ENDOSULFAN (032)

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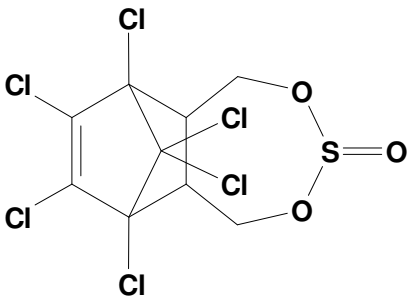
EXPLANATION

Endosulfan is a synthetic cyclodiene non-systemic insecticide and acaricide with both contact and stomach activity. It is widely used in agriculture to control a range of insects and mites on a broad spectrum of crops. It has been evaluated several times by the JMPR, the initial evaluation for residues being in 1967 and the latest in 1993. The 1998 JMPR established an ADI and an acute reference dose for endosulfan of 0-0.006 mg/kg bw and 0.02 mg/kg bw respectively. It was listed under the periodic re-evaluation programme in the 36th session of the CCPR for residue review by the 2006 JMPR.

The current Meeting received information from the manufacturer on physical and chemical properties, metabolism studies on plants and animals, environmental fate in soil, crop rotation, analytical methods, supervised trial data, processing studies, feeding studies, residues in food in commerce or at consumption and national maximum residues limits, residues in animal commodities as well as use patterns for Australia and The Netherlands.

IDENTITY

Common Name:	Endosulfan (BSI, ANSI and ISO approved)
Chemical Name:	
IUPAC:	6,7,8,9,10,10-hexachloro-1,5,5ª,6,9,9ª-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepin-3-oxide
CAS:	6,9-methano-2,4,3-benzodioxathiepin,6,7,8,9,10,10-hexachloro-1,5,5ª,6,9,9ª-hexahydro-3-oxide
FAO Specification (including year of publication):	CP/228
CAS registry number:	115-29-7
CIPAC number:	89
Synonyms and trade names:	See Names and other metabolites
Molecular formula:	$C_9H_6Cl_6O_3S$
Molecular mass:	406.96 g/mol
Structural Formula:	

Endosulfan consists of 2 isomers that differ in the configuration of the 7-membered dioxothiepin-oxide ring. These isomers are known as alpha endosulfan and beta endosulfan. The ratio of alpha endosulfan and beta endosulfan is approximately 2:1.

PHYSICAL AND CHEMICAL PROPERTIES

Pure active ingredient:

Property	Result	Reference
Purity	> 99% endosulfan ratio 2.1 α endosulfan/β endosulfan	
Melting point	α endosulfan: 109.2°C, β endosulfan: 213.3 °C Mean 83.3 °C	Albrecht & Kappes 1974b, Smeykal H 2001a
Boiling point	290 to 350°C.	Smeykal H 2001b, Röchling, Rexer, K and Maier 1990
Relative density	1.745 g / cm^3 at 20 °C	Albrecht, Kappes and Maier1974
Vapour pressure	Mixture alpha, beta - endosulfan: 1.7 x 10^{-3} Pa at 25 °C	OECD 104
	α - endosulfan: 1.9 x 10^{-3} Pa, β- endosulfan: 9.2 x 10^{-5} Pa at 25 °C	Sarafin, R 1987
Henry's law constant	α- endosulfan: 1.48 Pa x m^3 x mol^{-1}, β endosulfan: 0.07 Pa x m^3 x mol^{-1} at 24 °C	Weller O, 1990b
Colour	Colourless.	Kappes A, 1974a
Physical state	Solid.	
Odour	Odourless	Kappes A, 1974b
UV/VIS IR, NMR, MS spectra	α - endosulfan	
	UV molecular extinction ε =7.00 x 10^3 (mol^{-1} x cm^{-1}) at 212 nm	Wink O, 1985a
	IR wave number cm^{-1}: 3440 (OH, water), 2936 (C-H), 1605 (C=C), 1192 (S=O), 793 (C-Cl), 754 (C-C), 702 (S-O)	Sarafin R 1985b
	NMR : Multiplet 3.44 ppm, doublet-doublet 3.94 ppm and 4.77 ppm	Sarafin R 1985a
	β - endosulfan	
	UV molecular extinction ε =7.06 x 10^3 (mol^{-1} x cm^{-1}) at 212 nm	Wink O, 1985b
	IR wave number cm-1: 3440 (OH, water), 2953 (C-H), 1607 C=C), 1194 (S=O),779(C-Cl), 745 (C-C), 691 (S-O)	Sarafin R 1985c
	NMR : Multiplet 3.15 ppm, doublet-multiplet 4.12 ppm, doublet 5.08 ppm	Sarafin 1985d
	endosulfan	
	MS: m/z 407, 339, 323, 307, 295, 277, 207, 195,159	Sarafin R, & Winterscheidt, G 1985a, b
Solubility in water	α - endosulfan: 0.33 mg/L, β - endosulfan: 0.32 mg/L (pH 5, 22°C)	Sarafin, R. and Aßhauer, J.1987b, Görlitz, G.1990
Solubility in organic solvents	n-hexane 2.40 g/100 mL	OECD 116, Rexer K,1981, Huth G, 1996, Görlitz G, and Eyrich U.1986
	ethanol 6.50 g/100 mL	
	dichloromethane > 20 g/100 mL	
	ethyl acetate, toluene > 20 g/100 mL	
n-octanol/water coefficient	α - endosulfan 55500; log Pow= 4.74,	Sarafin R, Aßhauer J. 1987a; internal method.
	β - endosulfan 61400; log Pow=4.79 (pH 5.1, 22 °C).	
Dissociation in water	No indication of dissociation of endosulfan	Weller, O.1990a
Hydrolysis stability (25°C)	pH 5 > 200 days for α - endosulfan and β - endosulfan	Göerlitz,G and Rutz,U 1989
	pH 7= 19 days for α - endosulfan and = 10.7 days for β - endosulfan.	
	pH 9= 0.26 and 0.17 days for α- endosulfan and β-endosulfan respectively	
Estimated photochemical oxidative degradation	Reacts through photolysis (main product is endosulfan sulfate)	Paarlar, H. 1988

Technical material:

Property	Result	Reference
Purity	96.5%.	
Relative density	1.745 g/cm^3 CIPAC 1, 1970	Albrecht and Kappes K 1974
Colour	Cream to tan mainly beige	Rexer K and Maier1990/43649
Physical state	Flakes with tendency to agglomerate	Albrecht and Rexer K 1982/24344
Odour	Odour like sulphur dioxide	Rexer K and Albrecht 1982/24333
Flammability		
Autoflammability	No spontaneous ignition up to 400°C. Internal method.	Rexer, K. and Albrech 1982c; Huth G 1996
Flash point	Above 40°C	Rexer, K and Albrecht 1982b
Explosive properties	No potential for explosivity	Rexer, K and Albrecht 1982c
Oxidising properties	Not considered an oxidising agent.	Klais,O,Rexer,K,1995

FORMULATIONS

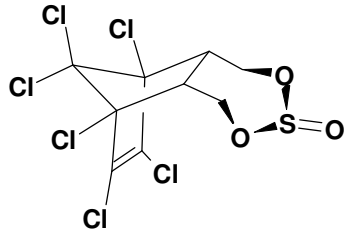
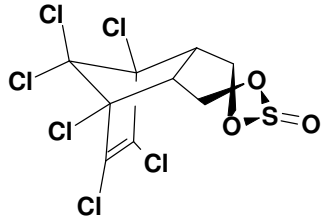
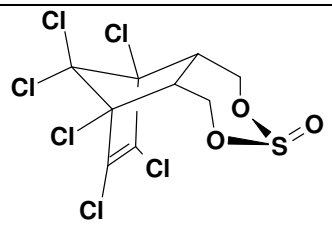
The main formulations were EC at the concentration between 30 and 50%.(w/w);

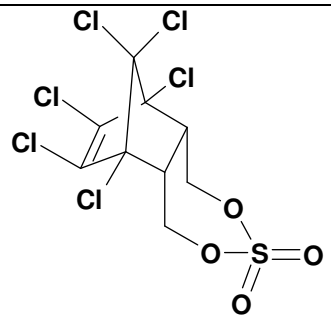
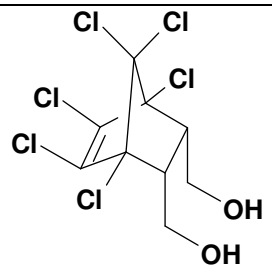
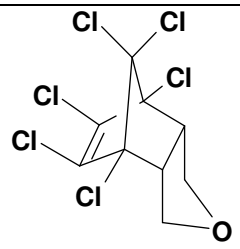
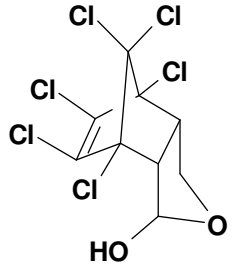
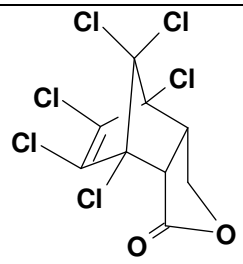
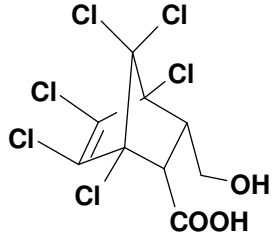
WP formulations were between 30 and 50%.(w/w);

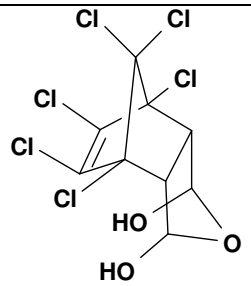
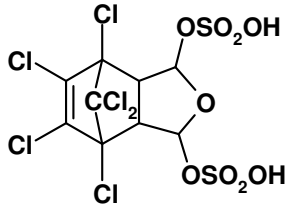
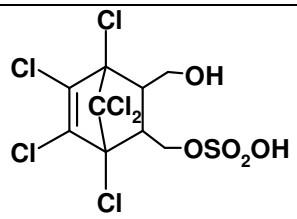
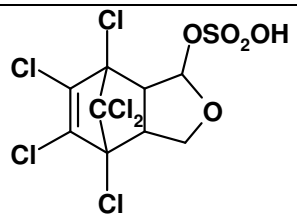
SC, CS, GR and powder formulations were also present in the market.

Endosulfan in EC and ULV formulations could be mixed with deltamethrin or dimethoate.

Names and codes of metabolites

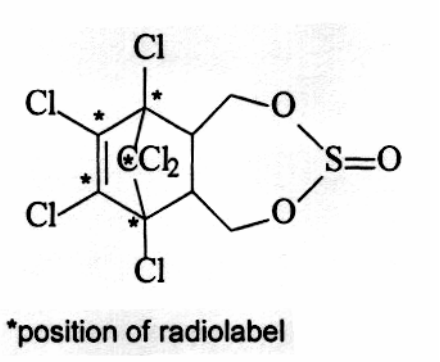
Common Name	Structural Formula	Company Code	Chemical Name
endosulfan (parent)	isomeric mixture of alpha- and beta-endosulfan in the ratio of approx. alpha 2-to beta –1	AE F002671 (former code: Hoe 002671)	6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepine-3-oxide (IUPAC)
alpha-endosulfan (asymmetric twist forms that only can be distinguished in the crystalline phase by X-ray spectrometry) (parent)	first twist form  second twist form 	AE F052618 (former code: Hoe 052618)	6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepine-3-oxide-alpha-isomer (IUPAC)
beta-endosulfan (symmetric) (parent)		AE F052619 (former code: Hoe 052619)	6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepine-3-oxide-beta-isomer (IUPAC)

Common Name	Structural Formula	Company Code	Chemical Name
endosulfan sulfate (plant, rat, cow, soil, natural water)		AE F051827 (former code: Hoe 051327)	6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepine-3,3-dioxide (IUPAC)
endosulfan diol (plant, rat, cow, surface water)		AE F051329 (former code: Hoe 051329)	1,4,5,6,7,7-hexachloro-bicyclo[2.2.1]hept-5-ene-2,3-dimethanol (IUPAC)
endosulfan ether (rat, cow)		AE F051330 (former code: Hoe 051330)	4,5,6,7,8,8-hexachloro-1,3,3a,4,7,7a-hexahydro-4,7-methano-isobenzofuran (IUPAC)
endosulfan hydroxy ether (rat, cow)		AE F051326 (former code: Hoe 051326)	4,5,6,7,8,8-hexachloro-1,3,3a,4,7,7a-hexahydro-4,7-methano-isobenzofuran-1-ol (IUPAC)
endosulfan lactone (rat, cow)		AE F051328 (former code: Hoe 051328)	4,5,6,7,8,8-hexachloro-1,3,3a,4,7,7a-hexahydro-4,7-methano-isobenzofuran-1-one (IUPAC)
endosulfan hydroxyl carboxylic acid (plant, surface water)		AE 0365278 (instable, therefore stored as Na salt, AE F114151)	1,4,5,6,7,7-hexachloro-3-hydroxymethyl-bicyclo[2.2.1]hept-5-ene-2-carboxylic acid and sodium 1,4,5,6,7,7-hexachloro-3-hydroxymethyl-bicyclo[2.2.1]hept-5-ene-2- carboxylate) (IUPAC)

Common Name	Structural Formula	Company Code	Chemical Name
endosulfan dihydroxy ether (rat)		AE 0035655 (intermediate, detected by MS of polar residues in the rat)	4,5,6,7,8,8-hexachloro-1,3,3a,4,7,7a-hexahydro-4,7-methano-isobenzofuran-1,3-diol
endosulfan dihydroxy ether disulfate (rat)		-	4,5,6,7,8,8-hexachloro-1,3,3a,4,7,7a-hexahydro-4,7-methano-isobenzofuran-1,3-diyl-bis(hydrogen sulfate)
endosulfan diol monosulfate (rat)		-	[1,4,5,6,7,7-hexachloro-3-(hydroxymethyl)bicyclo[2.2.1]-hept-5-en-2-methyl]-hydrogen sulfate
endosulfan hydroxy ether sulfate (rat)		-	4,5,6,7,8,8-hexachloro-1,3,3a,4,7,7a-hexahydro-4,7-methano-isobenzofuran-1-yl-hydrogen sulfate

METABOLISM AND ENVIRONMENTAL FATE

The metabolism and distribution in livestock and plants of endosulfan was investigated using endosulfan labelled with ^{14}C as shown below or alternatively with the ^{14}C at the remaining carbon atoms of the 6-membered ring only.



Animal metabolism

The Meeting received animal metabolism studies for endosulfan on rats, lactating cows, lactating sheep, and laying hens.

Rats

Studies on laboratory animal metabolism (rats) were evaluated by the WHO panel of the 1998 JMPR. Some studies not previously submitted are summarised below

Needham and Gutierrez-Giulianotti (1997) studied the metabolism of endosulfan by administration of a single oral dose of nominally either 1 or 6 mg ^{14}C endosulfan/kg body weight (bw). The majority of the oral dose was excreted in the faeces (70–90%) and urine (9–20%) as polar metabolites. The highest tissue residues were found in the kidneys (1.3 and 1.4 mg/kg equivalent) and liver (0.2 and 0.3 mg/kg-equivalent) for male and female rats. The residues in fat were generally lower (0.02 and 0.1–0.2 mg/kg equivalent in males and females).

Later Needman (2001) investigated the nature of metabolites in faeces and urine. The sulfate conjugate of endosulfan dihydroxyether, endosulfan diol sulfate conjugate, endosulfan dihydroxyether, two isomers of endosulfan dihydroxyether sulfate conjugates and endosulfan dihydroxyether disulfate conjugate were identified in urine. Faeces contained endosulfan diol sulfate conjugate, hydroxyl endosulfan ether sulfate conjugate, two isomers of endosulfan dihydroxyether sulfate conjugates, and endosulfan dihydroxyether disulfate conjugate. These metabolites accounted for approximately 2.1–8.6% of the dose in the urine and a further 5.5–8.6% of the dose in the acetonitrile extract of the 0-24 hour faeces sample.

In a toxicokinetics study (Needham *et al*., 1998) in the rat following repeated daily oral administration of 1 mg/kg/bw for 28 days, endosulfan sulfate was the major component in the fat. Metabolism of endosulfan involved either sulfoxidation to endosulfan-sulfate, a fat-soluble metabolite, followed by desulfatation to the diol, or direct hydrolysis to the diol followed by oxidation to the ether, the hydroxy-ether, the dihydroxy ether, and to the main metabolite in urine and faeces, the lactone.

The metabolites identified in this study were: alpha and beta endosulfan, endosulfan sulfate, endosulfan diol, endosulfan ether, endosulfan diol sulfate, endosulfan dihydroxy ether sulfate, endosulfan hydroxy ether, endosulfan lactone, endosulfan dihydroxy ether disulfate and endosulfan dihydroxy ether.

Lactating cows

The metabolism and distribution of ^{14}C endosulfan (98% purity; ratio alpha:beta = 2) was investigated by Leah and Reynolds (1996) in a lactating cow (450 kg) following repeated oral administration of ^{14}C-endosulfan at a mean daily dose of 288 mg/kg, equivalent to 0.64 mg/kg/bw/day for five consecutive days.

The dose was equivalent to 22 ppm in the diet. Urine and faeces were collected daily; milk was collected twice daily. At slaughter, liver, kidney, renal fat, subcutaneous fat and muscle (psoas and hindquarter) were sampled and the residues identified and quantified.

In milk, the TRR was detectable after 6 hours, reaching a maximum of 0.17 mg/kg eq 102 hours after the first dose.

TRR at 120 hours after initial dose and approximately 22 hours after final dose were generally low with the exception of the liver where the TRR were found to be 3.57 mg/kg eq tissue. TRR in fat were as follows: omental fat (1.28 mg/kg eq), renal fat (0.84 mg/kg eq) and subcutaneous fat (0.305 mg/kg eq). Residue levels in kidney (0.785 mg/kg eq) were comparable with levels in fat; residue levels in muscle (0.052 mg/kg eq) were lower.

For kidney 3.5% of TRR was extracted. A further 52% of the total ^{14}C residue (unextracted) was released by successive enzymatic incubations and mild acid/ base hydrolysis. Analysis was by TLC and HPLC. The final unextracted radioactivity accounted for 1.3%.

