05 < 0.05 (2) 1.4 1.8	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD (2) < 0.05 0.06	RAN-0292 Trial 05
USA (TX), 1995 (DK 668)	EC	0.056	80–110	2 3 4	27 3 30	plant 80 forage 69 stover 27	< LOD (2) 0.26 0.60 0.49 0.55	< LOD (2) < LOD (2) < 0.05 (2)	< LOD (2) < LOD (2) < 0.05 (2)	RAN-0292 Trial 06

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Commodities with % moisture.

Table 57 Zeta-cypermethrin residues in maize fodder and forage resulting from supervised trials with zeta-cypermethrin in France, Germany and the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 40

MAIZE FODDER FORAGE	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 1994 (DK 240)	EW	0.030		400	1	0 6 14 28 42 61	fodder fodder fodder fodder fodder silage	0.47 0.28 0.09 0.05 < 0.05 < 0.05	A-17-94-05 Trial KJ93
France, 1994 (DK 300)	EW	0.030		400	1	48	silage	< 0.05	A-17-94-05 Trial LA12
France, 1994 (Furio)	EW	0.030		400	1	0 7 14 28 42 35	fodder fodder fodder fodder fodder silage	1.0 0.44 0.22 0.12 0.10 < 0.05	A-17-94-05 Trial AC15
France, 1994 (Volga)	EW	0.030		600	1	25 45	fodder silage	< 0.05 < 0.05	A-17-94-05 Trial LD81
France, 1995 (Cecilia)	EW	0.03	0.0075	400	1	21 38	cob (milky) cobs, silage	< 0.05 < 0.05	A-17-96-11
France, 1995 (Cesar)	EW	0.03	0.0075	400	1	31 50	cob (milky) cobs, silage	< 0.05 < 0.05	A-17-96-11
France, 1995 (Furio)	EW	0.03	0.0075	400	1	22 39	cob (milky) cobs, silage	< 0.05 < 0.05	A-17-96-11
France, 1995 (Pactol)	EW	0.03	0.0075	400	1	28 56	cob (milky) cobs, silage	< 0.05 < 0.05	A-17-96-11
France, 1995 (Raphaela)	EW	0.03	0.0078	380	1	30 57	cob (milky) cobs, silage	< 0.05 < 0.05	A-17-96-10
France, 1995 (Volga)	EW	0.03	0.0078	380	1	30 57	cob (milky) cobs, silage	< 0.05 < 0.05	A-17-96-10
France, 1996 (Alvina)	EW	0.03	0.075	400	1	29 58	cob (milky) cobs, silage	< 0.05 < 0.05	A-17-96-23 1MB96R01M
France, 1996 (Cecilia)	EW	0.03	0.075	400	1	36 65	cob (milky) cob (silage)	< 0.05 < 0.05	A-17-96-23 2MB96R01M
France, 1996 (Magdalena)	EW	0.03	0.075	400	1	30 64	cob (milky) cob (silage)	< 0.05 < 0.05	A-17-96-23 4MB96R01M
France, 1996 (Volga)	EW	0.03	0.075	400	1	37 66	cob (milky) cob (silage)	< 0.05 0.10	A-17-96-23 3MB96R01M
France, 2002 (DK 312)	EW	0.038	0.0094	400	1	0 52	plants plants (cobs removed)	0.37 < 0.02	20021160/F1-FPMA F02N019R
France, 2002 (DK 312)	EW	0.035	0.0094	380	1	0 54	plants plants (cobs removed)	0.42 0.02	20021160/F1-FPMA F02N020R
Germany, 2001 (Banguy)	EW	0.035	0.0087	400	1	0 50	plants plants (cobs removed)	0.30 0.03	20011151/G1-FPMA G01N046R
Germany, 2001 (Büko)	EW	0.038	0.0089	430	1	0 51	plants plants (cobs removed)	0.36 0.03	20011151/G1-FPMA G01N045R

MAIZE FODDER FORAGE	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (IL), 2002 (Pioneer 37H24)	EC	0.056		22 +94 +102 +94	4	1 7 14 21	maize forage	0.51 0.64 0.49 0.57 0.27 0.27 0.25 0.23	P-3630 trial 1
USA (IL), 2002 (Pioneer 37H24)	EC	0.056		22 +94 +102 +94	4	1 7 14 21	maize stover	0.48 0.68 0.54 0.92 0.86 0.74 0.70 0.77	P-3630 trial 1
USA (NE), 2002 (Pioneer 33B50)	EW	0.056		94	4	1 7 14 21	maize forage	0.83 0.70 0.73 0.76 0.46 0.36 0.24 0.27	P-3630 trial 2
USA (NE), 2002 (Pioneer 33B50)	EW	0.056		94	4	1 7 14 21	maize stover	0.32 0.35 0.54 0.42 0.73 0.59 0.88 0.70	P-3630 trial 2

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 58 Zeta-cypermethrin residues in oats and triticale straw resulting from supervised trials with zeta-cypermethrin in Europe. Relates to Table 43

OATS, TRITICALE STRAW	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2002 (Zeus) triticale	EW	0.015	0.0038	390, 410	2	28	straw	0.28	20021160/E1-FPOT
Italy, 2002 (Rokorotta) oats	EW	0.015	0.0050	310	2	35	straw	0.18	20021160/E1-FPOT
Spain, 2002 (Prevision) oats	EW	0.015	0.0075	200	2	35	straw	0.39	20021160/E1-FPOT
Spain, 2002 (Galgo) triticale	EW	0.015	0.0075	200	2	35	straw	< 0.05	20021160/E1-FPOT

Table 59 Zeta-cypermethrin residues in wheat fodder and forage resulting from supervised trials with zeta-cypermethrin in France, Germany, Italy, Spain, the UK and the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 42

WHEAT FODDER AND FORAGE	Application					PHI[c]	Commodity[b]	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2001 (Brindur) winter wheat	EW	0.014	0.0045	310	2	35	straw	0.08	20011151/F1-FPCE F01N045R
France, 2001 (Nefer) winter wheat	EW	0.014	0.0047	300	2	0 7 13 22 31	plant plant plant plant straw	0.17 0.12 0.08 0.11 0.27	20011151/F1-FPCE F01N044R