A similar fractionation for liver indicated that only 30% of TRR was associated with lipids and that the majority of the residue was associated with more polar fractions such as proteins (24%) and the perchloric acid fraction (32%). This suggests that a large proportion of the residue is hydrophilic in nature.

Overall 38% of TRR in liver was extractable. A further 60% of the total ^{14}C residue (unextracted) was released by successive enzymatic incubations and mild acid/base hydrolysis. The final unextracted radioactivity was approximately 2.3%.

For fat (omental, renal and subcutaneous) and milk TRR was extracted by hexane. No further extraction was performed.

For muscle 69% of TRR was extracted with hexane. The unextracted radioactivity was released by enzymatic incubation and showed very low level of radioactivity which was not identified.

Table 1. Distribution and characterisation of ^{14}C in tissues and milk of cow.

	Tissue						
	Liver	Kidney	Muscle (psoas)	Omental fat	Renal fat	Subcut. fat	Milk (54 hrs)
TRR (mg/kg eq)	3.572	0.785	0.052	1.278	0.840	0.305	0.147
% Extracted	37.98	43.49	69.24	95.70	96.46	81.34	95.32
% Released[1]	53.87	52.24	13.86	-	-	-	
% Identified	87.80	86.03	65.87	83.64	83.83	67.79	88.57
% α -Endosulfan	2.72	-	15.14	-	-	-	-
% β-Endosulfan	-	3.08	-	-	-	-	-
% Endosulfan sulfate (mg/kg)	27.16 (0.97)	12.58 (0.10)	50.73 (0.026)	82.08 (1.05)	83.83 (0.70)	67.79 (0.21)	88.57 (0.13)
% Endosulfan lactone	9.16	6.86	-	-	-	-	
% Endosulfan diol	6.48	4.96	-	-	-	-	-
% Hydroxy Endosulfan ether	-	4.77	-	-	-	-	
% Endosulfan ether	6.76	2.13	-	-	-	-	-
% Polar	35.49	51.65	-	1.56	-	-	-
% BLA	0	0	15.65	0.32	1.86	0	3.22
unextracted (final)	2.23	1.27	15.8	4.30	3.50	19.75	4.68
loss	9.97	10.49	2.68	7.5	10.77	3.75	3.50

1) = By enzyme catalysed or enzyme catalysed + acid/base hydrolysis

Following administration of [^{14}C]-endosulfan at a dose rate equivalent to 22 ppm in the diet for five consecutive days, equivalent to 0.64 mg/kg body weight/day, radioactivity was detected in all edible tissues at between 0.052 and 3.57 mg/kg eq. The major metabolite identified in all tissues was endosulfan sulfate at levels ranging from 68 to 84% in fat and up to 88% in milk. Endosulfan lactone was found in kidney and liver tissue, indicating that the endosulfan is readily cleaved following administration to a dairy cow.

Lactating sheep

The metabolism and distribution of endosulfan was investigated in studies by Gorbach, *et al.* in 1968 using ^{14}C endosulfan (98% purity alpha/ beta=2 labelled in methylene group) and by Gorbach in 1965 in sheep following repeated oral administration of cold-endosulfan.

In the first study, a single dose of 0.3 mg/kg of ^{14}C endosulfan was administered to two East-Friesian milk sheep each weighing approximately 50 kg. Milk samples were drawn twice daily every morning and afternoon (for up to 22 days); urine and faeces samples were collected once daily.

Approximately 90% of the administered ^{14}C material was excreted in the urine and faeces. Endosulfan-diol and endosulfan-hydroxy-ether, but not parent, were found in urine while endosulfan was the majority of the residue in faeces.

In milk 1% of the TRR was found, with the entire radioactivity appearing to be endosulfan sulfate. The highest concentration of radioactivity found in the milk was 0.15 mg/kg eq at 24 hours after administration. Radioanalysis showed that 88% of the ^{14}C in milk was present in cream.

In the second study (cold study) three Merino sheep, each weighing approximately 50 kg, were given a gelatine capsule containing 15 mg cold endosulfan daily for 26 days (0.3 mg/bw/day). Endosulfan sulfate was the primary residue found in milk (0.02–0.1 mg/kg).

Laying hens

Reynolds (1996) investigated the metabolism and distribution of ^{14}C-endosulfan in laying hens. Six laying hens were orally dosed with [^{14}C]-endosulfan (98% purity; ratio alpha/beta=2) at 1.36 mg/animal/day (11 ppm in diet) for twelve consecutive days. At slaughter, liver, abdominal and subcutaneous fat, skin, skeletal muscle and undeveloped eggs were removed for determination of the distribution and magnitude of [^{14}C]-endosulfan related residues.

In egg yolks and whites TRR was detectable within 48 hours of the administration of the initial dose, with radioactivity in egg yolks continuing to rise until plateau at day 10 (0.85 mg/kg eq). The residues in egg whites were an order of magnitude lower with a maximum concentration of 0.013 mg/kg eq seen on day 6 of dosing. In undeveloped eggs the mean concentration of endosulfan-derived residues was 0.77 mg/kg eq.

TRR in tissues were generally low with the highest residues seen in the subcutaneous and abdominal fat at 0.88 and 0.97 mg/kg eq, respectively. The residues in skin and liver were slightly lower at 0.69 and 0.47 mg /kg eq, respectively. The value for muscle was much lower at 0.028 mg/kg eq.

Following the first dose of [^{14}C]-endosulfan, elimination was fairly rapid with 51% of the administered dose recovered within the first twenty-four hours of dosing. The overall mean daily recovery was 87% over the twelve-day study period indicating that the majority of the dose was excreted.

In muscle 64% of the TRR was extractable by hexane following partition with acetonitrile and was identified and quantified. Some 36% of the total [^{14}C] residue in muscle was unextractable and no further investigation was conducted.

The level of endosulfan and its metabolites in egg whites was low reaching a plateau of 0.013 mg/kg eq by day 6 of dosing. About 65% of the TRR (0.008 mg/kg eq) was organoextracted (acetonitrile). No further analysis was performed.

In abdominal and subcutaneous fat the TRR after extraction was quantified (97% and 98%, respectively) and identified. The loss and unextracted radioactivity were low (approximately 1–2%).

In the case of skin, the TRR after extraction was 94%, of which 90% was identified. The loss and unextracted radioactivity were approximately 4–6%.

Over 90% of the total [^{14}C] residue in liver was extractable. Subsequent enzymatic digestion permitted further quantitation of the nature of the residues.

Almost 60% of the radioactivity in liver was identified as endosulfan and its metabolites, of which the major metabolite was identified as endosulfan sulfate (46%). Approximately 23% of the total 14C residue was polar in nature. Approximately 9% was accounted for in procedural losses due partly to the particulate nature of some of the samples and another 9% of the radioactivity remained unextractable. For egg yolks 92% of TRR was extractable. Procedural losses and unextractable radioactivity was approximately 8% for each.

Isolation and identification of the residues in the tissues and excreta is summarised below. The results were the mean value of six birds.

Table 2. Distribution of ^{14}C endosulfan in tissues; eggs and excreta of hens.

% Identified / characterised									
Tissue	TRR (mg/kg eq)	% Extracted	% α endosulfan	% β endosulfan	% endosulfan sulfate	% endo-sulfan lactone	% endo-sulfan diol	% polar	% BLA*
Egg yolks	0.853	92.17[a]	4.74	1.32	46.38	1.82	-	20.18[b]	0.89
Egg whites	0.013	64.91	-	-	-	-	-	-	64.91
Skin	0.651	94.43	11.66	4.79	51.32	4.50	-	17.55	0.52
Subcut. fat	0.875	98.21	16.15	8.90	61.10	5.03	-	4.71	0.51
Abdom. fat	0.974	97.04	16.77	7.80	65.45	4.99	-	-	0.56
Liver	0.466	91.41	0.99	1.60	45.62	6.27	4.25	23.27[c]	-
Muscle	0.028	64.40	6.52	4.40	35.83	3.51	-	4.71	8-15
Excreta	NA	60.62	4.90	6.25	0.79	-	1.43	46.61	-

a = Each polar component was > 0.03 ppm

b = Hydrolysed to identified metabolites

c = Unknown metabolite less polar than parent compound 6.03% total

NA = Not applicable

*BLA = Below level of analysis

Following dosing of [^{14}C]-endosulfan at a dose rate equivalent to 11 ppm in the diet for 12 consecutive days, endosulfan-derived radioactivity was detectable in all edible tissues at between 0.013 and 0.97 mg/kg eq. The major metabolite identified in tissues (excluding egg white) was endosulfan sulfate, along with a small percentage of unchanged α - and β- endosulfan as well as some products of hydrolysis and oxidation of endosulfan, namely endosulfan diol (in liver) and endosulfan lactone.

The primary residues found in animal tissues were the parent, endosulfan, both alpha and beta isomers, and to a larger extent, endosulfan sulfate. The metabolism studies are consistent with the view that the parent is converted to the sulfate *in situ*, the latter of which is more likely to accumulate in tissues than the parent molecule. While liver seems to be the primary target organ for metabolism, the above residue components are clearly present in significant amounts in fat. It is likely that the high presence of these metabolites in fat is consistent with endosulfan being a fat-soluble pesticide.

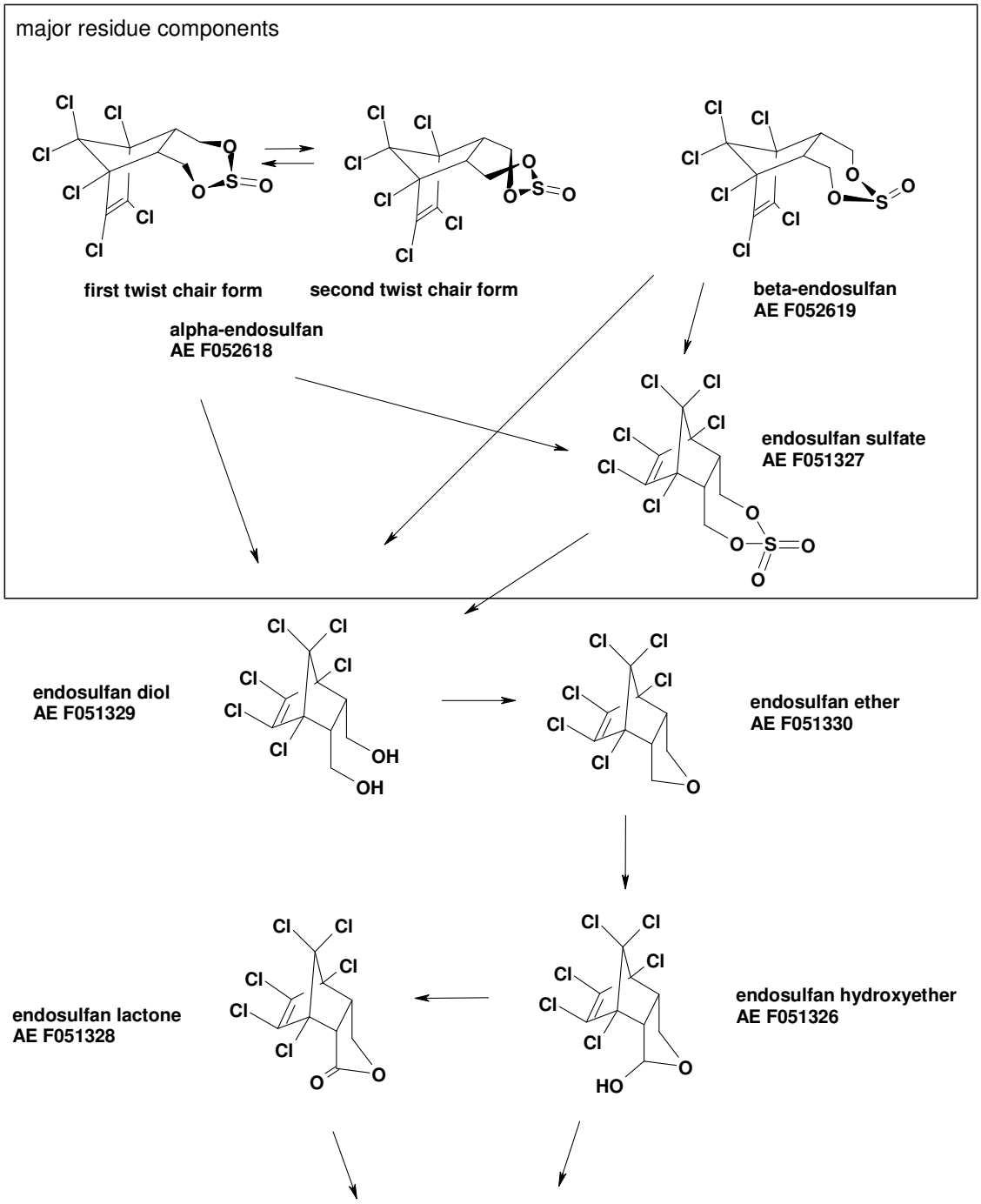


Figure 1. Metabolic pathway of endosulfan in the lactating cow.

Plant metabolism

The Meeting received information on the fate of endosulfan after application to tomato, cucumber, apple, sugar beet and soybean.

Tomato

The study was performed by Buerkle *et al.* (1990). Young tomato plants *(Lycopersicon lycopersicum,* variety: *Fruchta)* with green fruit were treated three times with 6,7,8,9,10-U-^{14}C-labelled endosulfan (98% purity; alpha:beta = 2) at intervals of 7 days, each time at an application rate equivalent to 635 g ai/ha. The active substance was formulated as an emulsifiable concentrate (35EC) with an actual concentration of 32.9% (w/v).

After treatment, the plants were grown outdoors, but protected from rain by a glass roof. Leaf and fruit were sampled 8, 13, 21, 27, 42, and 48 days after the last treatment. In addition, leaf samples were taken one or two days after each treatment. Samples were extracted and quantified by liquid scintillation counting (LSC). Identification was achieved through the use of high performance liquid chromatography (HPLC) using co-eluted reference standards and HPLC with mass spectrometric detection (HPLC/MS).

The total radioactive residues decreased from 0.35 to 0.03 mg/kg eq in the fruit (day 8 to 48 after the last treatment) and 27 to 13 mg/kg eq in the leaf (day 2 to 48). The isomeric ratio (α/β-endosulfan) in the leaf rinsate decreased from the original alpha 2/ beta 1 to alpha 0.54/ beta 1, two days after the third application.

Table 3. Characterisation of 6, 7, 8, 9, 10-u-^{14}C-endosulfan in% of TRR after treatment at 0.635 kg ai/ha on tomato and identification of metabolites.

Plant part	Days after the 3rd treatment	Alpha-endosulfan	Beta-endosulfan	endosulfan sulfate	endosulfan diol	Polar metabolite fraction	Non-extracted
Leaves	2	14.4	26.6	15.05	0.3	23.5	8.8
	8	12.2	18.2	21.7	-	26.8	8.5
	13	0.9	1.8	10.8	-	46.4	7.2
	21	2.3	6.3	16.7	0.6	46.1	15.0
	42	1.0	4.3	12.8	0.3	46.0	16.3
	48	1.5	5.2	11.2	-	46.5	26.4
Fruit	27*	75 (a + b) isomer		15			6.8

* Fruit analysis could not be conducted with samples at later dates due to a significant decrease of the total residues at later sampling intervals.

The polar metabolite fraction extracted from leaves contained predominantly endosulfan diol as the aglycone, which was conjugated as the sulfate (releasable with arylsulfatase).

Following repeated application of endosulfan, approximately 90% of the total radioactive residues could be extracted from tomato fruit and consisted of the parent isomers, α- and β-endosulfan and the metabolite endosulfan sulfate. These components therefore have to be considered as the relevant endosulfan residues in tomatoes. The leaf material contained trace amounts of free and considerable amounts of conjugated endosulfan diol.

Apple

A study on apple trees *(Malus sylvestris var. domestica,* variety: *Elstar)* was performed by Schwab (1995). A young apple tree was treated with 5a, 9a - ^{14}C-labelled formulated endosulfan (98% purity; alpha:beta =2) at a rate which corresponded to 1.5 kg ai/ha. The active substance was formulated as a 35EC. Thirteen (13) near-mature apples were present on the tree. The tree was protected from rain by a glass roof. Two to five apples and several leaves were sampled at 0, 7, 14, and 21 days after treatment. The apples were first rinsed with acetone and then extracted. Leaves of the last sampling date were extracted as for the apples, but without prior rinsing. Quantitation of radioactivity was achieved by LSC and identification conducted by HPLC and TLC using co-chromatographed reference standards and gas chromatography with mass spectrometric detection (GC/MS).

The total radioactive residues decreased from 81 to 25 mg/kg eq in the leaves from day 0 to day 21 and varied in the range 0.44–1.37 mg/kg eq in the apples but remained stable. The ratio of

apple extract/rinse increased from about 1:1 (day 0) to 3:1 (day 27). The composition of residues in leaves and fruits are shown in Table 4.

Table 4. Fate of characterisation of 5a, 9a, ^{14}C-endosulfan in% of TRR after treatment at 1.5 kg ai/ha on apple and identification of metabolites.

Plant part	Days after treatment	Alpha-endosulfan	Beta-endosulfan	endosulfan sulfate	endosulfan diol	Non extracted
Leaves	21	7.6	28.3	49.6	0.9	9.9
Apples*	0	54.3	43.1	-	-	3.8
	7	49.7	44.0	0.9	-	4.3
	14	47.9	43.4	1.5	-	2.9
	21	50.7	43.1	1.5	-	2.0

* The corresponding components in rinse and extract are given after summation.

Following application of endosulfan approximately 90% of the TRR could be extracted from the apples. These residues consisted almost exclusively of the parent isomers, α and β-endosulfan and to a very low extent the metabolite endosulfan sulfate. These findings suggest only the parent endosulfan being the relevant residue in the edible portion. In the leaves, endosulfan sulfate occurred as the major metabolite accounting for about 50% of the TRR. Only a trace of endosulfan diol was detected.

Cucumber

A study on cucumbers *(Cucumis sativus,* variety: *Melani* F,) was performed by Buerkle in 1995. Small fruits were treated three times with 5a,9a-^{14}C -labelled endosulfan (98% purity; alpha:beta = 2) at intervals of 7 days, each time at an application rate equivalent to 530 g ai/ha (470–537 g ai/ha; of a 350EC). After treatment, the plants were grown outdoors and protected from rain by a glass roof. Leaves and fruit were sampled 0, 3, 7, and 14 days after the last treatment. The sample analysis began no later than 3 weeks after sampling. Both the leaf and fruit samples were macerated and extracted without prior rinsing. The resulting organic extract was analysed for non-polar residue components. The aqueous phase was analysed for conjugated metabolites. Quantitation of radioactivity was achieved by LSC and identification conducted by HPLC and TLC using co-chromatographed reference standards and gas chromatography with mass spectrometric detection (GC/MS).

The total radioactive residues in the leaves decreased from 185 mg /kg eq to 52 mg/kg from 0 to 14 days after the last treatment. The corresponding levels in the fruit decreased from 0.23 to 0.18 mg/kg eq. The composition of residues was determined at the last sampling time, since the metabolism was extensive at this date. The residues in cucumbers following 14 days after the third treatment with endosulfan are presented in Table 5.

Table 5. Identification of metabolites resulting from 5a, 9a-^{14}C-endosulfan in% of TRR and mg/kg after treatment at 530g ai/ha on cucumber and a PHI of 14 days.

Components	mg/kg	% of TRR
α -endosulfan	0.026	14.5
β -endosulfan	0.026	14.6
endosulfan sulfate	0.038	21.4
Sum of 3 non-polar fractions	0.017	9.5
Non-polar fraction after hydrolysis*	0.005	2.7
Sum of 2 polar fractions after hydrolysis	0.029	15.9
Non-extracted	0.020	11.4
Loss during work-up	0.018	10.2
Sum	0.180	100

* This fraction is assumed to contain the aglycones after cleavage of the conjugates

Following three treatments with endosulfan about 75% of the total radioactive residues could be extracted from the cucumbers. The major components α- and β endosulfan and endosulfan sulfate contributed approximately 50% of the total radioactive residues. The portion of conjugated

metabolites was negligible, since hydrolysis of the polar fraction did not release a significant portion of apolar compounds. Several small fractions with different polarity were detected, each of them amounting to < 0.05 mg /kg eq. In contrast, the leaves contained 9.5% endosulfan diol and 24% hydroxy endosulfan carboxylic acid, mostly conjugated as glycosides, besides the previously mentioned components in cucumbers. The proportion of non-extracted TRR was low (about 10% in cucumber and 17% in the leaves).

Sugar beet

A study in sugar beet was performed by Selzer in 2001. The nature of residues, following treatment with (6,7,8,9,10 ^{14}C)endosulfan (98% purity; alpha:beta =2), was investigated.

The test item was applied as an emulsifiable concentrate, containing 33% ai (w/w). Plants were treated twice at a 21 day interval by spraying at a rate of 630 g ai/ha at each application. At both applications the plants were in the growth stage 39 (BBCH code). Plant samples were taken shortly after the 1st and 2nd applications (14/21 days after 1st application) and at maturity (4 weeks after the 2nd application).

Plant material at maturity was divided into leaves without leaf base (“leaves"), leaf base, and tap root with swollen stem base without leaf base ("roots") prior to analysis. The residues in leaves and roots were investigated separately. Leaves were rinsed with acetonitrile/water. Aliquots of the rinsed leaves and root samples were immediately analysed for TRR and for the composition of the residues by extraction followed by radio-HPLC. Representative samples were investigated with TLC as a second independent method.

Analysis of mature plants revealed that the concentration of radioactivity was highest in leaves (5.7 mg/kg eq), whereas in roots only very low residues were found (0.09 mg/kg eq), indicating only slight translocation from leaves to roots.

In leaves, more than 93% of TRR were extractable. In total, 52% of the TRR was identified in the leaves. A further 33% of the TRR was characterised as polar radioactivity, of which approximately 8% of TRR proved to be conjugates of endosulfan diol. By a stepwise treatment of the non-extractable residues (6.7% of TRR) with enzymes and acid/alkali, most of this residue (4% of TRR) could be released.

In roots, 93% of TRR (0.081 mg/kg eq) was extractable leaving 6.6% of TRR (0.006 mg/kg eq) as non-extractable. Re-extraction of the extract with dichloromethane resulted in the partition between the aqueous phase which was not further analysed due to the low amount of radioactivity (9.2% of TRR, 0.008 mg/kg eq) and the organic phase (79.2% of TRR, 0.069 mg/kg eq).

The organo-soluble residues in roots were almost completely identified (75% of TRR) with the exception of a minor metabolite (3.9% of TRR, 0.003 mg /kg eq) which was suggested to be de-chlorinated endosulfan sulfate by HPLC-MS.

Alpha endosulfan, beta endosulfan and endosulfan sulfate were the major radioactivity components in all plant parts. Endosulfan sulfate was the major metabolite of the extractable radioactivity in all cases.

The following summary table gives an overview on the total radioactive residues in leaves 21 days after the 1st treatment (representative for single application) and also of the TRR in leaves and roots at the final harvest 28 days after the 2nd application.

Table 6. Identification of metabolites resulting from [6,7,8,9,10-^{14}C]-endosulfan treatment at 630g ai/ha on sugar beet.

	% of TRR	Concentration [mg/kg eq]
Leaves (without leaf base), 21 days after 1st application, intermediate sample		
	100	2.02
Rinsing	16.29	0.33
HPLC Analysis		

Endosulfan diol	0.18	< 0.01 (0.004)
β-endosulfan	8.03	0.16
α-endosulfan	4.54	0.09
Extractable	67.46	1.36
(aqueous phase) Endosulfan diol	8.23	0.17
Endosulfan sulfate	21.72	0.44
β-endosulfan	3.96	e0.08
α-endosulfan	3.58	0.07
Total sum identified	50.24	1.02
Non-extractable residues	16.25	0.33
Releasable by enzyme/ NaOH treatment	5.64	0.11
Leaves (without leaf base), 28 days after 2nd application, final harvest		
	100	5.73
Rinsing	8.72	0.50
Endosulfan diol	0.20	0.01
Endosulfan sulfate	0.25	0.01
β-endosulfan	4.70	0.27
α-endosulfan	1.95	0.11
Extractable	84.60	4.85
Aqueous phase	32.73	1.87
HPLC Analysis after hydrolysis of the aqueous phase		
Endosulfan diol AEF051329*	8.11	0.46
Organic phase	46.68	2.67
Endosulfan diol	0.91	0.05
Endosulfan sulfate	33.09	1.89
β-endosulfan	6.90	0.39
α-endosulfan	3.77	0.21
Total sum identified	51.77	2.96
Non-extractable residues	6.69	0.38
Releasable by enzyme/ NaOH treatment	3.97	0.23
* released by acid hydrolysis indicating acid labile conjugates of Endosulfan diol in the aqueous phase; this value is not included in the total sum identified in the table		
Roots (beets), 28 days after 2nd application, final harvest		
	% of TRR	Concentration [mg/kg eq]
	100	0.087
Extractable	93.38	0.081
Aqueous phase	9.19	0.006
Organic phase	79.15	0.069
HPLC Analysis		
Endosulfan sulfate	59.65	0.052
β-endosulfan	4.06	0.004
α-endosulfan	11.60	0.01
Total sum identified	75.32	0.066
Non-extractable residues	6.62	0.006

Soybean

A study in soybeans was performed by Mislankar and Tull in 2003. The soybeans were treated with two applications of 530 g ai/ha, equivalent to the annual maximum of 1060 g ai/ha (6,7,8,9,10 ^{14}C) labelled as previously described (alpha:beta =2). Applications were made at forage stage 61 days before harvest and at hay stage 38 days before harvest.

Soybean (seed) samples were analysed in duplicate at maturity to determine the metabolic profile of the endosulfan. Soybeans (forage and hay) were also analysed at intermediate time points to establish the trend in metabolism. These time points included Day 0 (immediately post-treatment at R5, forage stage) and day 23 (prior to the second application at R6.5, hay stage).

The residue in the day zero soybean forage was recovered by acetonitrile surface wash and acetonitrile extraction. Residue remaining in the extracted fibre was measured by combustion. Residues in hay and beans were extracted; the remaining fibre was combusted to determine non-

extractable radioactive residue. Metabolites in the extracted component were identified by retention time comparison with authentic standards. The identities were confirmed by MS.

The total residue in forage samples at day 0 was 21.6 mg/kg eq, but after 23 days (prior to second application) this had declined to 0.54 mg/kg eq. The residue at final harvest in beans (Day 61) was 0.47 mg/kg eq.

The majority of residue at all time points was solvent extractable. In forage at day 0, the residue remained principally on the leaf surface and 16 mg/kg eq was recovered in the wash. The rest (4.95 mg/kg eq) was extractable with acetonitrile, for a total of 21.2 mg/kg eq.

In hay samples 87.0% of the TRR was extractable with acetonitrile (acetonitrile:water = 80:20). Similarly, in beans, 95.0% of the TRR was extractable with acetonitrile.

Table 7. Distribution of ^{14}C-endosulfan as% of TRR and mg/kg eq in the different parts of the plant.

Harvest time	Total residue (mg/kg eq)	Surface Wash Residue		Extractable Residue		Non extractable residue	
		% TRR	mg/kg eq	% TRR	mg/kg eq	% TRR	mg/kg eq
Day 0 Forage	21.5	75.4	16.3	23.0	4.9	1.6	0.34
Day 23 Hay	0.54	NA	NA	87.0	0.47	13.1	0.068
Day 61 Beans	0.47	NA	NA	94.5	0.45	5.6	0.026

Table 8. Characterisation of 6, 7, 8, 9, 10-u-^{14}C-endosulfan in% of the TRR after treatment at 0.53 kg ai/ha on soybean.

Plant part	Days after the last treatment	extractable	Alpha-endosulfan	Beta-endosulfan	endosulfan sulfate	total identified	Non-extracted
forage	0	98.4	61.2	36.8	0.3	98.3	1.6
hay	23	87	1.3	4	51.2	56.5 *	13.1
beans	61	94.5	1.5	5.3	78.4	85.2	5.6

*) Remainder of extracted material consisted of multiple water soluble components, none of which accounted for more than 0.05 ppm or 10% of TRR.

Non-extracted radioactivity was very low in forage and beans and it accounted for a maximum of 2% and 6.0%, respectively. In one hay sample non-extracted radioactivity accounted for 13.1% of the TRR. This was further subjected to hydrolysis with strong acid and base. The non-extracted radioactivity in hay accounted for 2% of the TRR.

The predominant residues found in plant material examined in these metabolism studies include parent endosulfan, both alpha and beta isomers, as well as endosulfan sulfate.

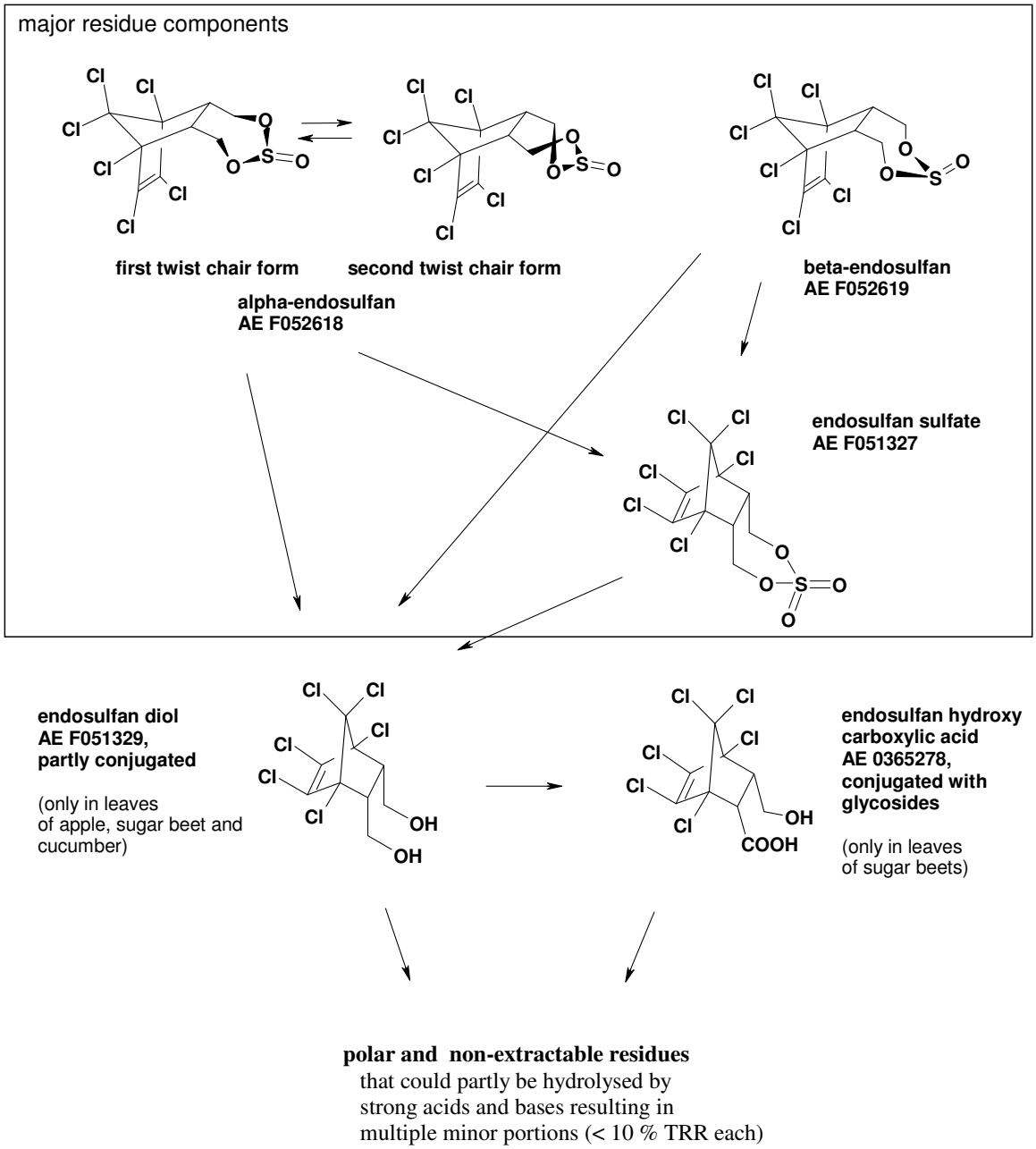


Figure 2. Metabolic pathway of endosulfan in plants (tomato, apple, sugar beet, cucumber and soybean).

Environmental fate in soil

The Meeting received information on the aerobic degradation, soil accumulation, hydrolysis, degradation in water and sediment systems and rotational crops.

Aerobic degradation (fate)

The aerobic degradation of endosulfan in soil was investigated in three laboratory studies with the ^{14}C-labelled parent isomers in the original ratio alpha-to-beta of approx. 2 to 1. An extra study was conducted with the major soil metabolite endosulfan sulfate.

In the first study, the isomeric endosulfan mixture (5a,9a-^{14}C, dioxothiepin-labelled) was applied to a silt loam and a loamy sand soil at a dose corresponding to a field rate of 2.63 kg ai/ha (Gildemeister and Jordan, 1984). After 60 days of incubation at 22 ± 2°C in the dark the composition of radioactive residues was similar in both soils consisted of a low contribution of the parent isomers (more beta than alpha isomer) while endosulfan sulfate was the main metabolite. Approximately 25–50% of applied radioactivity was not extractable.

A second study was conducted with 6,7,8,9,10-^{14}C labelled (bicyclic ring labelled) endosulfan (98% purity; alpha:beta = 2) in a sandy loam soil at 28 ± 2°C with an application rate corresponding to 2.6 kg ai/ha (Stumpf *et al*., 1988). Under comparable conditions as described above, the residues were also similar with a significant decrease of the parent, while endosulfan sulfate was the major soil metabolite found.

In a third soil metabolism study, 6,7,8,9,10-^{14}C labelled (bicyclic ring labelled) endosulfan was applied to five different soils (sandy loam SLV, loamy sand LS 2.2, silt loam SL2, sandy loam F821, sandy loam SLG; soil types according to USDA) and incubated for a maximum of 365 days at 21 ± 2°C in the darkness (Stumpf *et al*., 1995). In all soils the major metabolite was endosulfan sulfate which was subsequently degraded to the minor metabolites endosulfan diol, endosulfan lactone and other polar degradates, all of which amounting to less than 10% of applied radioactivity. The non-extractable residues amounted to 10–34% of applied radioactivity at the end of the study. The mineralization was observed to be very low in this study.

While the microbial activity significantly decreased after 3–4 months of incubation, the study does not represent field conditions.

Subsequently a special soil metabolism study was conducted with endosulfan sulphate (6,7,8,9,10 -^{14}C-labelled, bicyclic ring labelled) to four different soils (sandy loam LS 2.2, silty clay loam HE, loam SP, silt loam SLS) for a total incubation period of up to 365 days at 20 ± 2°C (Schnoeder, 2002 a,b,). The application rate of endosulfan sulfate corresponded to 0.84 kg ai/ha.

The mineralization rate at the end of the study, 365 days after application, was significant: 35% of applied radioactivity in LS 2.2, 16.7% in HE, 5% in SP and 23.4% in SLS indicating the complete degradation of the chlorinated ring structure. The non-extractable residues amounted to 25 – 33% of the applied radioactivity after 365 days of incubation. The expected soil metabolites endosulfan diol, endosulfan lactone and endosulfan hydroxy carboxylic acid were not detected at any time. However, a new polar metabolite was detected at 2–16% of the applied endosulfan sulfate in the four soils. This metabolite could not be identified but could be characterised as being more polar than the identified metabolites and containing at least one carboxylic group.

Table 9. Identification of metabolites resulting from [6,7,8,9,10-U-^{14}C]-endosulfan treatment in soil.