WHEAT FODDER AND FORAGE	Application					PHI[c]	Commodity[b]	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
France, 2002 (Soisson) winter wheat	EW	0.015	0.0037	410	2	42	straw	0.12	20021160/E1-FPWC F02N021R
Germany, 1992 (Asteron) winter wheat	EW	0.010		400	1	0 28 35	plant straw straw	0.34 0.67 0.70 0.70 0.68	94083/92
Germany, 1992 (Borenos) winter wheat	EW	0.010		400	1	0 28 35 49	plant straw straw straw	0.44 0.30 0.29 0.28 0.29 0.29	94083/92
Germany, 1992 (Consul) winter wheat	EW	0.010		400	1	0 35 72	plant plant straw	0.22 0.02 0.02 0.04 0.04	94083/92
Germany, 1992 (Consul) winter wheat	EW	0.010		400	1	0 28 35	plant straw straw	0.15 0.06 0.07 0.16 0.19	94083/92
Germany, 1992 (Orestis) winter wheat	EW	0.010		400	1	0 35 71	plant plant straw	0.30 0.085 0.09 0.095 0.10	94083/92
Germany, 1992 (Orestis) winter wheat	EW	0.010		400	1	0 40 46	plant straw straw	0.35 0.91 0.90 0.67 0.60	94083/92
Germany, 1993 (Orestis) winter wheat	EW	0.015		400	2	0 21 35 72	plant plant straw straw	0.38 0.22 0.12 0.10	14055/93 C-13 WW-WG No 1
Germany, 1993 (Orestis) winter wheat	EW	0.015		400	2	0 21 35 63	plant plant straw straw	0.58 0.17 0.14 0.04	14055/93 C-13 WW-WG No 6
Germany, 1993 (Orestis) winter wheat	EW	0.015		400	2	0 22 35 52	plant plant straw straw	0.57 0.16 0.21 0.19	14055/93 C-13 WW-WG No 7
Germany, 1993 (Ritmo) winter wheat	EW	0.015		400	2	0 21 35 70	plant plant straw straw	0.22 0.15 0.14 0.19	14055/93 C-13 WW-WG No 4
Germany, 1993 (Slejpner) winter wheat	EW	0.015		400	2	0 21 35 60	plant plant straw straw	0.26 0.18 0.18 0.08	14055/93 C-13 WW-WG No 2
Italy, 2002 (Svevo) spring wheat	EW	0.015	0.0038	400–410	2	0 14 21 28 35	plants plants plants plants straw	0.13 < 0.01 0.03 0.04 < 0.05	20021160/E1-FPSC I02N009R
Italy, 2002 (Violet) winter wheat	EW	0.015	0.0038	410	2	0 14 28 35 42	plants plants plants straw straw	0.09 0.03 0.03 < 0.05 < 0.05	20021160/E1-FPWC I02N005R

WHEAT FODDER AND FORAGE	Application					PHI[c]	Commodity[b]	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
Spain, 2002 (Chamorro) spring wheat	EW	0.015	0.0075	200–210	2	0 15 20 27 35	plants plants plants plants straw	0.38 0.37 0.26 0.19 0.38	20021160/E1-FPSC S02N004R
UK, 1994 (Riband) winter wheat	EW	0.015	0.005	300	2	0 32	plant straw	0.86 1.4	AG/95/0182 FD 6679
UK, 1994 (Riband) winter wheat	EW	0.015	0.005	300	2	0 14 21 46	plant 34 plant 51 stems 52 straw 91	0.74 0.69 1.0 1.0	AG/95/0182 FD 6680
UK, 1999 (Haven) winter wheat	EW	0.017	0.0087	200	2	52	straw	0.50	17788
UK, 1999 (Riband) winter wheat	EW	0.017	0.0084	200	2	63	straw	0.19	17788
USA (AR), 1999 (Pioneer 2684) wheat	EC	0.056		100	1 4 5	13 14 21	forage hay straw	0.71 0.66 1.9 1.7 2.2 2.2	P-3452 trial 02
USA (CO), 1999 (Ogallala) wheat	EW	0.056		94	1 4 5	14 14 21	forage hay straw	0.74 0.71 1.2 1.1 3.2 2.6	P-3452 trial 13
USA (IA), 1999 (Willcross 738) wheat	EC	0.056		95	1 4 5	14 20 21	forage hay straw	0.30 0.29 1.1 1.7 2.2 3.8	P-3452 trial 06
USA (ID), 1999 (Penewawa) wheat	EW	0.056		95	1 4 5	14 14 20	forage hay straw	0.38 0.31 5.3 4.4 5.1 5.2	P-3452 trial 16
USA (IN), 1999 (Pioneer 25R57) wheat	EC	0.056		94	1 4 5	14 14 18	forage hay straw	0.80 0.80 2.5 1.6 3.2 3.8	P-3452 trial 03
USA (KS), 1999 (2137) wheat	EW	0.056		94	1 4 5	14 21 21	forage hay straw	0.91 0.88 3.4 3.4 0.68 1.2	P-3452 trial 12
USA (MT), 1999 (2371) wheat	EC	0.056		94	1 4 5	14 14 21	forage hay straw	0.05 0.05 1.5 1.3 0.86 0.98	P-3452 trial 09
USA (MT), 1999 (926) wheat	EW	0.056		90–95	1 4 5	14 14 21	forage hay straw	0.55 0.54 5.5 4.7 3.6 3.9	P-3452 trial 11
USA (NB), 1999 (Nekota) wheat	EW	0.056		95	1 4 5	14 14 21	forage hay straw	0.72 0.67 2.1 2.7 0.93 0.79	P-3452 trial 10
USA (ND), 1999 (2375) wheat	EC	0.056		94	1 4 5	14 14 21	forage hay straw	0.16 0.17 1.7 1.3 0.70 0.35	P-3452 trial 08
USA (NY), 1999 (Nekota) wheat	EW	0.056		95–100	1 1 1 1 1	8 11 14 17 20	forage forage forage forage forage	1.5 1.5 0.91 0.77 0.82 0.83 0.44 0.53 0.38 0.41	P-3452 trial 05

WHEAT FODDER AND FORAGE	Application					PHI[c]	Commodity[b]	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (NY), 1999 (Nekota) wheat	EW	0.056		95–100	4 4 4 4 4	8 11 14 17 20	hay hay hay hay hay	3.5 2.6 1.8 2.2 2.2 1.9 1.5 1.4 1.5 1.3	P-3452 trial 05
USA (NY), 1999 (Nekota) wheat	EW	0.056		95–100	5	21	straw	1.9 1.6	P-3452 trial 05
USA (OH), 1999 (Terra SR 204) wheat	EW	0.056		90–100	1 1 1 1 1	7 12 15 16 20	forage forage forage forage forage	1.1 1.2 0.57 0.40 1.3 0.98 2.4 2.7 1.8 1.8	P-3452 trial 04
USA (OH), 1999 (Terra SR 204) wheat	EW	0.056		90–100	4 4 4 4 4	7 12 14 18 21	hay hay hay hay hay	2.8 2.7 2.2 3.0 1.2 2.1 0.97 1.3 1.4 1.5	P-3452 trial 04
USA (OH), 1999 (Terra SR 204) wheat	EW	0.056		90–100	5	21	straw	5.0 6.0	P-3452 trial 04
USA (OK), 1999 (Custer) wheat	EC	0.056		95–100	1 4 5	14 14 21	forage hay straw	1.7 1.8 4.6 4.9 6.1 6.0	P-3452 trial 14
USA (OK), 1999 (Jagger) wheat	EW	0.056		94	1 4 5	13 14 21	forage hay straw	1.3 1.5 3.8 3.0 3.2 2.9	P-3452 trial 07
USA (TX), 1999 (TAM-200) wheat	EC	0.056		85–90	1 4 5	14 14 21	forage hay straw	1.8 1.9 3.0 3.2 3.7 2.1	P-3452 trial 15
USA (VA), 1999 (Pioneer 2684) wheat	EC	0.056		94	1 4 5	14 14 21	forage hay straw	1.9 2.0 0.61 0.49 1.4 1.8	P-3452 trial 01

[a] US trials. Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Commodities with % moisture.

[c] Note that PHI for hay may include the interval between cutting and sampling, e.g., 3 days drying in the field.