Name of metabolite	Max. concentration (% of AR)	Report
Endosulfan sulfate	45.1% at day 30 34.7% at day 30 51-68% at days 59-120 in 4 soils and 77% at day 365 in 1 soil*)	Gildemeister, Jordan (1984) A29680 Stumpf (1988) A39429 Stumpf et al. (1995) A53618
Endosulfan diol	Sporadic (0.3%)	Stumpf (1988) A39429
	0.2-8.5% at days 120 to 365*)	Stumpf et al. (1995) A53618
Endosulfan lactone	1.0% at day 30	Gildemeister, Jordan (1984) A29680
	0.3-2.5% at days 59 to 240	Stumpf et al. (1995) A53618
Endosulfan ether	0.8% at days 8 and 30	Gildemeister, Jordan (1984) A29680
	Sporadic (0.6%)	Stumpf (1988) A39429

* Artificially increased portion due to drastic decrease of the biomass after approx. 4 months.

The degradation of endosulfan in soil is initiated through oxidation resulting in formation of the main metabolite, endosulfan sulphate.

Subsequent microbially induced hydrolysis of the sulfite diester (of endosulfan) and sulfate diester (of endosulfan sulfate) leads to ring opening of the 7-membered ring and formation of endosulfan diol. The endosulfan diol can be condensed to endosulfan ether (minor pathway) or oxidised to endosulfan hydroxy carboxylic acid and its condensation product endosulfan lactone. The chlorinated bicyclic carbon skeleton was shown to be completely degraded by considerable formation of labelled carbon dioxide in the soil metabolism study with ring labelled endosulfan sulfate.

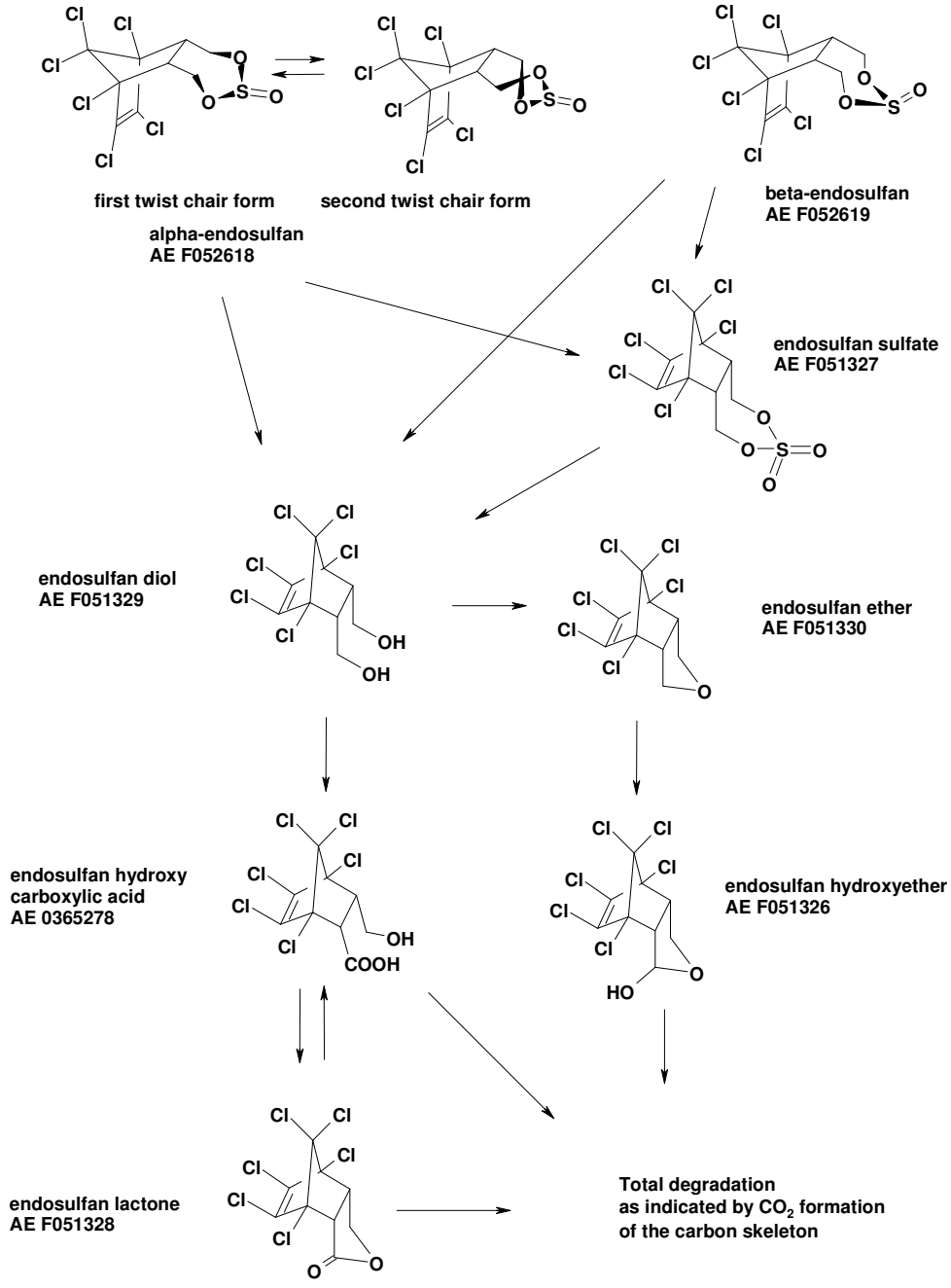


Figure 3. Proposed metabolic pathways for the degradation of endosulfan in soil and surface water.

Aerobic degradation (rate)

Laboratory conditions

Soil samples were taken from fields (Stumpf *et al*., 1995). Sieved (< 2mm) 50 or 100 g samples (dry weight) were adjusted to the intended moisture content (usually 40% of the maximum water holding capacity). The radioactive test substance was dissolved and aliquoted into the samples at a rate representing the maximum field application rate. The treated soil samples were stored in the dark at the intended temperature. During storage, radiolabelled CO_2 and other volatiles were trapped. At selected time periods the complete soil samples (usually two replicates per sampling time) were extracted with a mixture of acetonitrile and water. The extracted radioactivity was measured by LSC, with identification proceeding with liquid chromatography (TLC, reversed phase HPLC) through co-chromatography with authentic reference substances and by MS.

Laboratory studies were provided which investigated the metabolic pathway of endosulfan degradation. The half lives were calculated for the individual isomers and the sum of the endosulfan isomers assuming single first order kinetics. In addition, a half life was also given for the sum of parent endosulfan and the main soil metabolite endosulfan sulfate, as this metabolite is generally included in the residue definition.(Table 10).

The soil metabolism studies in the laboratory primarily served to disclose the metabolites of endosulfan in soil rather than to derive a realistic figure of the degradation half lives. This was due to the partial decrease of the microbial biomass and degradation capacity during incubation periods longer than 3 to 4 months. As a consequence, the degradation half lives determined in field dissipation studies are more realistic and reliable (see Table 11).

Table 10. Degradation half lives of endosulfan under laboratory conditions (days).

Soil	Incub. Temp. (°C)	DT50 α-endosulfan	DT50 β-endosulfan	DT50 α +β endosulfan -	DT50 endosulfan sulfate	Report
silt loam	22 ± 2			25.6*)		Gildemeister, Jordan (1984) A29680
loamy sand				37.6*)		
sandy loam	28 ± 2	23	58	37	100-150	Stumpf (1988) A39429
sandy loam	21 ± 2	12	158**)	98		Stumpf et al. (1995) A53618
loamy sand		39	264**)	128**)		
silt loam		19	132**)	90		
sandy loam		<10	108**)	92		
sandy loam		14	115**)	80		
sandy loam***)	20 ± 2				117	Schnoeder (2002) C019647 and C020629 (fortified with field fresh soil every 3 months)
silty clay loam					138	
loam					412****)	
silt loam					134	

*) Recalculated from the decreasing residue levels given in the report

**) The DT50 values for beta and partly for parent sum of Endosulfan are artificially increased, as the microbial biomass and consequently the degradation capacity of the soil samples significantly decreased after 3-4 months of incubation. Therefore, DT50 values from field dissipation studies are more reliable.

***) Soil types according to the USDA

****) Outlier, because the DT50 of Endosulfan sulfate was determined as 75.2 days in a field trial, which was conducted at that field, where this soil was sampled for the lab study.

Field conditions

In all field trials, the predominant portion of endosulfan and endosulfan sulfate residues were detected in the upper 5 cm soil layer indicating very low mobility in soil. Relevant trials are summarised in Table 11.

Table 11. Rate of degradation of α +β endosulfan and endosulfan sulfate in soil under field conditions.

Appl. rate [kg ai/ha]	Time schedule	Soil type*		DT50 (days)	DT90 (days)	Report
α +β endosulfan						
0.84	7/ 2000 - 4/ 2001	loam pH 5.8	cotton (application before emergence)	7.4**)	24.6**)	Hardy (2001) C015651: Spain
0.84	6/ 2000 – 6/ 2001	silt soil pH 7.7	cotton (application before emergence)	21**)	70**)	Balluff (2001) C018180 Greece
5x0.56 with 7-day intervals	8/ 1987 – 3/ 1989	sandy soil pH 4.1-6.4	tomato bare ground	75.9***) 89.6***)	252***) 298***)	Hacker (1989) A42193Georgia, USA
2x1.68 with a 29-day interval	June 1987 – Dec. 1988	loam – clay loam pH 6.7-6-9	cotton bare ground	92.9***) 89.5***)	309***) 207.5***)	Mester (1990) A42997 California, USA
Appl. rate [kg ai/ha]	Time schedule	Soil type*		DT50 (days)	DT90 (days)	Report
2x1.68 with a 29-day interval	July 1990 – Jan. 1992	loamy sand pH 6.8-7.8	cotton bare ground	alpha: 6-7 beta: 19-63 alpha: 6-11 beta: 23-36		Czarnecki & Mayasich (1992) A51819 California, USA
endosulfan sulfate						
0.84	July 2000 - April 2001	loam pH 5.8	cotton (application before emergence)	75.2	249.7	Hardy (2001) C015651 Spain
0.84	June 2000 – June 2001	silt soil pH 7.7	cotton (application before emergence)	161 or 46.8****)	536 or 156****)	Balluff (2001) C018180 Greece

*) Soil type according to USDA

**) Re-calculated assuming simple first order kinetics evaluation without the first day after application to exclude loss by volatilisation

***) Unexpected long DT values because the latest application was made late in season when cool fall and winter temperatures dominate (explanation by the author of report).

****) Alternative DT values depending on the evaluation: Inclusion of the slightly increased sulfate level at day 277 results in DT50/90 = 161/536 days, exclusion of the day 277 results in DT50/90 = 46.8/156 days.

The parent endosulfan (alpha and beta isomers in the ratio of approx. 2 to 1) degraded in soil with a half life in the range of 25–40 days at a temperature of 22°C according to the lab study of Gildemeister and Jordan (1984). In the field, however, the degradation half life was shortened to 7–21 days under southern European summer conditions (Hardy, 2001 and Balluff, 2001). However, at colder autumn and winter temperatures, the half life was increased to 75–93 days (Hacker, 1989 and Mester, 1990).

It appears that the alpha isomer degrades slightly faster (with a half life of 6–11 days) than the beta isomer (with a half life of 19–36 days) in the field (Czarnecki and Mayasich, 1992).

The main metabolite endosulfan sulfate degraded in soil with a half life of 117–138 days at 20°C in the laboratory (Schnoeder, 2002). In the field, a degradation half life was in the range of 75 to 161 days under southern European summer conditions (Hardy, 2001 and Balluff, 2001).

Soil accumulation

Endosulfan was applied to an apple orchard in the Netherlands three times per year with 14–35 day intervals over four subsequent years at a rate of 0.71 kg ai/ha (Tiirmaa *et al*., 1993). The soil of the orchard, a loamy clay with a pH of 6.6–6.8, was repeatedly sampled up to 1 year after the last application within and between the tree rows.

In spite of showing a great variation of residues in the individual soil samples, mean and plateau levels could be derived. Between the tree rows, these levels amounted to approx. 0.1 mg total residues (alpha + beta endosulfan + endosulfan sulfate + endosulfan diol) per kg soil during the first year and approx. 0.2 mg/kg total residues between the second and the fourth year of application in the upper 10 cm soil layer followed by a decrease after termination of the applications. In the tree rows, the mean residue levels amounted to 0.15 mg total residues/kg during the first year and to approximately 0.3 mg total residues/kg between the second and the fourth year of application in the upper 10 cm soil layer followed by a decrease after termination.

The residues consisted predominantly of endosulfan sulfate, a smaller proportion of beta endosulfan and very low levels of alpha endosulfan. Endosulfan diol only occasionally appeared at the level of the LOQ (0.01 mg/kg). Most of the residues were detected in the upper 5 cm layer. Residues below 10 cm were negligible.

In summary, this multi-year study showed only a slight increase, from the residue level of the first year, to form a relatively constant plateau level in the subsequent years, even in northern Europe with cold to moderate temperatures. This level again decreased following termination of the application.

In biologically active soil, endosulfan was degraded via oxidation to the main soil metabolite endosulfan sulfate, followed by hydrolysis to the minor metabolite endosulfan diol which was subsequently further oxidised. The chlorinated bicyclic carbon skeleton has been shown to be completely degraded by stoichiometric production of carbon dioxide formed from the ring carbon atoms.

Under warm to moderate conditions in the field (southern Europe), endosulfan degraded moderately. A detailed review indicates that the degradation half life of alpha endosulfan is shorter than that of the beta isomer. The main soil metabolite endosulfan sulfate is more persistent than the isomers of the parent, and degrades with a half life of approximately 75–161 days, depending on the evaluation conditions. Other metabolites only appear at low levels in soil and are deemed to be not relevant.

Hydrolysis

Two studies (Gorlitz, 1982 and 1989) were submitted on the abiotic hydrolysis of alpha and beta endosulfan. The parent isomers were incubated in sterile buffer solution at constant temperatures. The results are given in Table 12.

Soil hydrolysis would only play a role under very alkaline and moist conditions where the half life of hydrolysis is shorter than the half life of microbial degradation in soil. In the summer, the upper soil layer can dry out and hydrolysis (and microbial degradation) is reduced. Irrigation and precipitation can accelerate both degradation processes, but in soil, microbial degradation is more prominent.

Table 12. Half lives of sterile hydrolysis of alpha and beta endosulfan at different pH values.

Isomer	T in °C	pH 5	pH 7	pH 9	Report
alpha	22	> 1 year	22 days	7.0 hours	Goerlitz & Kloeckner, 1982, A31069
beta		> 1 year	17 days	5.1 hours	
alpha	25	> 200 days	19 days	6.2 hours	Goerlitz & Rutz, 1988,

Isomer	T in °C	pH 5	pH 7	pH 9	Report
beta		> 200 days	10.7 days	4.1 hours	A40003

Endosulfan-diol was identified as the only hydrolysis product.

Degradation in water/sediment systems

Two studies on the behaviour of radiolabelled endosulfan in water-sediment systems were submitted. In the first study, endosulfan was incubated in two natural water-sediment systems at a pH of 7.3 and 7.8 at 22 ± 2°C for 51 days (Gildemeister, 1983 and addendum Stumpf, 1990). Endosulfan rapidly disappeared from the water body by adsorption to the sediment and oxidation to endosulfan sulfate and hydrolysis to endosulfan diol. Finally endosulfan hydroxy carboxylic acid was formed.

In the second study, radiolabelled endosulfan was incubated at a pH range of 7.2–8.2 also in two natural water-sediment systems up to 120 days at 20 ± 2°C (Jonas, 2002). This study yielded similar results. A rapid disappearance from the water body was observed with the concomitant formation of the above mentioned metabolites. This was followed by formation of a moderate portion of residues which were non-extractable from the sediment (8.7–19.0% of the applied radioactivity (AR) after 120 days of incubation) and partial mineralization (1.5% of AR).

The maximum portion of the metabolites and the day of reaching the maximum are shown in Table 13.

Table 13. Identification of metabolites of endosulfan in water and sediment. The incubation day of maximum appearance is added in brackets.

Name of metabolite	Max. concentration (% of AR/day of max.)	Report
Endosulfan sulfate	water body:24.1 (8) and 57.6 (0) sediment:16.2 (8) and 12.2 (16)	Gildemeister, (1983) A31182 and Stumpf, (1990), A44231
	water body:8 (3) and 5.3 (58) sediment:0 (120) and 22.3 (120)	Jonas, (2002) C022921,
Endosulfan diol	sporadically water body:2.4 (51) and 2.3 (32) sediment:not detectable	Gildemeister, (1983) A31182 and Stumpf, (1990), A44231
	water body:35.0 (2) and 23.6 (3) sediment:41.5 (10) and 12.4 (10)	Jonas, (2002) C022921
Endosulfan lactone	water body: 1.2 (4 and 8) and 1.6 (2) sediment:not detectable	Gildemeister, (1983) A31182 and Stumpf, (1990), A44231
	water body:0.1 (93) and 0.3 (120) sediment:3.1 (58) and 0.7 (120)	Jonas, (2002) C022921
Endosulfan hydroxy carboxylic acid	water body:24.7 (16) and 28.4 (16) sediment:4.0 (32) and 3.1 (51)	Gildemeister, (1983) A31182 and Stumpf, (1990), A44231
	water body:32.9 (93) and 44.3 (93) sediment:not detectable	Jonas, (2002) C022921

The major metabolites of endosulfan in surface water were: endosulfan sulfate, endosulfan diol and endosulfan hydroxy carboxylic acid. In the sediment, the major metabolites of endosulfan were endosulfan sulfate and endosulfan diol.

Rate of degradation in water and sediment

Different half lives could be derived for the disappearance of endosulfan and its metabolites from the water body and the total water-sediment system. The dissipation rates of the parent isomers can be directly derived from the basic water sediment reports (Gildemeister, 1983 and addendum Stumpf, 1990; Jonas, 2002). For degradation rates of the metabolites, a kinetic modelling of the residue levels in water and sediment of the study of Jonas was conducted (Hammel, 2004).

The resulting dissipation (transfer to another compartment, i.e., adsorption of dissolved residues by the sediment) and degradation (disappearance by chemical/microbial transformation) rates are given in the table below.

Table 14. Dissipation and degradation half lives of endosulfan and its metabolites in water and sediment.

System	Temp (°C)	pH	Dissipation: DT50 (α +β endosulfan) from the water body	Degradation:DT50 (α +β endosulfan) in the total system	Report
α +β endosulfan					
River Main Gravel pit	22 ± 2 22 ± 2	7.3 7.8	< 1 day < 1day	12 days 10 days	Gildemeister, (1983) A31182 and Stumpf, (1990), A44231
Krempe (stream in a marsh area) Ohlau (stream surrounded by pastures)	20 ± 2	7.5 – 8.2 7.2 – 8.2	0.7 days 1.6 days	3.3 days 15.8 days	Jonas (2002), C022921
Kinetic modelling of numerically combined data of Krempe and Ohlau					
Endosulfan	20 ± 2	7.2 – 8.2		38.0 days	Hammel (2004), C042131
Endosulfan sulfate	20 ± 2	7.2 – 8.2		53.2 days	Hammel (2004), C042131
Endosulfan diol	20 ± 2	7.2 – 8.2		29.5 days	Hammel (2004), C042131
Endosulfan hydroxy carboxylic acid	20 ± 2	7.2 – 8.2		106.4 days	Hammel (2004), C042131

Endosulfan was stable under abiotic hydrolysis in acid conditions. However, the half life through hydrolysis decreased significantly as the pH-value increased.

In a surface-water system, endosulfan disappeared very rapidly from the water body by partition to the sediment with a dissipation half life of < 1 to 1.6 days. The microbial degradation in the total water-sediment system occurred at a moderate rate, the half life dependant on the evaluation method used. Assuming single first order degradation kinetics, the degradation half life was in the range 3.3–15.8 days. Using a more complex partition and degradation model (ACSL) the degradation half life determined was 38 days for the combined parent isomers.

In summary endosulfan was degraded in natural surface water and sediment via the major metabolites endosulfan sulfate, endosulfan diol and endosulfan hydroxy carboxylic acid. These metabolites were degraded with half lives between 29.5 and 106.4 days, with the formation of a small amount of non-extractable residues and carbon dioxide.

Residues in succeeding crops

The Meeting received endosulfan residues studies in succeeding crops. The study by Krebs *et al*., (1986) investigated three crops spinach, radish and carrots which were sown into a field plot directly after application of endosulfan.

The formulation was sprayed on three field plots (4 x 25 m^2) in 1985 at an application rate equivalent to 18.8 L of formulation/ha. The study was conducted at an exaggerated rate of 6.6 kg ai/ha which is between 2 to 6× that of the current maximum application rate. The pesticide was incorporated in the plough layer (0 - 25 cm) by grubbing, ploughing and agitation with a Rotavapor. Immediately after this tillage, spinach *(Spinacia oleracea,* variety *Matador),* carrot *(Daucus carota ssp. sativa,* variety *Duwicker)* and little radish *(Raphanus sativus, var. sativa,* variety *Sora*) were sown with a hand seed drill and grown till harvest. Plant samples and soil from the corresponding plot (0 - 20 cm) were taken at the following intervals: spinach and little radish: 0, 28, and 42 days after

treatment and sowing; carrot: 0, 106, and 133 days after soil treatment and sowing. The samples were analysed for α- and β-endosulfan and endosulfan sulfate using the residue method (AL 9/83 of Hoechst AG).

Table 15. Total endosulfan residues in mg/kg on crops rotated immediately after soil treatment at a rate of 6.6 kg ai/ha.

Crop	Days after soil treatment and sowing	Residues in soil [mg/kg]	Residues in Leaf [mg/kg]	Residues in Root /tuber[mg/kg]
Spinach	0	0.24	-	-
	28	0.13	0.19	-
	42	0.44	0.16	-
Carrot	0	0.58	-	-
	106	0.62	0.2	0.3
	133	0.96	0.14	0.18
Little radish	0	0.96	-	-
	28	0.54	0.06	0.052
	42	0.66	0.025	0.05

The total endosulfan residues in soil varied considerably even at day 0 probably due to incomplete incorporation in the soil. Nevertheless, a general finding could be observed. The residues in the plants were always lower than the corresponding soil residues (with one exception: spinach on day 28, probably due to an outlier of the corresponding soil residue).

With the data given above, uptake factors were estimated, i.e., the ratio of residues between soil and plant. The results of this calculation are given in Table 16.

Table 16. Uptake factors for Endosulfan (ratio of the residues in crop/soil).

Crop	Days after Application	Leaf	Root/Tuber
Spinach	42	0.36	-
Carrot	133	0.14	0.19
Little radish	42	0.04	0.08

In summary, the endosulfan residues taken up by root and leafy crops, which were sown immediately after soil treatment at a 6× application rate, were generally lower than the corresponding residues in soil.

RESIDUE ANALYSIS

Analytical methods

The Meeting received descriptions and validation data of analytical methods for endosulfan (α and β) and the metabolite endosulfan sulfate residues in crops, animal commodities, soil and water. Special methods were made available that could determine further minor metabolites such as endosulfan diol, endosulfan lactone or endosulfan hydroxyether.

The principle of most methods involves a solvent extraction step such as acetone, acetonitrile followed by different matrix dependant clean up steps such as GPC, Florisil or silica gel column chromatography. The final determination is carried out by GC mostly with ECD detection.

The Dutch multiresidue method MRM-1 (anonymous) has a reported limit of quantitation (LOQ) of 0.02 mg/kg for each component. This method was also adopted as AL 60/86 (Werner *et al*., 1987) for the analysis of soil and body fluids. For soil a lower limit of the practical working range of 0.01 mg/kg was validated (Seefeld, 1990).

As a confirmatory method, GC-MS detection can be used as described in Multi-residue method 1 in Part 1 of "Analytical methods for Pesticide Residue in Foodstuffs (Working Group for the Development and Improvement of Residue-analytical Methods, 1996).

The method described in report 95-0061 (Huff and Winkler, 1997) is recommended for the analysis of animal tissues.

Table 17. Summary of analytical method.

Sample material Sample type	Matrix	Method of analysis	LOQ	Reference Author, Year
Plant				
Potato	tuber	extraction acetone or acetone+dichloromethane+petroleum ether detection GC ECD	0.02 mg/kg α-endosulfan, β-endosulfan and endosulfan sulfate	Martens, R. 1998a Analytical method and validation for the determination of residues of endosulfan and deltamethrin by GC. Date: 8/24/98. Hoechst Schering AgrEvo GmbH, Frankfurt am Main. Agredoc No.: C000413. Report No: DGMF01/97-0. Unpublished. Amendment: Martens, R. 1998b. Deltamethrin, endosulfan, AE F032640, AE F002671.Date: 11/30/98.Agredoc No: C001652. Amendment to Report No: DGMF01/97-0. R. Unpublished.
Peach	fruit			
Onions Rape seed	vegetable oilseed			
Cucumber	fruiting vegetable	extraction and detection as above	0.02 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Martens, R. 1998c. Validation of analytical method DGM F01/97-0 for residues of endosulfan and deltamethrin in cucumber, orange, melon and tomato. Date: 11/18/1998. Hoechst Schering AgrEvo GmbH, Frankfurt am Main. Agredoc No.: C001152. Report No.: CR97/027.
Orange	fruit			
Tomato	fruiting vegetable			
Melon	fruiting vegetable			
Wheat	cereals (grain)	extraction and detection as above	0.02 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Martens, R. 2000b. Validation of analytical method DGM F01/97-0 for dry crops (grain). Date: 4/3/2000. Hoechst Schering AgrEvo GmbH, Frankfurt am Main. Agredoc No.: C006935. Report No.: CR99/025. Unpublished
Citrus	fruit	extraction and detection as above	0.02 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Martens, R. 2000a. Data generation and enforcement method for residues on plant material by GC. Date: 3/28/00. Aventis CropScience. Agredoc No.: C007949. Report No.: DGM F01/97-1. Unpublished.
Peach	fruit			
Tomato	fruiting vegetable			
Sugar beet	Root, tuber			
Oranges	fruit	extraction and detection as above	0.02 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Haines, B.K., 2001. Independent Laboratory Validation for the Determination of Residues of deltamethrin in Lettuce, Oranges, Milk and Fat, and endosulfan in Lettuce and Oranges Using Method DGM F01/97-1. Date: 3.29.01. Xenos Laboratories, Inc., Ottawa, Ontario, Canada. Agredoc No.: B003259
Lettuce	leafy vegetable			
Cotton	oilseed	extraction cyclohexane+ethyl acetate GC-ECD GC-NPD	0.02 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Wrede, A. 2002. Analytical method and validation of endosulfan in cotton by GC-MSD Code: AE F002671. Date: 5/21/2002. Aventis CropScience GmbH, Frankfurt am Main. Germany. Agredoc No.: C022533. Report No.: AM 02/03
Grape Tomato potato	processed product	extraction acetone/wate65/35 partition dichloromethane petroleum ether clean up florisil GC/ECD	0.25 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Winkler, D.A. 1997. Freezer Storage Stability of Endosulfan (α ,β and Sulfate) On Crop Raw Agricultural Commodities and Processed Commodities. Date: 9/29/97. Agredoc No.: A57831. Report No.: EN-CAS # 95-0072. Unpublished

Sample material Sample type	Matrix	Method of analysis	LOQ	Reference Author, Year
Animal matrices				
Milk		extraction acetone+dichloromethane+petroleum ether detection GC ECD	0.02 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Haines, B.K., 2001. see above
Milk Egg Fat, Liver Muscle		extraction petroleum ether+ acetone 75/25 detection GC ECD Confirmation GC/MSD	0.025 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Huff, D.K. and Winkler, D.A. 1997. Validation of the analytical method in animal tissues, egg (white and yolk) and dairy matrices based upon FDA pesticide analytical manual, volume I multi-residue methodology for the determination of endosulfan (alpha, beta and sulfate). Date: 11/13/97. EN-CAS Analytical Laboratories, Winston-Salem, NC. Agredoc No.: A57847. Report No.: 95-0061. Reg. No.: 44427601
Milk, Egg Liver and Muscle		GC/ECD	0.25 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Winkler, D.A. 1998a. Freezer Storage Stability of Endosulfan (α ,β and Sulfate) On Animal Tissue and Dairy Matrices. Date: 6/22/98. Agredoc No.: A67512. Report No.: EN-CAS # 96-0046. Unpublished
Soil		extraction with acetone partition with dichloromethane GC/ECD	0.01 mg/kg α-endosulfan, β-endosulfan endosulfan sulfate	Seefeld, F. 1990. Validation report. Analysis of endosulfan residues in soil. Date: 12/10/90. Biologische Zentralanstalt Berlin, Kleinmachnow. Agredoc No.: C008891. Report No.: Oec11/90

Plant matrices

The method of analysis (Martens, 1998a, b) is based on the Dutch multiresidue method MRM-1, and describes the quantification of residues of endosulfan. The relevant residue of endosulfan consists of α-endosulfan, β-endosulfan and endosulfan sulfate. Basic validation data for potatoes, peaches, onions and rape seed were reported as well as recovery data from supervised residue trials where a modified version of this method was applied.

In the basic validation, all compounds were extracted from matrices with acetone followed by dichloromethane/petroleum ether (1/1 v/v). Later, for the analysis of samples from field trials, this extraction was simplified by taking a mixture of acetone/dichloromethane/petroleum ether (1:1:1 v/v/v). The extract was centrifuged and cleaned-up via gel permeation chromatography (GPC) and mini silica gel column. Analytes were determined by GC with ECD detection.

Table 18. Basic validation, recoveries in potato (tuber), peach, onions and rape seed.

Analyte	Fortification Level (mg/kg)	Mean Recovery (%)	RSD (%)	N	Overall mean recovery, RSD
Potatoes tuber					
α-endosulfan	0.02	84	4.3	5	84%
	0.2	85	5.2	5	RSD 4.5
β-endosulfan	0.02	89	4.4	5	89%
	0.2	90	8.2	5	RSD 6.3
Endosulfan sulfate	0.02	78	2.9	5	86%
	0.2	94	5.3	5	RSD 11.1
Peaches					
α-endosulfan	0.02	91	14.9	5	91%
	0.2	92	4.3	5	RSD 10.3
β-endosulfan	0.02	85	8.2	5	90%
	0.2	96	3.4	5	RSD 8.8
Endosulfan sulfate	0.02	86	7.8	5	92%
	0.2	98	2.6	5	RSD 10

Analyte	Fortification Level (mg/kg)	Mean Recovery (%)	RSD (%)	N	Overall mean recovery, RSD
Onions					
α-endosulfan	0.02	80	7.0	5	82%
	0.2	83	3.4	5	RSD 5.5
β-endosulfan	0.02	80	3.8	5	83%
	0.2	86	2.8	5	RSD5
Endosulfan sulfate	0.02	83	7.5	5	87%
	0.2	90	4.2	5	RSD 7
Rape seed					
α-endosulfan	0.02	78	6.4	5	86%
	0.2	94	1.7	5	RSD 10.5
β-endosulfan	0.02	87	2.9	5	89%
	0.2	91	3.1	5	RSD3.8
Endosulfan sulfate	0.02	81	12.2	5	88%
	0.2	95	3.0	5	RSD11.4

The report provides further validation of the method DGM F01/97-0 (Martens) for cucumber, orange, melon and tomato. All compounds were extracted from matrices with acetone followed by dichloromethane/petroleum ether (1:1 v/v). After centrifugation and cleanup via GPC and mini silica-gel column, the analytes were determined by GC/ECD.

Table 19. Basic validation, recoveries in cucumber, orange, melon and tomato.

Analyte	Fortification Level (mg/kg)	Mean Recovery(%)	RSD (%)	N	Overall mean recovery, RSD
Cucumber					
α-endosulfan	0.02	106	4.3	5	101%
	0.2	95	2.0	5	RSD 6.5
β-endosulfan	0.02	109	4.9	5	103%
	0.2	97	2.8	5	RSD 7.5
Endosulfan sulfate	0.02	107	4.2	5	101%
	0.2	96	2.3	5	RSD 6.7
Orange peel					
α-endosulfan	0.02	72	3.2	5	76%
	0.2	80	3.0	5	RSD 6.4
β-endosulfan	0.02	84	5.1	5	83%
	0.2	83	3.6	5	RSD 4.1
Endosulfan sulfate	0.02	104	13.1	5	96%
	0.2	88	5.9	5	RSD 13.6
Orange pulp					
α-endosulfan	0.02	67	2.7	5	73%
	0.2	79	4.1	5	RSD9.3
β-endosulfan	0.02	75	5.1	5	78%
	0.2	82	7.9	5	RSD 7.7
Endosulfan sulfate	0.02	88	3.8	5	90%
	0.2	92	6.7	5	RSD 5.7
Melon peel					
α-endosulfan	0.02	93	6.7	5	95%
	0.2	96	3.7	5	RSD 5.2
β-endosulfan	0.02	93	3.3	5	95%
	0.2	96	4.8	5	RSD 4.5
Endosulfan sulfate	0.02	100	6.3	5	103%
	0.2	105	2.1	5	RSD 5.2
Melon fruit					
α-endosulfan	0.02	90	5.5	4	95%
	0.2	102	4.5	3	RSD 8.2
β-endosulfan	0.02	91	3.5	5	96%
	0.2	102	7.1	4	RSD 7.5
Endosulfan sulfate	0.02	91	1.9	5	97%
	0.2	104	5.9	4	RSD 8

Analyte	Fortification Level (mg/kg)	Mean Recovery(%)	RSD (%)	N	Overall mean recovery, RSD
Tomato					
α-endosulfan	0.02 0.2	85 91	0.7 2.3	3 5	88% RSD 4.5
β-endosulfan	0.02 0.2	88 94	2.6 3.8	5 5	91% RSD 4.9
Endosulfan sulfate	0.02 0.2	79 98	5.3 2.2	5 5	89% RSD11.7

This report (Martens, 2000) contains validation data of the method DGM F01/97-0 for dry crops (grain). All compounds were extracted from matrices with acetone/dichloromethane/petroleum ether (1:1:1 v/v). After centrifugation and cleanup via GPC and mini silica-gel column, the analytes were determined by GC/ECD. The LOQs for α-endosulfan, β-endosulfan and endosulfan sulfate were established at 0.02 mg/kg. There were no interferences in control samples.

The specificity of the method was demonstrated by a confirmatory technique using a GC column with a different stationary phase a medium-polarity (50% phenyl-50% methyl polysiloxane column) as opposed to the original method and validations which used a DB-1 or the equivalent EC-1, a non-polar 100% dimethyl polysiloxane column. Recoveries using the DB-17 column were in the range of 68−107% and control samples showed no apparent residues.

Table 20. Recoveries and RSD at 0.02 and 1 mg/kg for endosulfan α, β and sulfate in grain.

Analyte	Fortification Level (mg/kg)	Mean Recovery(%)	RSD(%)	N	Overall mean recovery, RSD
α-endosulfan	0.02 1	88 89	3 11	7 7	88% RSD 4.5
β-endosulfan	0.02 1	89 96	5 13	7 7	91% RSD 4.9
Endosulfan sulfate	0.02 1	88 98	7 10	7 7	89% RSD11.7

The report (Martens, 2000) describes a new version of analytical method DGM F01/97-0 where some modifications with regard to optimisation were incorporated. Endosulfan residues are extracted from the matrices with a mixture of acetone/dichloromethane/petroleum ether (1/1/1). After centrifugation and clean-up via GPC (gel permeation chromatography) and mini silica-gel column, the analytes were determined by GC/ECD.

Table 21. Recoveries and RSD for endosulfan α, β and sulfate in citrus, tomato, peach and sugarbeet.