Table 60 Zeta-cypermethrin residues in rice straw resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 44

RICE STRAW	Application				PHI	Commod	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (AR), 1997 (Cypress)	EC	0.056	80–110	4	16	straw	0.21 0.32	< 0.05 (2)	< 0.05 (2)	P-3332 trial 01
USA (AR), 1997 (Cypress)	EC	0.056	85–105	4	14	straw	0.60 0.29	< 0.05 (2)	0.05 < 0.05	P-3332 trial 02
USA (AR), 1997 (Cypress)	EC	0.056	90–95	4	14	straw	0.45 0.57	< 0.05 (2)	0.05 0.07	P-3332 trial 03
USA (AR), 1997 (Bengal)	EC	0.056	80–90	4	14	straw	0.59 0.64	< 0.05 (2)	< 0.05 0.06	P-3332 trial 04

RICE STRAW	Application				PHI	Commod	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (AR), 1997 (Kaybonnet)	EC	0.056	94	4	14	straw	0.58 0.61	< 0.05 (2)	0.09 < 0.05	P-3332 trial 05
USA (AR), 1997 (Cypress)	EC	0.056	94	4	14	straw	0.35 0.32	< LOD < 0.05	< 0.05 (2)	P-3332 trial 06
USA (MO), 1997 (Kaybonnet)	EC	0.056	95	4	14	straw	0.15 0.11	< 0.05 (2)	< 0.05 (2)	P-3332 trial 07
USA (LA), 1997 (Cypress)	EC	0.056	94	4	14	straw	0.28 0.49	0.06 < 0.05	0.094 0.077	P-3332 trial 08
USA (LA), 1997 (Cypress)	EC	0.056	90	4	17	straw	0.79 0.61	< 0.05 (2)	< 0.05 0.06	P-3332 trial 09
USA (LA), 1997 (Cypress)	EC	0.056	70–90	4	14	straw	0.34 0.30	< 0.05 (2)	< 0.05 (2)	P-3332 trial 10
USA (LA), 1997 (Cypress)	EC	0.056	70–80	4	14	straw	0.37 0.15	< 0.05 (2)	0.05 < 0.05	P-3332 trial 11
USA (MS), 1997 (Lemont)	EC	0.056	75–90	4	14	straw	0.35 0.17	< 0.05 (2)	< 0.05 (2)	P-3332 trial 12
USA (MS), 1997 (Lemont)	EC	0.056	95	4	14	straw	0.23 0.27	< 0.05 (2)	0.06 < 0.05	P-3332 trial 13
USA (TX), 1997 (Kaybonnet)	EC	0.056	60–70	4	14	straw	0.87 1.4	< 0.05 (2)	< 0.05 (2)	P-3332 trial 14
USA (TX), 1997 (Kaybonnet)	EC	0.056	60–75	4	14	straw	1.8 1.8	< 0.05 (2)	< 0.05 (2)	P-3332 trial 15
USA (TX), 1997 (Cypress)	EC	0.056	70–80	4	14	straw	0.83 1.5	< 0.05 (2)	< 0.05 (2)	P-3332 trial 16
USA (CA), 1997 (M204)	EC	0.056	85–90	4	14	straw	0.19 0.39	< LOD (2)	< LOD < 0.05	P-3332 trial 17
USA (CA), 1997 (M202)	EC	0.056	85–90	4	14	straw	0.18 0.29	< 0.05 < LOD	< 0.05 (2)	P-3332 trial 18
USA (CA), 1997 (M202)	EC	0.056	94	4	14	straw	0.10 0.11	< LOD (2)	< LOD (2)	P-3332 trial 19
USA (CA), 1997 (M204)	EW	0.056	85–90	4	14	straw	0.28 0.49	< LOD < 0.05	< 0.05 (2)	P-3332 trial 20
USA (CA), 1997 (M202)	EW	0.056	85–90	4	14	straw	0.65 0.56	< LOD < 0.05	< 0.05 (2)	P-3332 trial 21
USA (CA), 1997 (M202)	EW	0.056	94	4	14	straw	0.084 0.16	< LOD (2)	< LOD (2)	P-3332 trial 22

[a] Residues reported as undetected are listed as < LOD (limit of detection). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 61 Zeta-cypermethrin residues in sugar beet tops resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 36

SUGAR BEET TOPS	Application					PHI	Commodity	Residue, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	kg ai/hL	water (L/ha)	no.	days		zeta	
USA (WI), 2002 (Beta 6600)	EW	0.084 +0.028 +0.056		88 +92 +95	3	7 14 21 28 35	tops	0.61 0.61 0.52 0.44 0.34 0.28 0.07 0.05 < 0.05 (2)	P-3630 trial 3
USA (ID), 2002 (Beta Seeds 4490R)	EW	0.085 +0.030 +0.056		94 +86 +87	3	7 14 21 28 35	tops	0.64 0.62 0.56 0.43 0.39 0.33 0.11 0.07 0.09 0.09	P-3630 trial 4
USA (MN), 2003 (Holy HH 811)	EC	0.084 +0.028 +0.056		94 +94 +94	3	3 7 14 21	tops	0.85 0.84 1.1 0.87 0.78 0.67 0.55 0.47	P-3630 trial 5
USA (MN), 2003 (Holy HH 811)	EW	0.083 +0.028 +0.056		94 +94 +94	3	3 7 14 21	tops	0.82 0.79 0.97 0.86 0.67 0.65 0.34 0.32	P-3630 trial 5
USA (ID), 2003 (Beta Seed 8450)	EC	0.084 +0.029 +0.056		88 +89 +89	3	3 7 14 21	tops	0.62 0.46 0.52 0.51 0.40 0.30 0.18 0.16	P-3630 trial 6
USA (ID), 2003 (Beta Seed 8450)	EW	0.083 +0.028 +0.056		88 +89 +89	3	3 7 14 21	tops	0.58 0.52 0.56 0.50 0.36 0.34 0.18 0.18	P-3630 trial 6
USA (ND), 2003 (Holy HH811)	EC	0.083 +0.029 +0.056		94 +94 +94	3	3 7 14 21	tops	0.67 0.60 0.66 0.68 0.23 0.18 0.25 0.22	P-3630 trial 7
USA (ND), 2003 (Holy HH811)	EW	0.083 +0.029 +0.056		94 +94 +94	3	3 7 14 21	tops	0.67 0.52 0.75 0.73 0.21 0.21 0.30 0.21	P-3630 trial 7

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.02 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

Table 62 Zeta-cypermethrin residues in sugar beet tops resulting from supervised trials with zeta-cypermethrin in the USA. Replicate values arise from replicate plots or replicate field samples. Relates to Table 37

SUGAR BEET TOPS	Application				PHI	Commod	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (MI), 1995 (Monogerm Hybrid HME17)	EW	0.056	180	3	50	sugar beet tops (moisture 83–84%)	0.13 0.08	< 0.05 (2)	< 0.05 0.05	RAN-0289