Analyte	Fortification Level (mg/kg)	N	Overall mean recovery, RSD	RSD (%)	STUDY
Mandarin peel					
α-endosulfan	0.02/1	2+2	93	8	ER 98 ECS 741
β-endosulfan	0.02/1	2+2	109	13	ER 98 ECS 741
Endosulfan sulfate	0.02/1	2+2	113	6	ER 98 ECS 741
Mandarin pulp					
α-endosulfan	0.02/1	2+2	101	2	ER 98 ECS 741
β-endosulfan	0.02/1	2+2	90	17	ER 98 ECS 741
Endosulfan sulfate	0.02/1	2+2	96	5	ER 98 ECS 741
Orange peel					
α-endosulfan	0.02/1	1+2	98	7	ER 98 ECS 740
β-endosulfan	0.02/1	1+2	108	13	ER 98 ECS 740
Endosulfan sulfate	0.02/1	1+2	113	5	ER 98 ECS 740

Analyte	Fortification Level (mg/kg)	N	Overall mean recovery, RSD	RSD (%)	STUDY
Orange pulp					
α-endosulfan	0.02	2	91	12	ER 98 ECS 740
β-endosulfan	0.02	2	93	0	ER 98 ECS 740
Endosulfan sulfate	0.02	2	98	1	ER 98 ECS 740
Tomato					
α-endosulfan	0.02/0.5	2+1	90	17	ER 98 ECS 752
β-endosulfan	0.02/0.5	2+1	103	21	ER 98 ECS 752
Endosulfan sulfate	0.02/0.5	2+1	97	8	ER 98 ECS 752
Peach					
α-endosulfan	0.02/1/2	3+1+2	88	15	ER 98 ECS 754
β-endosulfan	0.02/1/2	3+1+2	91	19	ER 98 ECS 754
Endosulfan sulfate	0.02/1/2	3+1+2	89	21	ER 98 ECS 754
Sugar beet leaves with head					
α-endosulfan	0.02/0.5/5	1+1+1	82	6	ER 98 ECS 746
β-endosulfan	0.02/0.5/5	1+1+1	82	6	ER 98 ECS 746
Endosulfan sulfate	0.02/0.5/5	1+1+1	92	8	ER 98 ECS 746
Sugar beet roots					
α-endosulfan	0.02	2	114	5	ER 98 ECS 746
β-endosulfan	0.02	2	107	11	ER 98 ECS 746
Endosulfan sulfate	0.02	2	105	15	ER 98 ECS 746

Method DGM F01/97-1 (Haines B.K 2001) is a modification of method DGM F01/97-0 for which validation data was provided in the previously summarised reports. Both are derived from the multiresidue method MRM-1. The main difference with method DGM F01/97-0 is that a single extraction step is performed employing a mixture of acetone/dichloromethane/petroleum ether (1/1/1). Some validation data for various matrices were reported in the previously summarised reports in which these modifications were already introduced. Quantitation was performed by GCD/ECD. For each matrix type, five replicates fortified at the LOQ and five replicates fortified at 10 × LOQ were analysed. Two blank samples were also analysed for each matrix. Endosulfan was successfully validated in lettuce and oranges.

Table 22. Recoveries and RSD at 0.02 and 1 mg/kg for endosulfan α, β and sulfate in lettuce, orange and milk.

Analyte	Fortification Level (mg/kg)	Mean Recovery (%)	RSD(%)	Mean Recovery (%)	RSD(%)	N
Lettuce						
		Set #1		Set # 2		
α-endosulfan	0.02	122	7.47	101	4.47	5
	0.2	81.2	7.17	98.1	10.9	5
β-endosulfan	0.02	102	6.15	108	4.62	5
	0.2	75.2	7.97	108	11.8	5
Endosulfan sulfate	0.02	99.1	4.22	99.6	6.88	5
	0.2	80.7	8.99	110	14.8	5
Orange						
		Set #1		Set # 2		
α-endosulfan	0.02	105	9.97	NA	NA	5
	0.2	87.4	6.58	NA	NA	5
β-endosulfan	0.02	116	6.95	NA	NA	5
	0.2	94.8	7.39	NA	NA	5
Endosulfan sulfate	0.02	92.2	4.99	NA	NA	5
	0.2	90.7	7.68	NA	NA	5

Analyte	Fortification Level (mg/kg)	Mean Recovery (%)	RSD(%)	Mean Recovery (%)	RSD(%)	N
Milk						
		Set #1		Set # 2		
α-endosulfan	0.02	101	4.28	NA	NA	5
	0.2	96.2	2.94	NA	NA	5
β-endosulfan	0.02	112	4.77	NA	NA	5
	0.2	103	3.44	NA	NA	5
Endosulfan sulfate	0.02	102	5.13	NA	NA	5
	0.2	101	3.53	NA	NA	5

The method was developed by Wrede (2002). Residues of α-endosulfan, β-endosulfan and endosulfan sulfate were extracted with cyclohexane/ethyl acetate (1:1, v/v) from the different matrices. After different clean-up steps, e.g. GPC and silica gel column, analytes were determined by GC-MSD. The LOQ was 0.02 mg/kg in cotton bolls, lint and seed for each analyte. Apparent levels in controls were < 30% of the LOQ. The specificity of the method was demonstrated by a confirmatory technique using GC-MS.

Table 23. Recoveries in cotton matrices.

Analyte	Matrix	Fortification Level (mg/kg)	Mean Recovery%	SD (a)%	RSD (a)%	n	Overall Mean recovery, SD/RSD
α- endosulfan (AE F052618)	Bolls	0.02	69	15	22	9	68
		0.20	60	6	9	5	13/19
		1.0	81	3	3	2	
	Lint	0.02	81	9	11	7	80
		0.20	79	5	6	5	7/9
	Seed	0.02	81	19	23	9	75
		0.20	65	3	5	6	17/22
β-endosulfan (AE F052619)	Bolls	0.02	80	12	15	9	79
		0.20	72	9	13	5	12/15
		1.0	93	1	2	2	
	Lint	0.02	90	8	9	7	90
		0.20	89	7	8	5	7/8
	Seed	0.02	81	10	13	9	83
		0.20	86	13	15	6	11/14
Endosulfan sulfate (AE F051327)	Bolls	0.02	93	11	11	9	89
		0.20	82	10	13	5	11/12
		1.0	87	8	10	2	
	Lint	0.02	99	17	17	7	98
		0.20	96	9	10	5	14/14
	Seed	0.02	97	14	15	9	95
		0.20	93	12	13	6	13/14

a) RSD = SD/Mean Recovery x 100%

Animal matrices

The report by Huff and Winkler (1997) describes the validation of an optimised analytical method for the determination of endosulfan (alpha, beta and sulfate) residues in animal tissues, eggs (whites and yolks) and dairy matrices based on methodologies described in the FDA Pesticide Analytical Manual. The report validates the method by determining endosulfan (alpha, beta and sulfate) in animal tissues, eggs (whites and yolks) and dairy matrices treated with ^{14}C-endosulfan, and additionally establishes a GC/MSD confirmatory procedure for determining endosulfan (alpha, beta and sulfate) residues in animal tissues, egg (whites and yolks) and dairy matrices.

Samples of animal tissues (except liver) were blended with 75:25 petroleum ether/acetone, sodium sulfate, and Celite and then filtered. The evaporated sample was then dissolved in petroleum ether and partitioned with acetonitrile (ACN). The ACN was combined with water and saturated NaCl and partitioned against petroleum ether. The sample was evaporated to dryness, then dissolved in hexane and loaded onto a Florisil SPE column. The eluate was analysed by GC/ECD.

Samples of liver were treated the same way except that the aqueous ACN/brine was partitioned with petroleum ether.

Milk and egg white samples were treated with ethanol and potassium oxalate and extracted with diethyl ether and petroleum ether. The top layer was removed, washed and then passed over sodium sulphate prior to evaporation to dryness and further purified with a Florisil SPE column.

Egg yolk samples were blended with 75:25 petroleum ether/acetone, sodium sulfate and Celite, then filtered. The filtrate was evaporated, dissolved in petroleum ether and passed over alumina-N. The alumina-N eluate was partitioned with can and then petroleum ether. The sample was evaporated, dissolved in hexane and loaded onto a Florisil SPE column.

The mean and standard deviations for method validation recovery results are shown in the tables. The method is reliable and reproducible for the determination of endosulfan residues in beef muscle, liver, heart, kidney, fat and poultry liver, muscle and fat, milk egg whites and egg yolks.

Table 24. Mean recoveries and standard deviation in animal matrices.

Matrix	Mean Recovery and Standard Deviation[1]		
	Alpha endosulfan	Beta endosulfan	Endosulfan sulfate
Method Validation Results			
Beef Muscle	83% ± 3.0% (n=15)	82% ± 3.2% (n=15)	87% ± 3.4% (n=15)
Beef Liver	87% ± 7.6% (n=15)	85% ± 7.5% (n=15)	88% ± 5.5% (n=15)
Beef Fat	84% ± 7.2% (n=15)	87% ± 4.5% (n=15)	94% ± 3.2% (n=15)
Milk	80% ± 10% (n=15)	86% ± 11% (n=15)	85% ± 11% (n=15)
Egg Whites	78% ± 4.9% (n=15)	86% ± 6.9% (n=15)	85% ± 8.9% (n=15)
Egg Yolks	80% ± 5.7% (n=15)	81% ± 5.8% (n=15)	86% ± 6.4% (n=15)
^{14}C Method Validation Results			
Beef Muscle	77% ± 6.5% (n=6)	82% ± 6.2% (n=6)	81% ± 5.9% (n=6)
Beef Liver	76% ± 6.0% (n=6)	83% ± 2.0% (n=6)	89% ± 4.3% (n=6)
Beef Heart	80% ± 7.8% (n=6)	86% ± 2.6% (n=6)	81% ± 3.7% (n=6)
Beef Kidney	86% ± 7.2% (n=6)	86% ± 8.4% (n=6)	87% ± 6.4% (n=6)
Renal fat	63% ± 23% (n=6)	94% ± 7.2% (n=6)	89% ± 9.8% (n=6)
Omental Fat	72% ± 8.2% (n=6)	75% ± 4.5% (n=6)	73% ± 5.3% (n=6)
Poultry Liver	98% ± 18% (n=6)	96% ± 14% (n=6)	100% ± 11% (n=6)
Poultry Muscle	94% ± 4.3% (n=6)	91% ± 1.9% (n=6)	90% ± 2.9% (n=6)
Poultry Fat	52% ± 26% (n=6)	66% ± 19% (n=6)	80% ± 8.8% (n=6)
Milk	77% ± 1.6% (n=6)	81% ± 3.1% (n=6)	84% ± 5.4% (n=6)
Egg Whites	88% ± 7.9% (n=6)	88% ± 3.1% (n=6)	88% ± 3.0% (n=6)
Egg Yolks	76% ± 3.3% (n=6)	76% ± 3.7% (n=6)	76% ± 3.6% (n=6)

1: For Method Validation there were 5 fortifications at 0.025 ppm, 5 at 0.25 ppm and 5 at 0.70 ppm; for ^{14}C Method Validation there were 3 fortifications at 0.025 ppm and 3 fortifications at 0.70 ppm, except for egg yolk, where there were 2 fortifications at 0.025 ppm and 3 fortifications at 0.70 ppm.

The method completely accounted for all incurred endosulfan derived residues in animal tissues, eggs (whites and yolks) and dairy matrices with the minor exception of poultry liver.

Table 25. Recoveries of endosulfan sulfate in animal matrices and alpha and beta endosulfan in poultry fat and egg yolks.

Matrix	EN-CAS ID#	ppm Expected			% Recovery of Expected ^{14}C Residue		
		Alpha	Beta	Sulfate	Alpha	Beta	Sulfate
Beef Muscle	EN8169A	< 0.025	< 0.025	0.026	--	--	112
	EN8169B	< 0.025	< 0.025	0.026	--	--	85
Beef Liver	EN8170A	< 0.025	< 0.025	0.0969	--	--	76
	EN8170B	< 0.025	< 0.025	0.969	--	--	79
Beef Heart	EN8172A	< 0.025	< 0.025	< 0.025	--	--	174[a]
	EN8172B	< 0.025	< 0.025	< 0.025	--	--	191[a]
Beef Kidney	EN8173A	< 0.025	< 0.025	0.065	--	--	122
	EN8173B	< 0.025	< 0.025	0.065	--	--	98
Renal Fat	EN8174A	< 0.025	< 0.025	0.704	--	--	138
	EN8174B	< 0.025	< 0.025	0.704	--	--	138

Matrix	EN-CAS ID#	ppm Expected			% Recovery of Expected ^{14}C Residue		
		Alpha	Beta	Sulfate	Alpha	Beta	Sulfate
Omental Fat	EN8175A	< 0.025	< 0.025	1.049	--	--	119
	EN8175B	< 0.025	< 0.025	1.049	--	--	129
Poultry Liver	EO6586A	< 0.025	< 0.025	0.213	--	--	41
	EO6586B	< 0.025	< 0.025	0.213	--	--	32
Poultry Muscle	EN8179A	< 0.025	< 0.025	< 0.025	--	--	--
	EN8179B	< 0.025	< 0.025	< 0.025	--	--	--
Poultry Fat	EN8180A	0.137	0.076	0.637	105	93	98
	EN8180B	0.137	0.076	0.637	114	95	102
Milk	EO5090A	< 0.025	< 0.025	0.130	--	--	151
	EO5090B	< 0.025	< 0.025	0.130	--	--	80
Egg Whites	EN8176A	< 0.025	< 0.025	< 0.025	--	--	--
	EN8176B	< 0.025	< 0.025	< 0.025	--	--	--
Egg Yolks	EN8177A	0.040	< 0.025	0.396	98		116
	EN8177B	0.040	< 0.025	0.396	108		79

a. Percent recovery elevated due to samples being quantitated below screening level.

Soil

The endosulfan and the metabolite endosulfan-sulfate were extracted from the soil with acetone. After dilution with brine and clean-up by liquid-liquid partition with dichloromethane and a silica gel column, determination was carried out by GC/ECD.

Table 26. Recovery values determined for residues of Endosulfan in soil.

Analyte	Fortification Level (mg/kg)	Recoveries (mg/kg)	Recoveries (%)	RSD[1] (%)	LOD (mg/kg)	LOQ (mg/kg)
Soil DEU89 I 71721						
AE F052618	UTC	0.0001		201		
(alpha endosulfan)	0.01	0.0091	90.3	16.7	0.004	0.01
	1.0	0.895	89.5	15.9		
AE F052619	UTC	0.0006		183		
(beta endosulfan)	0.01	0.0099	93.4	19.7	0.006	0.01
	1.0	0.870	87.0	15.0		
AE F051327	UTC	0.0001		332		
(Endosulfan sulfate)	0.01	0.010	99.8	19.1	0.005	0.01
	1.0	0.857	85.7	17.0		
Soil DEU89 I 71741						
AE F052618	UTC	0.0004		142		
(alpha endosulfan)	0.01	0.080	75.8	12.3	0.004	0.01
	1.0	0.784	78.4	14.1		
AE F052619	UTC	0.0005		156		
(beta endosulfan)	0.01	0.0083	78.6	11.9	0.004	0.01
	1.0	0.777	77.7	20.1		
AE F051327	UTC	0.0003		195		
(Endosulfan sulfate)	0.01	0.0085	81.7	10.7	0.004	0.01
	1.0	0.757	75.6	21.1		

Specific methods

Hong Li (1999) used the method XAM-53 described in the report for storage stability for endosulfan on sugar beet leaves for the determination of endosulfan alpha, beta, sulfate, lactone and diol residues in wheat grain, forage and straw, and sugar beet roots and tops. Residues were extracted from crops partitioned with hexane and the organic phase dried with sodium sulfate and concentrated. The sample is cleaned up using a silica gel SPE conditioned with hexane. Alpha and beta endosulfan, endosulfan sulfate and lactone were analysed by GC/ECD. The diol was derivatised with N-methyl-N-trimethylsilyl-trifluoroacetamide and analysed using GC/ECD. The LOQ was 0.05 mg/kg. The

method validation showed recoveries in sugarbeet leaves of 79, 78 and 79% for endosulfan lactone spiked at 0.05 mg/kg, and of 77, 81 and 74% for endosulfan diol spiked at 0.05 mg/kg.

Gardner and Snowdon (1995) used extraction by acetone followed by partitioning with dichloromethane. After purification on silica solid phase the determination was by gas chromatography with electron capture detection. The recovery on melon (peel and pulp) and grapes was above 90% for alpha, beta and sulfate endosulfan.

Idstein *et al*. (1995) used extraction by acetone/water following by partitioning with dichloromethane. Final quantification was done by GC/ECD. The LOQ was 0.01 mg/kg. The recoveries obtained with alpha, beta endosulfan and endosulfan sulfate on potatoes were 74, 81 and 84% respectively at the 0.01 mg/kg fortification level.

Werner *et al*. (1987) investigated the analysis of endosulfan-diol and endosulfan-lactone in soil, water and urine and endosulfan and endosulfan-sulfate in soil, water, urine and plant material. Samples were extracted, cleaned up and then analysed for α and ß endosulfan and endosulfan sulfate with GC/ECD. In the case of endosulfan-diol the cleaned final extract was derivatised (silylated) before being quantified. This method was validated in Seefeld (1990.

Stability of pesticide residues in stored analytical samples

The deep freeze stability (Winkler, 1997, 1998b) of endosulfan (alpha, beta and the sulfate) on raw agricultural commodities (RACs) and processed commodities (PCs) were investigated when stored frozen for 18 months. Control samples were fortified at 0.25 mg/kg with endosulfan (alpha, beta and the sulfate) and stored at approximately < -10°C. Unfortified control samples were stored frozen under the same conditions and one unfortified control and two freshly fortified controls were analysed concurrently with stored fortification samples at each analysis interval to determine procedural recovery. The method in FDA Pesticide Analytical Manual (PAM) (Volume 1, Sections 302, 303 and 304, 1994 Edition) was used for the analyses.

Endosulfan was stable for 18 months in RAC matrices (grape, potato, tomato, cantaloupe and lettuce) and PC matrices (grape juice, potato flakes, potato flakes, potato wet peel, tomato paste and tomato puree), and for at least 12 months in grape raisin. The recovery ranges for the stored fortifications are shown in the following tables for the average fresh fortification recovery.

Table 27. Summary of endosulfan stored fortification results in crop RAC and in crop PC.