SUGAR BEET TOPS	Application				PHI	Commod	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
USA (CA), 1995 (H89778)	EW	0.056	180	3	50	sugar beet tops (moisture 86%)	< 0.05 (2)	< LOD (2)	< LOD (2)	RAN-0289
USA (MN), 1996 (Mono Hi Kari) Wheaton	EW	0.056	94	3	50	sugar beet tops	0.08 0.07	< 0.05 (2)	< 0.05 (2)	RAN-0302
USA (MN), 1996 (Mono Hi Kari) Campbell	EW	0.056	94	3	50	sugar beet tops	0.07 0.05	< 0.05 (2)	< 0.05 (2)	RAN-0302
USA (ND), 1996 (Mono Hi Kari)	EW	0.056	94	3	50	sugar beet tops (moisture 90%)	< 0.05 (2)	< LOD (2)	< 0.05 < LOD	RAN-0302
USA (OH), 1996 (Rupp Seed Co, Lot 1531)	EW	0.056	94	3	54	sugar beet tops	< 0.05 (2)	< 0.05 (2)	< 0.05 (2)	RAN-0302
USA (NE), 1996 (Monohy 55)	EW	0.056	140	3	50	sugar beet tops	0.09 0.05	< 0.05 (2)	< 0.05 (2)	RAN-0302
USA (TX), 1996 (Monohy 9155)	EW	0.045	80	3	50	sugar beet tops	< 0.05 (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (CO), 1996 (Monahakaii)	EW	0.056	140	3	50	sugar beet tops (moisture 88%)	0.08 0.07	< 0.05 < LOD	< LOD (2)	RAN-0302
USA (CA), 1996 (Spreckles NB3)	EW	0.056	190	3	50	sugar beet tops (moisture 88%)	0.11 0.08	< LOD < 0.05	< LOD < 0.05	RAN-0302
USA (ID), 1996 (WS PM-9) Jerome	EW	0.056	190	3	49	sugar beet tops	0.14 0.15	< LOD (2)	< LOD (2)	RAN-0302
USA (ID), 1996 (WS PM-9) Rupert	EW	0.056	180	3	50	sugar beet tops (moisture 90%)	< LOD (2)	< LOD (2)	< LOD (2)	RAN-0302
USA (OR), 1996 (PS 951010-22 D)	EW	0.056	100	3	49	sugar beet tops (moisture 90%)	< 0.05 < LOD	< LOD (2)	< LOD (2)	RAN-0302

[a] Abbreviations:zeta = zeta-cypermethrin; DCVA = 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid. Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

FATE OF RESIDUES IN STORAGE AND PROCESSING

In processing

The Meeting received information on the fate of zeta-cypermethrin residues during the processing of apples, beans, maize, peaches, peanuts, peas, plums, soya beans, spinach, sugar beet, sugar cane, sunflower seeds, tomatoes and wheat.

Table 63 Zeta-cypermethrin residues in spinach, sugar cane, sugar beet and maize and their processed commodities resulting from trials with zeta-cypermethrin in the USA

CROP	Application				PHI	Commodity[b]	Residues, mg/kg[a]			Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	cis-DCVA	trans-DCVA	
SPINACH										
USA (AZ), 1999 (Bolero F1)	EW	0.056	80	6	1	leaf (field)[c] leaf (processor) washed steamed microwaved puree canned	6.73 7.11 7.15 6.17 4.12 3.33 3.96 6.31 6.02 5.02 4.30 4.33 3.82 1.89	0.087 0.12 0.12 0.11 0.13 0.057 0.11 0.075 0.16 0.079 0.13 0.051 0.064 0.033	0.15 0.17 0.18 0.17 0.21 0.13 0.17 0.13 0.24 0.14 0.22 0.11 0.12 0.063	PC-0300
SUGAR CANE										
USA (LA), 1995 (LCP-8289)	EC	0.056 +0.056 +0.056 +0.28	164 162 172 157	4	20 20 20	sugar cane RAC molasses 19 white sugar 4	0.16 0.16 0.07 0.06 < LOD (2)	< LOD (2) 0.06 0.07 < LOD (2)	< LOD (2) 0.26 0.28 < LOD (2)	RAN-0282
SUGAR BEET										
USA (ID), 1995 (mono-Hy 62)	EW	0.056 +0.056 +0.28	181 184 164	3	50	sugar beet roots 78 molasses 26 dried pulp 4 white sugar 0	< LOD < LOD (2) < 0.05 (2) < LOD (2)	< LOD < 0.05 < LOD < LOD (2) < LOD (2)	< LOD < 0.05 (2) < LOD (2) < LOD (2)	RAN-0283
MAIZE										
USA (IL), 1994 (Pioneer 3245)	EW	0.056 +0.056 +0.056 +0.28	102 110 98 105	4	30 30	maize grain[d] starch[d] refined oil[d] maize grain[e] grits[e] meal[e] flour[e] refined oil[e]	< LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < 0.05 (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	< LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	RC-0053

[a] Abbreviations:zeta = zeta-cypermethrin; DCVA = 3-(2,2-dichlorovinyl)2,2-dimethylcyclopropanecarboxylic acid. Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg). Residues reported as "trace", i.e., detected but below LOQ (0.05 mg/kg), are listed as < 0.05 mg/kg.

[b] Commodity and % moisture where available.

[c] Only visibly rotted outer leaves were removed in the field.

[d] Maize, wet milling process. Also analysed for 3-phenoxybenzoic acid, all < LOD.

[e] Maize, dry milling process. Also analysed for 3-phenoxybenzoic acid, all < LOD.

Sugar cane

In a sugar cane processing study (McChesney, 1996, RAN-0282), cane was washed and then milled with 25% maceration water. The extracted juice was treated with lime, heated and treated with a poly-electrolyte flocculent, after which the mud was allowed to settle. The clear juice was evaporated to syrup. Further boiling produced a massecuite* and then sugar crystals. After a series of crystallizations to remove sugar, the resulting mother liquor became molasses. Raw sugar was dissolved in water and recrystallised as white sugar after decolourization of the solution with activated charcoal. Residue data are summarised in Table 63.

* Massecuite: the mixture of sugar crystals and syrup (mother liquor) obtained during the crystallization stage of sugar refining.

Sugar beet

In a sugar beet processing study (McChesney, 1996, RAN-0283), sugar beets were washed with hot water to remove excess field dirt and cut into 15 cm pieces and then into cossettes approximately 1–3 mm thick. Extraction of sugar was effected with water at 70–75 °C. Beet pulp was pressed to recover sugar solution. Pressed pulp was dried to approximately 3% moisture in a bin air dryer at 82–85 °C. Raw juice was purified by addition of lime and carbon dioxide at 83–87 °C to precipitate impurities. Decanted juice was screened and filtered, treated with carbon dioxide and filtered again. The clarified juice was concentrated and centrifuged to separate sugar crystals from molasses. Further purification produced white sugar. Residue data are summarised in Table 63.

Maize

In a maize processing study (Noon and Wood, 1996, RC-0053), maize was treated with zeta-cypermethrin at an exaggerated application rate, but residues of cypermethrin or metabolites were not detectable (< 0.01 mg/kg) in the maize grain. When the maize was processed by wet and dry milling procedures, residues were not detectable in the processed commodities except for maize flour. Residue data are summarised in Table 63.