Storage Months	Matrix	Alpha	Beta	Sulfate	Matrix	Alpha	Beta	Sulfate
3	Grape	89, 97	94, 102	91, 97	Grape	105, 113	111, 118	110, 118
6		87, 91	88, 91	89, 94	Raisin	100, 113	107, 120	107, 119
9		89, 90	92, 91	92, 92		98, 100	99, 94	108, 98
12		92, 88	75, 70	94, 87		92, 99	68, 68	94, 93
18		93, 91	100, 93	102, 94		NA	NA	NA
3	Potato	91, 90	98, 102	89, 92	Potato	78, 81	84, 88	87, 91
6		96, 89	97, 91	99, 91	Flakes	83, 86	93, 98	93, 103
9		77, ,84	81, 88	80, 85		82, 86	60, 63	92, 94
12		94, 93	96, 94	95, 93		84, 87	91, 93	101, 102
18		54, 57	59, 61	62, 63		68, 69	75, 74	80, 80
3	Tomato	90, 95	93, 97	89, 92	.Tomato	94, 91	100, 99	92, 93
6		90, 102	91, 102	92, 104	Paste	88, 90	94, 96	97, 98
9		93, 93	95, 95	96, 95		85, 86	90, 93	90, 92
12		100, 98	103, 101	107, 103		77, 76	64, 58	82, 77
18		79, 88	81, 91	80, 95		95, 102	97, 106	99, 108
3	Cantaloupe	87, 87	91, 92	88, 87	Potato	99, 92	96, 88	98, 85
6		91, 94	92, 91	92, 92	Wet Peel	90, 93	87, 89	91, 96
9		91, 98	91, 85	93, 86		72, 67	76, 81	75, 79
12		94, 98	95, 100	95, 99		92, 92	71, 70	90, 89
18		81, 102	81, 103	78, 98		97, 112	97,117	109, 92

Storage Months	Matrix	Alpha	Beta	Sulfate	Matrix	Alpha	Beta	Sulfate
3	Lettuce	93, 94	98, 97	94, 92	Tomato	100, 98	100, 95	100, 96
6		89, 90	88, 87	92, 91	Puree			
9		80, 81	83, 82	86, 83		82, 87	95, 103	93, 98
12		87, 87	90, 90	93, 94		89, 91	65, 67	85, 86
18		86, 104	86, 109	84, 112		81, 105	85, 113	81, 114
3	Grape Juice	97,95	100, 101	104, 102				
6		98, 81	103, 102	107, 105				
9		90, 98	76, 78	102, 103				
12		92, 89	92, 98	96, 99				
18		79, 88	81, 91	80, 95				

Control samples were fortified at 0.50 mg/kg with endosulfan lactone or endosulfan diol, (Diot and Kieken, 2004) and stored at about -18°C. Unfortified control samples were stored frozen under the same conditions and one unfortified control and two freshly fortified controls were analysed concurrently with stored fortification samples at each analysis interval to determine procedural recovery. The method of analysis used was XAM-53; the LOQ for both endosulfan lactone and endosulfan diol is 0.05 mg/kg.

Apparent residues of endosulfan lactone and endosulfan diol in stored control sugar beet leaves samples were below 10% of the spiking level in spiked samples. Stored samples spiked with endosulfan lactone were stable for 18 months, but then showed a decrease of 33% over the final 6 months of the 2 year storage period. Endosulfan diol was stable for 24 months in sugar beet leaves.

Table 28. Endosulfan stored fortification results in sugar beet leaves.

Storage Interval (Days)	Mean Recovery,%	Mean Concurrent Recovery,%	Mean Recovery,%	Mean Concurrent Recovery,%
	endosulfan lactone		endosulfan diol	
0	74	87	80	81
91	68	77	80	80
174	74	86	110	111
287	80	103	94	96
365	62	87	90	95
553	62	92	94	94
749	48	80	64	76

Samples of beetroot, lemons and leafy lettuce were analysed after six months of storage (Bodnaruk 2001). The analysis was conducted by extraction with acetone following by partition with dichloromethane; no further clean up was conducted.

The results are including in the following table.

Table 29. Endosulfan stability during 6 months of storage at –20°C.

Storage Months	Matrix	Alpha mg/kg	Beta mg/kg	Sulfate mg/kg	total mg/kg	% degradation
0	Leafy lettuce	1.60	1.50	0.31	3.40	
6		1.50	1.20	0.28	3.00	-13
0		0.34	0.39	0.33	1.00	
6		0.42	0.39	0.36	1.20	+20
0		0.15	0.14	0.19	0.48	
6		0.14	0.12	0.19	0.45	-6
0	Lemons	0.10	0.14	0.012	0.25	
6		0.11	0.15	0.01	0.27	+8
0		0.049	0.10	0.008	0.16	
6		0.059	0.13	0.006	0.20	+24
0	Lemons	0.052	0.12	0.007	0.17	
6		0.052	0.12	0.007	0.18	+6

Storage Months	Matrix	Alpha mg/kg	Beta mg/kg	Sulfate mg/kg	total mg/kg	% degradation
0	Beetroot	0.18	0.11	0.10	0.39	
6		0.53	0.30	0.15	0.98	+125
0		0.10	0.11	0.11	0.32	
6		0.084	0.082	0.026	0.25	-21
0		0.062	0.063	0.075	0.20	
6		0.051	0.062	0.085	0.20	0

Stability of pesticide residues in stored analytical samples (animal tissue)

Control samples were fortified at 0.25 mg/kg with endosulfan (alpha, beta and sulfate) and stored at < 10°C (Winkler, 1998a). Unfortified control samples were stored frozen under the same conditions and one unfortified control and two freshly fortified controls were analysed concurrently with stored fortification samples at each analysis interval to determine procedural recovery. Recovery results were corrected for the average recovery of the corresponding fresh fortification samples. The analytical method used was derived from PAM 1, Sections 303/304 (see A57847).

The analysis results indicated that endosulfan was stable for 12 months in animal tissues (beef muscle and liver), egg (whites and yolks) and milk. The overall fresh procedural recoveries for all matrices ranged from 63% to 104% for endosulfan (alpha, beta and sulfate), with the exception of 4 recoveries, ranging from 52% to 59%, shown as outliers. The recovery ranges for the stored fortifications are shown in the following tables for the average fresh fortification recovery.

Table 30. Endosulfan stored fortification results in animal tissues.

Matrix	Storage Interval (Months)	% Recovery Range for Stored Fortifications (Uncorrected)		
		Alpha	Beta	Sulfate
Beef Muscle	3	86, 82	88, 82	89, 82
	6	87, 82	86, 79	90, 82
	9	77, 76	81, 81	84, 84
	12	82, 95	87, 101	86, 101
Beef Liver	3	76, 75	75, 74	75, 73
	6	70, 69	71, 73	69, 72
	9	59, 57	75, 74	83, 82
	12	82, 81	94, 90	118, 111
Egg Whites	3	76, 79	78, 81	83, 84
	6	66, 66	71, 70	84, 81
	9	67, 68	74, 74	80, 82
	12	61, 70	62, 70	78, 83
Egg Yolks	3	82, 74	84, 77	64, 74
	6	78, 78	83, 84	83, 84
	9	72, 83	73, 83	67, 75
	12	72, 63	64, 50	76, 58
Milk	3	83, 73	83, 81	80, 74
	6	86, 83	87, 86	86, 85
	9	75, 74	77, 76	76, 75
	12	98, 104	103, 114	104, 115

USE PATTERN

Information on registered uses made available to the meeting is shown in Table 31.

Table 31. Registered uses of endosulfan on crops.

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Apple	Australia	EC	350 g/L	Spray	66.5		NS	28
Apple	Canada	WP	50%				0.65	15
Apple	Canada, BC	WP	50%			4333- 4500	0.75-1.12	15
Apple	Canada, E.	WP	50%			4500 to NS	2.25-3.38	15
Apple	Central America	EC	350 g/L				0.7	21
Apple	Chile	EC	320 g/L		3.2 to 9.6	1500- 2000		25
Apple	Chile	EC	320 g/L		12..8-16	2000- 2500		25
Apple	Chile	EC	320 g/L		19 to 25	2000- 2500		25
Apple	Chile	WP	48.25%		75-96			NS
Apple	China	EC	350 g/L			1500- 2000		NS
Apple	Japan	WP	48%	Spray	0.03%	NS		30
Apple	Japan	EC	30%	Spray	0.03-0.04%	NS		30
Apple	Japan	EC	30%	Dip	0.006%	NS		120
Apple	Namibia	SC	475 g/L	Spray		300 to 3500	1.18-1.66	14
Apple	S. Arabia	EC	350 g/L	Spray	35-52.5	NS		28
Apple	S. Africa	SC	475 g/L	Spray		300 to 3500	1.18-1.66	14
Apple	USA, exc CA	EC	360 g/L	Spray		4675 to NS	0.55- 2.80	21
Apple	USA, exc CA	WSB	50%	Spray		4675 (air 187)	2.80	21
Apple	USA-CA	EC WSB	360 g/L 50%	Spray		4675 (air 187)	0.55- 2.80	30
Apple	Zimbabwe	SC	47.5%	Spray	23-368	NS		14
Apple, Custard	Australia	EC	350 g/L	Spray	52.5-70		NS	7
Avocados	Australia	EC	350 g/L	Spray		52.5-70	0.735	14
Bananas	Australia	EC	350 g/L	Spray		52.5		14
Bean	Angola	SC	475 g/L	Spray		NS	0.36-0.72	NS
Bean, common, adzuki, faba, mung.	Australia	EC	350 g/L	Spray		50 to NS	0.17-0.35	NR
Bean	Canada	EC	400 g/L	Spray		NS	0.6-1.0	2
Beans	Central America	EC	350 g/L	Spray		NS	0.5-0.7	4
Bean	Chile	EC	320 g/L	Spray		400 to NS	0.24-0.4	14
Bean, broad	Chile	WP	48.2%	Spray		NS	0.48-0.72	7
Bean, French	Chile	WP	48.2%	Spray		NS	0.48-0.72	7
Bean	Japan	EC	30%	Spray	0.1-0.25%	NS		14
Bean	Myanmar	EC	350 g/L	Spray		233-420	0.44- 0.67	14
Bean, incl kidney	Namibia	SC	475 g/L	Spray		30 (air) to NS	0.75 to 1.5	2
Bean, kidney	Peru	EC	355 g/L	Spray	88.5	NS		21
Beans, incl kidney beans	South Africa	SC	475 g/L	Spray		30 to NS	0.35-0.72	2
Beans,	South Africa	SC	475 g/L	Spray		30 to NS	0.35-0.72	NS
Bean	USA, exc CA	EC	360 g/L	Spray		93(air 185)	0.56-1.12	3
Bean	USA, exc CA	WSB	50%	Spray		93.5 (air 9.31)	1.12- 2.24	3
Bean	USA-CA	EC	360 g/L	Spray		93.5 (air 9.31)	0.56-1.12	3
Bean	USA-CA	WSB	50%	Spray		93.5 (air 9.31)	1.12-2.24	3
Bean	Zimbabwe	EC	35%	Spray		200	0.49	2
Bean	Zimbabwe	SC	47.5%	Spray		1000	0.57	2
beetroot	Australia	EC	350 g/L	Spray	66.5		0.735	14
Brassicas	N. Zealand	EC	350 g/L	Spray		NS	0.70	14
Broccoli	Australia	EC	350 g/L	Spray	66.5		0.73	7
Broccoli	Canada	EC	400 g/L	Spray		NS	0.6-0.8	7
Broccoli	Canada	WP	50%	Spray		1000 to NS	0.5-0.88	7

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Broccoli	Central America	EC	350 g/L	Spray		NS	0.52-0.7	7
Broccoli	USA, exc CA	EC	360 g/L	Spray		93 (air 186)	0.83-1.12	7
Broccoli	USA, exc CA	WSB	50%	Spray		93 (air 9.3)	0.84-1.1	7
Broccoli	USA-CA	EC	360 g/L	Spray		93 (air 9.3)	1.33 qt/A	7
Broccoli	USA-CA	WSB	50%	Spray		93 (air 9.3)	0.84-1.12	7
Br. Sprts	Canada	EC	400 g/L	Spray		NS	0.52-0.7	7
Br. Sprts	Central America	EC	350 g/L	Spray		NS	0.52-0.7	7
Br. Sprts	Namibia	SC	475 g/L	Spray		30 to NS	0.47	7
Br. Sprts	South Africa	SC	475 g/L	Spray		30 to NS	0.47	7
Br. Sprts	USA, exc CA	EC	360 g/L	Spray		93 (air 186)	0.72- 1.12	14
Br. Sprts	USA, exc CA and USA-CA	WSB	50%	Spray		93 (air 9.3)	1.65-2.2	14
Br. Sprts	USA-CA	EC	360 g/L	Spray		93(air 9.3) to NS	1.12	14
Cabbage	Australia	EC	350 g/L	Spray	66.5		0.735	7
Cabbage	Canada	EC	400 g/L	Spray		NS	0.6-0.8	7
Cabbage	Canada	WP	50%	Spray		1000 to NS	0.5-0.88	7
Cabbage	Central America	EC	350 g/L	Spray		NS	0.52-0.7	7
Cabbage	Chile	WP	48.2%	Spray		NS	0.5-0.72	NS
Cabbage	Japan	EC	30%	Spray	0.03-0.06%	NS		7
Cabbage, Chinese	Japan	EC	30%	Spray	0.03-0.06%	NS		30
Cabbage	Japan	EC	35%	Spray	0.03-0.07%	NS		7
Cabbage	N.Zealand	EC	350 g/L	Spray		NS	0.42-0.7	14
Cabbage	Turkey	EC	360 g/L	Spray		NS	0.72	14
Cabbage	USA, exc CA	EC WSB	360 g/L 50%	Spray Spray		93 (air 9.3)	0.82-1.12	7
Cabbage	USA-CA	EC WSB	360 g/L 50%	Spray Spray		93 (air 9.3)	0.82-1.12	7
Cauliflower	Australia	EC	350 g/L	Spray	66.5		0.735	7
Cauliflower	Canada	EC	400 g/L	Spray		NS to NS	0.6-0.8	7
Cauliflower	Canada	WP	50%	Spray		1000 to NS	0.5-0.87	7
Cauliflower	Central America	EC	350 g/L	Spray		NS	0.42-0.7	7
Cauliflower	Japan	EC	35%	Spray	0.03-0.07%	NS		7
Cauliflower	N Zealand	EC	350 g/L	Spray		NS	0.42-0.7	14
Cauliflower	USA, exc CA	EC	360	Spray		93 (air 186) to NS	0.83-1.120	14
Cauliflower	USA, exc CA	WSB	50%	Spray		93 (air 9.3)	0.82-1.12	14
Cauliflower	USA-CA	EC WSB	360 50%	Spray Spray		93 (air 9.3)	1.33 qt/A 0.82-1.12	14
Carrots	Australia	EC	350 g/L	Spray	66.5			14
Cashew	Australia	EC	350 g/L	Spray	70			14
Celery	Australia	EC	350 g/L	Spray	66.5			7
Celery	Canada	EC	400 g/L	Spray		NS	0.8	14
Celery	Canada	WP	50%	Spray		NS	0.875	14
Celery	Central America*	EC	350 g/L	Spray		NS	0.52-0.70	4
Celery	USA, exc CA	EC WSB	360 g/L 50%	Spray Spray		93 (air 187) to NS	0.56-1.12	4
Celery	USA, exc CA	EC WSB	360 g/L 50%	Spray		93 (air 187) to NS	0.56	7
Celery	USA-CA	EC WSB	360 g/L 50%	Spray		93 (air 9.3)	0.56-1.12	4
Celery	USA-CA	EC WSB	360 g/L 50%	Spray		93 (air 9.3)	0.66 qt/A 0.56	7
Cereals	Australia	EC	350 g/L	Spray			0.17-035	NR
Chayote	Australia	EC	350 g/L		66.5-70		0.735	3
Cherry	Canada, E/W	WP	50%	Spray		4333- 4500	1.62-2.25	15
Cherry	Chile	WP	48.2%	Spray	70-96	NS		NS
Cherry	Japan	EC	35%	Spray	0.04-0.07%	NS	0.43-0.7	GS

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Cherry	Namibia	SC	475 g/L	Spray		300 to 3500	1.18-1.66	14
Cherry	S. Africa	SC	475 g/L	Spray		300 to 3500	1.18-1.66	14
Cherry	USA, exc CA	EC	360 g/L	Spray		2500-3115	2.24-2.76	21
Cherry	USA, exc CA	EC	360 g/L	Spray	120	NS		NS
Cherry	USA, exc CA	WSB	50%	Spray		NS	2.24-2.75	21
Cherry	USA, exc CA	WSB	50%	Spray	32	NS		21
Cherry	USA-CA	EC	360	Spray		3812 (air 187)	2.24-2.76	21
Cherry	USA-CA	WSB	50%	Spray		3812 -4676 (air 187)	2.24-2.75	21
Cherry	USA, exc CA	WSB	50%	dip	600	NS		GS
Cherry	USA-CA	EC	360	dip	600	NS		GS
Cherry	USA-CA	WSB	50%	dip	600	NS		GS
Citrus	Angola	SC	475 g/L	Spray	47-107	NS		NS
Citrus	Australia	EC	350 g/L	Spray	3.5-10.5	NS		3
Citrus (thrips)	Central America	EC	350 g/L	Spray	35-70	NS		NS
Citrus	Central America	EC	350 g/L	Spray	35-52	NS		NS
Citrus	Chile	WP	48.2%	Spray	72-96.5	NS		NS
Citrus	Morocco	EC	330 g/L	Spray	57	NS		30
Citrus	Morocco	CS	330 g/L	Spray	57	NS		NS
Citrus	Mozambique	SC	47.5%	Spray	1-107	NS		NS
Citrus	S. Arabia	EC	350 g/L	Spray	35-52	NS		NS
Citrus	S. Africa	SC	475 g/L	Spray	47-107	NS		NS
Citrus, no bearing	USA, exc CA USA-CA	EC	360	Spray		4676 to NS (air 9.31)	2.76	>12 mo
Citrus, no bearing	USA, exc CA USA-CA	WP WSB	50% 50%	Spray Spray		NS 4676	2.5 1.26	>12 mo >12 mo
Cocoa	Brazil	EC	350 g/L	Spray		400 to 600	0.35-0.52	30
Cocoa	Cameroon	EC	350 g/L	Spray		NS	0.26	28
Cocoa	Ivory Coast	EC/CS	280 g/L	Spray		40 to NS	0.21/0.24	NS
Cocoa	Ivory Coast	EC	500 g/L	Spray		40 to NS	0.25	4
Cocoa	Malaysia	EC	33%	Spray		NS	0.15	28
Cocoa	Nigeria	EC	280 g/L	Spray		NS	0.21	NS
Coffee	Brazil	EC	350 g/L	Spray		100 to 250	0.52-0.70	70
Coffee	Cameroon	EC	350 g/L	Spray		NS	0.52	28
Coffee	Central America	EC	350 g/L	Spray		200 to 600	0.52-0.70	21
Coffee	Cuba	EC	350 g/L	soil		NS	0.52-.61	30
Coffee	Cuba	EC	482g/kg	Spray		NS	0.48-0.72	NS
Coffee	Ecuador	EC	350 g/L	Spray		NS	0.63-0.70	14
Coffee	Namibia	SC	475 g/L	Spray	47.5	30 to NS		14
Coffee	Peru	EC	355 g/L	Spray	105	NS		21
Coffee	S. Africa	SC	475 g/L	Spray	47.5	30 to NS		14
Coffee	Sudan	EC	500 g/L	Spray	NS	NS		NS
Coffee	Thailand	EC	350 g/L	Spray	70- 87.5	NS		7 to 14
Coffee	Zimbabwe	EC/ /SC	35,35 47,5%	Spray	245	NS		21
Cotton	Angola	SC	475 g/L	Spray		NS	0.24-0.83	NS
Cotton	Australia	EC	350 g/L	Spray		NS	0.73	56
Cotton	Benin	EC	330 g/L	Spray		10	0.66	NS
Cotton	Brazil	EC	350 g/L	Spray		100 to 250	0.35-0.875	30
Cotton	Burkina	EC	350 g/L	Spray		10	0.35	NS
Cotton	Central America	EC	350 g/L	Spray		NS	0.52-0.70	0
Cotton	China	EC	350 g/L	Spray		NS	0.052-0.084	NS
Cotton	Greece, Cyprus	WP	470 g/kg	Spray	71-94	NS		60
Cotton	Ecuador	CE	350 g/L	Spray		NS	0.35-0.875	14
Cotton	Ethiopia	ULV	250 g/L	Spray		NS	0.625-0.75	7 to 14
Cotton	Ethiopia	EC	350 g/L	Spray		20 to 300	0.70-0.78	7 to 14
Cotton	India	NS	29.7%	Spray		NS		NS
Cotton	Iran	EC	350 g/L	Spray		NS	1.05	15