Table 64 Zeta-cypermethrin residues in apples, peaches, plums, tomatoes, peas, beans, wheat, soya beans, sunflowers and peanuts and their processed commodities resulting from trials with zeta-cypermethrin in the USA

CROP	Application				PHI	Commodity	Residues, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
APPLE								
USA (WA), 2001 (Basin Beauty)	EW	0.056	190	6	14 14 14 14 14 14 14 14	apple, field apple, unwashed apple, washed wet pomace (juice) wet pomace (sauce) apple juice canned apples apple sauce	0.10 0.15 < 0.05 (2) < 0.05 0.41 0.19 < 0.05 < LOD < LOD	P-3559 Trial 12
USA (WA), 2001 (Basin Beauty)	EW	0.056	940	6	14 14 14 14 14 14 14 14	apple, field apple, unwashed apple, washed wet pomace (juice) wet pomace (sauce) apple juice canned apples apple sauce	0.13 0.15 < 0.05 (2) < 0.05 0.36 0.14 < LOD < LOD < LOD	P-3559 Trial 12
PEACH								
USA (GA), 2001 (SG91-7) peach	EC	0.056	190	6	14 14 canned peach pureed peach peach nectar	peach, field peach, processor	0.09 0.07 < LOD < LOD < LOD	P-3558 Trial 09
USA (GA), 2001 (SG91-7) peach	EC	0.056	1000	6	14 14 canned peach pureed peach peach nectar	peach, field peach, processor	0.14 0.06 < LOD < LOD < LOD	P-3558 Trial 09

CROP	Application				PHI	Commodity	Residues, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
PLUM								
USA (CA), 2001 (d'Agan) plum	EC	0.056	195	6	14 14 14	plum, pitted, field plum, pitted, proc prune, pitted	0.21 0.20 0.15 0.075 0.40 0.32	P-3558 Trial 21
TOMATO								
USA (CA), 1999 (Rio Grande)	EC	5×0.056 +2.8	94	6	1	tomato, field tomato, processor tomato puree tomato paste	0.05 0.06 0.09 < 0.05 < 0.05 (2) < 0.05 (2)	P-3450
USA (NY), 1999 (Mountain Pride)	EC	0.056	94	6	1	tomatoes tomatoes unwashed tomatoes cooked tomatoes washed	0.07 0.07 < LOD < 0.05 < LOD (2) < LOD (2)	P-3451 Trial 01
USA (VA), 1999 (Super Sweet)	EW	0.056	94	6	1	tomatoes tomatoes unwashed tomatoes cooked tomatoes washed	< 0.05 (2) < LOD < 0.05 < LOD (2) < LOD < 0.05	P-3451 Trial 02
PEAS								
USA (NY), 1999 (Bolero)	EW	0.056	94	6	1	succulent shelled unwashed peas washed peas canned peas pea puree	< 0.05 (2) < LOD (2) < LOD (2) < LOD (2) < LOD (2)	P-3441 trial 06
USA (MI), 1999 (Oregon Sugar Pod II)	EC	0.056	94	6	1	edible-podded unwashed washed cooked microwaved steamed	0.23 0.35 0.21 0.20 0.17 0.17 0.14 0.14 0.15 0.18 0.17 0.16	P-3441 trial 12
USA (OR), 1999 (Oregon Sugar Pod II)	EW	0.056	94	6	1	edible-podded unwashed washed cooked microwaved steamed	0.16 0.20 0.10 0.12 0.09 0.12 0.09 0.11 0.09 0.12 0.10 0.09	P-3441 trial 14
BEANS								
USA (NY), 1999 (Improved Tendergreen) green bush beans	EW	0.056	94	6	1	whole pods whole pods unwashed beans washed beans cooked beans microwaved steamed beans	0.08 0.09 0.05 0.05 < 0.05 < 0.05 < 0.05 0.05 0.06	PC-0301 trial 01
USA (IN), 1999 (Provider) snap beans	EW	0.056	94	6	1	whole pods whole pods unwashed beans washed beans cooked beans microwaved steamed beans	0.20 0.20 0.23 0.27 0.30 0.18 0.11 0.20 0.24 0.24 0.27	PC-0301 trial 05
USA (ID), 1999 (Tendergreen) succulent beans	EC	0.056	94	6	1	whole pods unwashed beans washed beans canned cut bean bean puree	< LOD < 0.05 < 0.05 < 0.05 0.05 < 0.05	PC-0301 trial 06

CROP	Application				PHI	Commodity	Residues, mg/kg[a]	Ref
country, year (variety)	Form	kg ai/ha	water (L/ha)	no.	days		zeta	
WHEAT								
USA (ND), 1999 (23750	EC	4×0.065 +0.28	94	5	22	wheat grain, field wheat grain, processor bran middlings shorts flour germ aspirated grain	0.07 0.07 0.09 0.09 0.13 0.13 < 0.05 (2) < 0.05 (2) < 0.05 (2) < 0.05 (2) 11 9.4	P-3453
SOYBEAN								
USA (OH), 1999 (SC9367RR)	EC	5×0.056 +2.8	100	6	34	grain, field grain, processor grain dust [a] meal hulls refined oil	< 0.05 (2) < 0.05 (2) 4.3 4.4 < LOD (2) < 0.05 (2) < 0.05 (2)	P-3444
SUNLOWER SEED								
USA (MN), 1981 (variety not known). [Sample storage before analysis exceeds 900 days.]	EC cypermethrin	0.11		5	79	sunflower seed hulls meal, solvent extracted oil, refined soapstock	0.12 0.11 0.10 0.13 0.14 0.11 < LOD (2) < 0.05 (2) < LOD (2)	P-0920
PEANUTS								
USA (GA), 2001 (Georgia Green)	EC	5×0.065 +1×0.28	90–100	6	7 7	kernel kernel (at process) meal oil	< LOD (4) < LOD (2) < LOD (2) < LOD (2)	P-3551 Trial 01

[a] Aspirated grain fractions.

Tomatoes

In a tomato processing study, harvested tomatoes were inspected and sorted and then soaked in 0.5% sodium hydroxide at 55–65 °C for three minutes and then rinsed with a high pressure spray for 30 seconds (Buser, 2000, P-3450). The tomatoes were then pulped in a hammermill and heated rapidly to 79–85 °C for 30 seconds. Hot juice was separated with a Pulper Finisher. More juice was recovered by pressing the wet pomace. The fresh juice was then frozen for storage. At a later date, the juice was thawed and heated to not exceed 82 °C and then evaporated to produce the puree. The puree was packed in sealed cans and heated at 96–100 °C for 20 minutes and then cooled. A portion of puree was further evaporated and 1% salt added. The paste was packed in sealed cans and heated at 96–100 °C for 20 minutes and then cooled. Residue levels in the tomatoes and processed commodities are summarised in Table 64.

Soya beans

In a soya bean processing study, harvested soya beans were dried in an oven at 43–57 °C until the moisture content was 10–13% (Chen, 2000, P-3444). Grain dust was generated by cycling the dried soya beans from a bin, through drag conveyors and a bucket conveyor and back into the bin for 120 minutes. As the sample moved, grain dust was aspirated from the system. A sample of the soya beans was further dried to 7–10% moisture and then cleaned to remove particulate material. The soya beans were hulled in a disc mill with separation of kernel and husk material. Kernels were heated to 70–80 °C and flaked and passed into a flaker-expander to produce collets of kernel material ready for

extraction of crude oil with arm hexane. Solvent was evaporated from the mixture to produce crude oil, which was refined according to AOCS Method Ca 9b-52 resulting in refined oil and soapstock. Residue data are summarised in Table 64.

Peaches

In a peach processing study (Latorre, 2002, P-3558), harvested peaches were inspected and then peeled by immersion in a boiling sodium hydroxide solution (1.5%) for approximately 60 seconds followed by 15 seconds in an abrasive peeler. The peeled fruit were discharged into a citric acid solution (2%) and were then were halved and pitted by hand. Sliced peaches were then divided for canning or conversion to puree or nectar. Sliced peaches were packed in cans followed by the addition of hot water (90–99 ˚C). The cans were sealed and cooked (20 minutes at 98–100 ˚C) to produce canned peaches. For production of puree (baby food), sliced peaches were cooked with water in a steam kettle (98–100 ˚C) for 2 minutes and then were pulped and strained. The puree was combined with 0.14% ascorbic acid, heated to 96–98 ˚C for sterilization, and canned. For production of nectar, an aliquot of puree was combined with an equal volume of water and a corn syrup solution was added to adjust sugar content. The nectar was heated (96–98 ˚C) for sterilization after ascorbic acid was added (0.18 g/kg of nectar), following which the nectar was canned and sealed. Residue data are summarised in Table 64.

Prunes

In a prune drying study (Latorre, 2002, P-3558), harvested d'Agan plums were sorted to remove leaves, stems and other debris as well as damaged fruit. The plums were washed with cold water for 5 minutes and placed on drying trays for drying in a laboratory tray air dryer at 75 ˚C until the moisture level fell within 19–29%. Drying typically takes 18–36 hours. Residue data are summarised in Table 64.

Apples

In an apple processing study (Latorre, 2002, P-3559), Basin Beauty apples were inspected and culled and then washed in cold water for 5 minutes. Aliquots of the washed apples were used in the separate processes for canning, apple sauce and juice production.

For juice, the washed apples were converted to apple pulp in a hammer mill, heated to 40–50 °C and treated with enzyme for 2 hours. The pulp was pressed and filtered to produce juice and pomace

For canned apple, the washed apples were peeled, cored and sliced and placed in cold water to prevent discoloration. Apple slices were placed in cans, which were topped up with warm syrup. The cans were sealed and cooked for 20 minutes.

For apple sauce, the washed apples were peeled, cored, sliced and cooked in water at 98–100 °C until completely soft. The cooked apple slices were pulped and passed through a 2 mm screen. After addition of sugar, the apple sauce was heated to a minimum 79 °C and packed into cans and sealed. The waste material from the pulper was combined with the chopped peel and cores to produce the pomace. Residue data are summarised in Table 64.

Wheat

In a wheat milling study (Nagel, 2000, P-3453), the harvested wheat was dried at 43–57 ˚C until the moisture content was in the range of 10–13%.

Grain dust (aspirated grain) was generated by cycling the dried wheat from a bin, through drag conveyors and a bucket conveyor and back into the bin for 120 minutes. As the sample moved, grain dust was aspirated from the system. All the material to pass through a 2360 micron sieve was classified as grain dust.

For flour milling, wheat was first cleaned of large and small foreign particles. Then moisture was adjusted to 17.5% for milling with a break mill producing bran, middlings and flour. Further milling with other rollers and screens produced shorts and flour.

For production of germ, a sample of cleaned wheat was moisture adjusted to 16% and then milled to produce germ and bran. Germ and bran were separated in a suitable sifter.

Zeta-cypermethrin residues in wheat and milled fractions are summarised in Table 64.

Processing factors have been calculated for zeta -cypermethrin residues in peaches, peas, plums, spinach, sugar cane, sunflower seeds, tomatoes and wheat. The data for apples, maize, peanuts, soya beans and sugar beets could not be used because residue levels did not exceed the LOQ in the raw commodity.

Table 65 Summary of processing factors for zeta-cypermethrin residues. The factors are calculated from the data recorded in tables in this section

Raw agricultural commodity (RAC)	Processed commodity	Calculated processing factors.	Median or best estimate
Peach	canned peach	< 0.14, < 0.17	< 0.14
Peach	peach nectar	< 0.14, < 0.17	< 0.14
Plum	dried prune	3.6, 2.8	3.2
Tomato	tomato puree	< 0.56	< 0.56
Tomato	tomato paste	< 0.56	< 0.56
Peas	cooked peas	0.48, 0.48, 0.50, 0.61	0.52
Peas	microwaved peas	0.52, 0.62, 0.50, 0.67	0.58
Peas	steamed peas	0.59, 0.55, 0.56, 0.50	0.55
Beans	cooked beans	< 0.59, 1.0	0.8
Beans	microwaved beans	0.59, 1.2	0.9
Beans	steamed beans	0.71, 1.35	1.0
Wheat	bran	1.4	1.4
Wheat	flour	< 0.56	< 0.56
Wheat	germ	< 0.56	< 0.56
Sunflower seed	meal	< 0.09	< 0.09
Sunflower seed	refined oil	< 0.46	< 0.46
Spinach	steamed spinach	0.59, 0.95	0.77
Spinach	microwave ed spinach	0.90, 0.75	0.82
Spinach	pureed spinach	0.65, 0.65	0.65
Spinach	canned spinach	0.57, 0.28	0.43

RESIDUES IN ANIMAL COMMODITIES

Farm animal feeding studies

The meeting received a lactating dairy cow feeding study and a laying hen feeding study, which provided information on likely residues resulting in animal commodities, milk and eggs from cypermethrin residues in the animal diet.

Lactating dairy cows

Groups of three (or four) lactating Holstein dairy cows fitted with eartags containing cypermethrin (animals weighing 442–642 kg and 443–699 kg on days 1 and 28–30 respectively) were dosed once daily via gelatin capsules with cypermethrin at 0 ppm, 5 ppm (1×), 15 ppm (3×) and 50 ppm (10×) in the diet, for 28 consecutive days (Chen, 1994, P-2901). Milk was collected on 12 occasions for analysis (days –1, 1, 2, 4, 7, 10, 14, 21, 28, 29, 31 and 34) and was pooled from the a.m. and p.m. milkings of the test day. The dosing was suspended after 28 days and the eartags were removed. Two

animals from each group were slaughtered within 24 hours of the final doses. The remaining animals were slaughtered either 3 or 6 days after the final doses. Tissues collected for analysis were liver, kidney, peritoneal fat, subcutaneous fat, pectoral muscle and adductor muscle. Animals consumed averages of 15.3–22.9 kg feed (estimated 86% dry matter in feed) each per day and produced approximately 7.4–17.2 kg milk per animal per day (means for each animal through the test period).

Residue levels of cypermethrin (Table 66) and metabolites (Table 67) were measured in the milk and tissues. Residue levels of cypermethrin reached a plateau in milk at some time between 5 and 15 days after dosing was initiated (Figure 7). Residue levels in milk declined substantially after dosing ceased on day 28.

Residues of cypermethrin were just detectable in fat and cream from the ear-tag use only. Residues of cypermethrin did not appear in the liver even at the highest dose, but were present in kidney and muscle. Residue levels were much higher in fat than in other tissues, supporting the assignment of cypermethrin as a fat-soluble compound. Residue levels in fat were approximately proportional to the dosing levels.

Residue data were available on milk and cream from day 7 milk (Table 66 and Figure 8). The residue concentrations in cream were on average seven times the concentration in milk. No information was available on the lipid or water content of the cream.

Table 67 summarises the metabolite residue data in the tissues and milk. Levels of the metabolites in tissues and milk were generally lower than parent compound concentrations.

Table 66 Cypermethrin residues in milk and tissues of lactating Holstein dairy cows (3–4 per group), fitted with eartags containing cypermethrin, dosed once daily via gelatin capsule with cypermethrin at the equivalent of 5 ppm (T-II), 15 ppm (T-III) and 50 ppm (T-IV) in the diet, for 28 consecutive days (Chen, 1994, P-2901)

Tissue, matrix	Cypermethrin, mg/kg								
	T-I, eartags only		T-II, eartags + 5 ppm in diet		T-III, eartags + 15 ppm in diet		T-IV, eartags + 50 ppm in diet		
	day 28	+ 3 days	day 28	+ 3 days	day 28	+ 3 days	day 28	+ 3 days	+ 6 days
Kidney	< 0.01 (2)	< 0.01	< 0.01 0.012	< 0.01	0.012 0.016	0.027	0.024 0.070	0.074	0.054
Liver	< 0.01 (2)	< 0.01	< 0.01 (2)	< 0.01	< 0.01 (2)	< 0.01	< 0.01 (2)	< 0.01	< 0.01
Muscle, pectoral	< 0.01 (2)	0.017	< 0.01 0.013	0.031	0.079 0.038	0.050	0.10 0.20	0.13	0.12
Muscle, adductor	< 0.01 (2)	< 0.01	< 0.01 (2)	0.011	0.041 0.014	0.018	0.028 0.041	0.059	0.034
Fat, peritoneal	0.017 < 0.01	< 0.01	0.10 0.15	0.18	0.44 0.53	0.49	1.35 1.96	0.53	1.42
Fat, SC	< 0.01 (2)	< 0.01	0.063 0.088	0.091	0.46 0.32	0.30	0.74 0.99	1.03	0.69
Milk, day 7	< 0.002 (3)		0.012 0.013 0.013		0.035 0.036 0.043		0.12 0.14 0.094 0.083		
Skim milk, day 7	< 0.002 (3)		< 0.002 (3)		0.003 0.003 0.002		0.008 0.006 0.004 0.005		
Cream, day 7	0.010 0.016 < 0.01		0.10 0.073 0.083		0.31 0.21 0.25		0.008 0.006 0.004 0.005		
Milk, day 28	< 0.002 (3)		0.009 0.018 0.012		0.047 0.045 0.044		0.18 0.24 0.12 0.20		
Milk, day 31		< 0.002		0.002		0.010		0.022	0.028
Milk, day 34									0.015

Table 67 Metabolite residues in milk and tissues of lactating Holstein dairy cows, fitted with eartags containing cypermethrin, dosed once daily via gelatin capsule with cypermethrin at the equivalent of 50 ppm (T-IV) in the diet, for 28 consecutive days (Chen, 1994, P-2901)

Tissue, matrix	Metabolite residues, mg/kg								
	cis-DCVA T-IV, eartags + 50 ppm in diet			*trans*-DCVA T-IV, eartags + 50 ppm in diet			3-phenoxybenzoic acid T-IV, eartags + 50 ppm in diet		
	day 28	+ 3 days	+ 6 days	day 28	+ 3 days	+ 6 days	day 28	+ 3 days	+ 6 days
Kidney	0.018 0.022	< 0.01	< 0.01	0.13 0.10	0.017	< 0.01	0.041 0.031	< 0.01	< 0.01
Liver	0.011 0.011	< 0.01	< 0.01	0.024 0.025	< 0.01	< 0.01	< 0.01 (2)	< 0.01	< 0.01
Muscle, pectoral	< 0.01 (2)	< 0.01	< 0.01	< 0.01 (2)	< 0.01	< 0.01	< 0.01 (2)	< 0.01	< 0.01
Muscle, adductor	< 0.01 (2)	< 0.01	< 0.01	< 0.01 0.011	< 0.01	< 0.01	< 0.01 (2)	< 0.01	< 0.01
Fat, peritoneal	0.11 0.24	0.14	0.14	0.11 0.21	0.11	0.10	0.026 0.058	0.017	0.019
Fat, SC	0.086 0.11	0.084	0.052	0.084 0.10	0.070	0.041	0.016 0.013	< 0.01	< 0.01
Milk, day 7	< 0.002 (4)			< 0.002 (3) 0.004			< 0.002 (4)		
Skim milk, day 7	< 0.002 (4)			< 0.002 (4)			< 0.002 (4)		
Cream, day 7	0.079 0.10 0.086 0.11			0.053 0.066 0.057 0.069			< 0.01 0.011 0.014 0.015		
Milk, day 28	< 0.002 (4)			< 0.002 (4)			< 0.002 (4)		
	cis-DCVA T-III, eartags + 15 ppm in diet			trans-DCVA T-III, eartags + 15 ppm in diet			3-phenoxybenzoic acid T-III, eartags + 15 ppm in diet		
Fat, peritoneal	0.038 0.041 0.029			0.036 0.034 0.024			< LOD (3)		
Fat, SC	0.025 0.023 0.034			0.025 0.025 0.032			< LOD (3)		
Cream, day 7	0.031 0.022 0.034			0.016 0.014 0.020			< LOD (3)		
	cis-DCVA T-II, eartags + 5 ppm in diet			trans-DCVA T-II, eartags + 5 ppm in diet			3-phenoxybenzoic acid T-II, eartags + 5 ppm in diet		
Fat, peritoneal	0.016 0.029 0.014			0.011 0.026 0.012			< 0.01 (3)		
Fat, SC	< 0.01 (3)			< 0.01 (3)			< 0.01 (3)		
Cream, day 7	0.014 < 0.01 0.017			< 0.01 (3)			< 0.01 (3)		

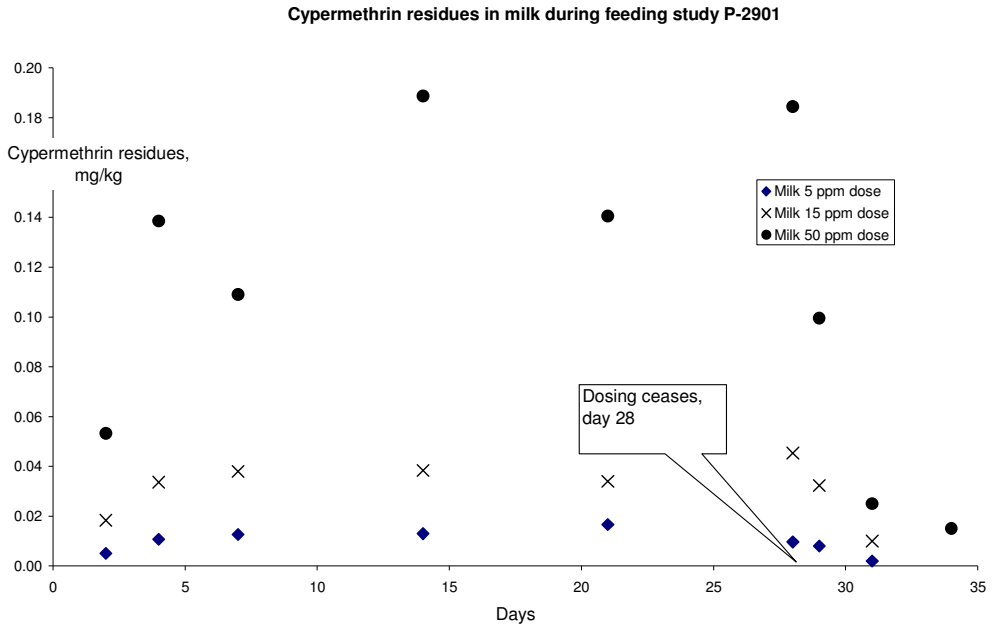


Figure 7 Cypermethrin residue levels in milk at three dosing levels during a 28 days feeding study with lactating Holstein dairy cows (Chen, 1994, P-2901)

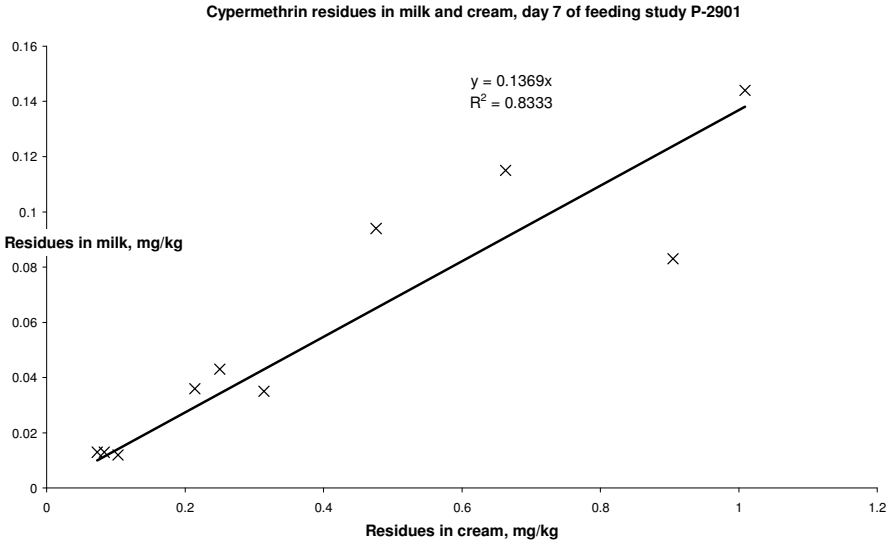


Figure 8 Relationship between cypermethrin residue levels in milk and cream from day 7 milk from Holstein dairy cows (Chen, 1994, P-2901)

Laying hens

Three groups of laying White Leghorn hens (10, 10 and 14 birds per group, weighing approximately 1.6 kg/bird at both study initiation and completion) were dosed via gelatin capsules with cypermethrin at the equivalent of 2 ppm (1×), 6 ppm (3×) and 20 ppm (10×) in the diet for 28 consecutive days (Nagel, 1994, P-2925). Eggs were collected daily. Most of the birds were slaughtered within 24 hours of the final doses. Tissues collected for analysis were thigh muscle, breast muscle, fat, kidneys and muscle. Birds consumed approximately 150–160 g feed each per day (estimated 89% dry matter in the feed). Two hens from the 10× treatment were slaughtered 3 days after the final doses and two were slaughtered 6 days after the final doses. Residues data for cypermethrin and metabolites are summarised in Table 68 and Table 69.

Cypermethrin residues are more prevalent in the fat than in other tissues, supporting the assignment of cypermethrin as a fat-soluble compound. Also, cypermethrin appears in the yolk and not the albumen in eggs. The metabolite levels in tissues and eggs are either undetectable or much lower than those of the parent compound.

Table 68 Cypermethrin residues in eggs and tissues of laying White Leghorn hens (10–14 per group), dosed once daily via gelatin capsule with cypermethrin at the equivalent of 2 ppm (1×), 6 ppm (3×) and 20 ppm (10×) in the diet for 28 consecutive days (Nagel, 1994, P-2925). Replicate residues represent pooled samples from replicate subgroups of 3–4 hens

Tissue, matrix	Cypermethrin residues, mg/kg[a]								
	2 ppm (1×)			6 ppm (3×)			20 ppm (10×)		
							28 days	+ 3 days	+ 6 days
Liver							< LOD (3)	< LOD	< LOD
Kidney							< LOD (3)	< LOD	< LOD
Thigh muscle	< LOD (3)			< LOD (3)			< LOD (3)	< 0.05	< LOD
Breast muscle							< LOD (3)	< LOD	< LOD
Fat	< LOD (2) < 0.05			0.066 0.086 < 0.05			0.13 0.19 0.17	0.18	0.17
Whole eggs, day 1							< LOD (4)		
Whole eggs, day 3				< LOD (3)			< 0.025 (4)		
Whole eggs, day 7	< LOD (3)			< 0.025 (3)			< 0.025 (3) 0.03		
Whole eggs, day 10	< LOD (3)			< 0.025 (3)			< 0.025 (2) 0.03 0.04		
Whole eggs, day 18	< LOD (3)			< 0.025 (2) < LOD			0.03 0.04 < 0.025 0.03		
Whole eggs, day 22	< LOD (3)			< 0.025 (3)			< 0.025 0.03 0.03 0.03		
Whole eggs, day 28	< LOD (3)			< 0.025 (3)			< 0.025 0.03 < 0.025 0.03		
Egg yolks, day 21	< 0.025 (3)			0.03 0.04 0.03			0.069 0.079 0.067 0.10		
Egg yolks, day 27	< 0.025 (3)			0.03 0.04 0.03			0.086 0.061 0.056 0.067		
Egg yolks, day 31							0.072		
Egg yolks, day 34							< 0.025		
Egg albumen, day 21				< LOD (3)			< LOD (4)		
Egg albumen, day 27				< LOD (3)			< LOD (4)		
Egg albumen, day 31							< LOD		
Egg albumen, day 34							< LOD		

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg for tissues and 0.005 mg/kg for egg matrices). Detected residues below LOQ are listed as < 0.05 mg/kg for tissues and < 0.025 mg/kg for egg matrices.

Table 69 Metabolite residues in eggs and tissues of laying White Leghorn hens (10–14 per group), dosed once daily via gelatin capsule with cypermethrin at the equivalent of 20 ppm (10×) in the diet for 28 consecutive days (Nagel, 1994, P-2925). Replicate residues represent pooled samples from replicate subgroups of 3–4 hens

Tissue, matrix	Metabolite residues, mg/kg[a]								
	cis-DCVA Cypermethrin dose 20 ppm			*trans*-DCVA Cypermethrin dose 20 ppm			3-phenoxybenzoic acid Cypermethrin dose 20 ppm		
	28 days	+ 3 days	+ 6 days	28 days	+ 3 days	+ 6 days	28 days	+ 3 days	+ 6 days
Liver	< LOD (2) < 0.05	< LOD	< LOD	< LOD (3)	< LOD	< LOD	< LOD (3)	< LOD	< LOD
Kidney	< LOD (3)	< LOD	< LOD	< LOD (2) < 0.05	< LOD	< LOD	< LOD (3)	< LOD	< LOD
Thigh muscle	< LOD (3)	< LOD	< LOD	< LOD (3)	< LOD	< LOD	< LOD (3)	< LOD	< LOD

Tissue, matrix	Metabolite residues, mg/kg[a]								
	cis-DCVA Cypermethrin dose 20 ppm			*trans*-DCVA Cypermethrin dose 20 ppm			3-phenoxybenzoic acid Cypermethrin dose 20 ppm		
	28 days	+ 3 days	+ 6 days	28 days	+ 3 days	+ 6 days	28 days	+ 3 days	+ 6 days
Breast muscle	< LOD (3)	< LOD	< LOD	< LOD (3)	< LOD	< LOD	< LOD (3)	< LOD	< LOD
Fat	< 0.05 (3)	< 0.05	< 0.05	< LOD < 0.05 (2)	< 0.05	< LOD	< LOD (3)	< LOD	< LOD
Whole eggs, day 1–28	< LOD (28)			< LOD (25) < 0.05 (3)			< LOD (28)		
Egg yolks, day 21, 27	< LOD (8)			< LOD (8)			< LOD (8)		
Egg albumen, day 21, 27	< LOD (8)			< LOD (4) < 0.05 (4)			< LOD (8)		

[a] Residues reported as undetected are listed as < LOD (limit of detection, 0.01 mg/kg for tissues and 0.005 mg/kg for egg matrices). Detected residues below LOQ are listed as < 0.05 mg/kg for tissues and < 0.025 mg/kg for egg matrices.

Information was provided on national residue definitions for cypermethrin.

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