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Cotton	Ivory Coast	CS	330 g/L	Spray		NS	0.66	NS
Cotton	Madagascar	EC	352 g/L	Spray		NS	0.85	21
Cotton	Mali	EC	500 g/L	Spray		10	0.50	NS
Cotton	Morocco	EC/CS	330 g/L	Spray		NS	0.66	30
Cotton	Mozambique	SC	47.5%	soil		NS	0.04-0.71	NS
Cotton	Myanmar	EC	350 g/L	Spray		233—420	0.52-0.7	14
Cotton	Namibia	SC	475 g/L	Spray		280 to NS	0.24-0.83	35
Cotton	Namibia	SC	475 g/L	air		280 to NS	0.47-0.71	35
Cotton	Pakistan	EC	320 g/L	Spray		NS	0.4	3
Cotton	Pakistan	EC	352 g/L	Spray		NS	0.7-1	NS
Cotton	Peru	EC	355 g/L	Spray	88	NS		21
Cotton	South Africa	EC	352 g/L	Spray		NS	0.85	21
Cotton	South Africa	SC	475 g/L	Spray		30 to NS	0.24-0.83	35
Cotton	South Africa	SC	475 g/L	Air		30 to NS	0.47-0.71	35
Cotton	Southern EU	SC	330 g/L	Spray	0.1%	700-1000		21
Cotton	Spain	EC	350 g/L	Spray	0.15 -0.3%	NS		21
Cotton	Spain	EC	350 g/L	Spray	52-70	NS		21
Cotton	Sudan	EC	500 g/L	Spray		NS	0.90	28
Cotton	Sudan	ULV	500 g/L	Spray		NS	0.84	NS
Cotton	Sudan	EC	50%	G, A		NS	0.90	NS
Cotton	Thailand	EC	350 g/L	Spray		NS	0.21	7 to 14
Cotton	Togo	CS	330 g/L	Spray		10 to NS	0.66	NS
Cotton	Turkey	EC	360 g/L	Spray		NS	0.72	14
Cotton	Turkey	WP	32.9%	Seed	0.93/100 kg	NS		NA
Cotton	USA, exc CA	EC	360 g/L	Spray		93 (air 187)	0.41-1.12	NS
Cotton	USA, exc CA	WSB	50%	Spray		93 (air 9.3)	0.56-1.68	NS
Cotton	USA-CA	EC	360 g/L	Spray		93 (air 9.3)	0.41-1.12	NS
Cotton	Venezuela	CE	350 g/L	Spray		NS	0.35-0.70	14
Cotton	Zimbabwe	EC	35%	Spray	333	50 to 150		NS
Cotton	Zimbabwe	EC	35%	Spray	150	25 to 100		NS
Cotton	Zimbabwe	EC	35%	ULV	100-162	1.7 to 5		NS/0
Cotton	Zimbabwe	EC EC	35% 35%	Spray, Air	5100	5 to 15		NS/0
Cotton	Zimbabwe	EC	35%	Spray	499	25 to 100		0
Cotton	Zimbabwe	WP WP	50% 50%	Spray spray	330 500	50 to 150 35 to 100		NS
Cotton	Zimbabwe	WP	50%	Soil		20to 200	2	NS
Cotton	Zimbabwe	SC	47.5%	Spray	500	50 to 150		NS
Cotton	Zimbabwe	SC	47.5%	Spray	475	35 to 100		NS
Cotton	Zimbabwe	SC	47.5%	Spray, air	125.5	5 to 15		NS
Crucifers	Namibia	SC	475 g/L	Spray	95	30 to NS		7
Crucifers	S. Africa	SC	475 g/L	Spray	95	30 to NS		7
Crucifers	Zimbabwe	SC	47.5%	Spray		1000- 2000	0.47-0.95	7
Cucumber	Australia	EC	350 g/L	Spray	66.5-70		0.735	3
Cucumber	Canada	EC	400 g/L	Spray	50-60	NS		2
Cucumber	Canada	WP	50%	Spray			0.50-0.75	2
Cucumber	Canada	EC	400 g/L	Spray		NS	0.60	2
Cucumber	Canada	WP	50%	Spray		NS	0.50-0.55	2
Cucumber	Central America	EC	350 g/L	Spray		NS	0.52-0.70	0
Cucumber	Chile	WP	48.2%	Spray		NS	0.48-0.73	NS
Cucumber	Japan	EM	30%	Spray	0.03-0.06%	NS		1
Cucumber	USA, exc CA	EC	360 g/L	Spray		93 (air 187)	0.55- 1.12	2
Cucumber	USA, exc CA JSA -CA	WSB	50%	Spray		93 (air 9.3)	0.56-1.12	2
Cucumber	USA-CA	EC	360 g/L	Spray		NS	0.55 to 112	2
Cucurbits	Australia	EC	350 g/L	Spray	66.5-70		0.735	3
Cucurbits	Namibia	SC	475 g/L	Spray	47.5	30 to NS		1
Cucurbits	S. Africa	SC	475 g/L	Spray	47.5	30 to NS		1
Cucurbits	Zimbabwe	SC	47.5%	Spray	47.5	NS		0

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Gooseberries	Australia	EC	350 g/L		66.5		0.735	7
Eggplant	Australia	EC	350 g/L		66.5		0.735	7
Grape	Canada	WP	50%	Spray		3000 to NS	1.50	30
Grape	Central America	EC	350 g/L	Spray		NS	0.52-0.70	7
Grape	Chile	WP	48.25%	Spray	72-96.5	NS		NS
Grape	Croatia	EC	350 g/L	Spray	0.15-0.2%	NS		NS
Grape	Japan	EC	30%	spray	0.3-0.6%	NS		Before germin'n
Grape	Namibia	SC	475 g/L	Spray		500 to 1500	0.24-0.72	14 to 42
Grape	Namibia	SC	475 g/L	Spray		500 to 1500	0.30-0.89	14 to 42
Grape	S. Africa	SC	475 g/L	Spray		500 to 1500	0.30-0.89	14-42
Grape	Turkey	EC	360 g/L	Spray	54	NS		14
Grape	Turkey	WP	32.9%	Soil		NS	0.75	15
Grape	Turkey	EC	360 g/L	Spray	54	NS		14wp
Grape	USA, exc CA	EC	360 g/L	Spray		2100-2800	1.25 -2.24	7
Grape	USA, exc CA	WSB	50%	Spray		NS	1.12-1..68	7
Grape	USA-CA	EC	360 g/L	Spray		NS	1.25-2.24	7
Grape	USA-CA	WSB	50%	Spray		1870-2800 (air 187)	1.12-1.68	7
Grapefruit	Australia	EC	350 g/L	spray	3.5-10.5			3
Guavas	Australia	EC	350 g/L	spray	52.5-70			7
Hazelnut	Poland	EC	350 g/L	Spray		2000- 2500	0.875	NS
Hazelnut	Spain	EC	350 g/L	Spray	0.30%	NS		30
Hazelnut	Spain	EC	350 g/L	Spray	70	NS		30
Hazelnut	Turkey	EC	360 g/L	Spray	54	NS		14
Hazelnut	Turkey	WP	32.9%	Spray		NS	3	15
Kiwi	Australia	EC	350 g/L	Spray	52.5-70			14
Lemons	Australia	EC	350 g/L	Spray	3.5-10.5			3
Longans	Australia	EC	350 g/L	Spray	70			7
Loquats	Australia	EC	350 g/L	Spray	70			28
Linseed	Australia	EC	350 g/L	Spray			0.175-0.35	NR
Lupins	Australia	EC	350 g/L	Spray			0.175-0.35	NR
Lychees	Australia	EC	350 g/L	Spray	52.5-70			7
Macadamia	Australia	EC	350 g/L	Spray	52.5-70		0.525	2
Mandarins	Australia	EC	350 g/L	Spray	3.5-10.5			3
Mangoes	Australia	EC	350 g/L	Spray	52-70			7
Marrow	Australia	EC	350 g/L	Spray	66.5-70		0.735	3
Melon	Australia	EC	350 g/L	Spray	66.5-70		0.735	3
Melon	Canada	EC	400 g/L	Spray		NS	0.60	2
Melon	Canada	WP	50%	Spray		NS	0.50-0.55	2
Melon	Central America	EC	350 g/L	Spray		NS	0.52-0.70	0
Melon	Chile	EC	320 g/L	Spray		400 to NS	0.24-0.40	7
Melon	Chile	WP	48.25%	Spray		NS	0.48-0.73	NS
Melon	Japan	GR	3.3%	Spray		NS	1.5	GS
Melon	Turkey	EC	360 g/L	Spray			0.36-1.08	14
Melon	USA, exc CA	EC	360 g/L	Spray		93 (air 187)	0.563-1.12	2
Melon	USA, exc CA USA-CA	WSB	50%	Spray		93(air 9.3)	0.56-1.12	2
Melon	USA-CA	EC	360 g/L	Spray		NS	0.56-1.12	2
Melon	Venezuela	CE	350 g/L	Spray		NS	0.52	7
Okra	Australia	EC	350 g/L	Spray	66.5		0.735	7
Orange	Australia	EC	350 g/L	Spray	3.5-10.5		0.35-0.735	3
Papaya	Australia	EC	350 g/L	Spray	52.5		0.175-0.735	7
Passion fruit	Australia	EC	350 g/L	Spray	52.5-70			14
Peach	Canada	EC	400 g/L	Spray	70	NS		15
Peach	Canada	EC	400 g/L	Dip tree	600	NS		NA
Peach	Canada, E/W	WP	50%	Spray	75			15
Peach	Canada, E/W	WP	50%	Spray	37-50		1.6-2.25	15
Peach	Central America	EC	350 g/L	Spray		NS	0.52-0.70	21

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Peach	Chile	EC	320 g/L	Spray	8-10	1500- 2000		25
Peach	Chile	EC	320 g/L	Spray	13-16	2000- 2500		25
Peach	Chile	EC	320 g/L	Spray	20-25	2000- 2500		25
Peach	Chile	WP	48.25%	Spray	72-96.5	NS		NS
Peach	Japan	EC	30%	Trunk	2%	NS		Post hvst
Peach	Namibia	SC	475 g/L	Spray	2.5 to 3.5	300 to 3500	1.19-1.66	14
Peach	S. Africa	SC	475 g/L	Spray	2.5 to 3.5	300 to 3500	1.19-1..66	14
Peach	USA, exc CA	EC	360	Spray		2500- 3130	2.24-2.76	21
Peach	USA, exc CA	EC	360	Spray		4675	to 2.76	30
Peach	USA, exc CA USA-CA	EC	360	dip	600	NS		NA GS
Peach	USA, exc CA	WSB	50%	Spray		NS	2.24-2.50	21
Peach	USA, exc CA	WSB	50%	Spray		NS	2.24-2.50	30
Peach	USA, exc CA	WSB	50%	dip		NS	2.24-2.50	GS
Peach	USA-CA	EC	360 g/L	Spray		93, (air 187)	to 2.76	30
Peach	USA-CA	WSB	50%	Spray		3740-4675 (air 187)	2.24-2.50	30
Peach	USA-CA	WSB	50%	dip	1.21	NS		GS
Peach	Zimbabwe	EC	35%	Spray	35	NS		10
Pear	Australia	EC	350	Spray	52.5-66.5		0.735	28
Pear	Canada, BC	WP	50%	Spray		4333- 4500	1.62-2.25	15
Pear	Canada, E.	WP	50%	Spray		4500 to NS	2.25-3.37	15
Pear	Central America	EC	350 g/L	Spray		NS	0.52-0.70	21
Pear	Chile	EC	320 g/L	Spray	8-9.6	1500- 2000		25
Pear	Chile	EC	320 g/L	Spray	12.8-16	2000- 2500		25
Pear	Chile	EC	320 g/L	Spray	19- 25	2000-2500		25
Pear	Chile	WP	48.25%	Spray	72.2-96.5	NS		NS
Pear	Cyprus	EC	350 g/L	Spray	52-122	NS		21
Pear	Greece	WP	470 g/kg	Spray	70-94	NS		30
Pear, Asian	Japan	WP	48%	Spray	0.032	NS		30
Pear, Asian	Japan	EC	30%	Spray	0.03-0.06%	NS		30
Pear	Namibia	SC	475 g/L	Spray		300 to 3500	1.18-1.66	14
Pear	S. Arabia	EC	350 g/L	Spray	35-52	NS		28??
Pear	S. Africa	SC	475 g/L	Spray		300 to 3500	1.18-1.66	14
Pear	USA, exc CA	EC	360 g/L	Spray		1870-4675 (air 187)	2.24-2.76	7
Pear	USA, exc CA	EC	360 g/L	Spray	30-60	NS		NS
Pear	USA, exc CA	WSB	50%	Spray		2800(air 93)	2.24-2.73	7
Pear	USA, exc CA	EC	360 g/L	soil	180-270//hl	1870-3740		Prior to bloom
Pear	USA, exc CA	WSB	50%	soil	0.06%	1870-3740		GS
Pear	USA, exc CA	WSB	50%	Spray	0.03-0.06%	NS		GS
Pear	USA-CA	EC	360 g/L	Spray		4675	2.24-2.76	7
Pear	USA-CA	EC WSB	360 g/L 50%	Soil	600 0.06%	1870-3740 1870-4675		prior to bloom
Pear	USA-CA	EC	360 g/L	Spray	0.02-0.05%	NS		GS
Pear	USA-CA	WSB	50%	Spray		3700-4675 air 93	2.24-2.76	7
Pear	USA-CA	WSB	50%	Spray	0.03-0.06%	NS		GS
Peas field, cow, chick, pigeon	Australia	EC	350 g/L	Spray			0.175-0.35	NR
Pecan	Australia	EC	350 g/L	Spray	52.5		0.98	14
Pepper sweet	Australia	EC	350 g/L	Spray	66.5		0.735	3
Peppers G	Canada	EC	400 g/L	Spray	500-600	NS		2
Peppers	Canada	EC	400 g/L	Spray		NS	0.6-1.13	2
Peppers	Canada	WP	50%	Spray		NS	0.5-1.12	2
Peppers	Cyprus, Greece	WP	470 g/kg	Spray	70-94	NS		GS
Peppers	Cyprus	EC	350 g/L	Spray	52-122	NS		
Peppers	Greece	EC	350 g/L	Spray	52-122	NS		1

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Peppers	USA, exc CA	EC	360 g/L	Spray		93 (air 187)	0.56-1.12	4
Peppers	USA, exc CA	EC	360 g/L	Spray		As above	0.56	1
Peppers	USA, exc CA	WSB	50%	Spray		93 (air 9.3)	0.56	1
Peppers	USA, exc CA	WSB	50%	Spray		As above	0.56-1.12	4
Peppers	USA-CA	EC	360 g/L	Spray		93 (air 9.3)	0.56	1
Peppers	USA-CA	EC	360 g/L	Spray		As above	0.56 to 1.12	4
Peppers	USA-CA	WSB	50%	Spray		As above	0.56	1
Peppers	USA-CA	WSB	50%	Spray		As above	0.56-1.12	4
Persimmons	Australia	EC	350 g/L	Spray	52.5-70		0.735	7
Pineapple	Central America	ECF	350 g/L	Spray		200 to 600	1.4-2.1	7
Pineapple	Namibia	SC	475 g/L	Spray		30 to NS	1.187	5 mo
Pineapple	S. Africa	SC	475 g/L	Spray		30 to NS	1.187	5 mo
Pineapple	USA-CA	EC	360 g/L	Spray		93 (air 187)	1.66-2.24	7
Pistachio	Australia	EC	350 g/L	Spray	70	NS	0.735	14
Pomegranate	Australia	EC	350 g/L	Spray	70	NS	0.735	14
Pome fruit	Australia	EC	350 g/L	Spray	52.5-66.5	NS		28
Potato	Australia	EC	350 g/L	Spray		NS	0.735	14
Potato	Austria	WP	32.9%	Spray		NS	0.19-0.26	35
Potato	Canada	EC	400 g/L	Spray		NS	0.6-0.8	0
Potato	Canada	WP	50%	Spray		NS	0.5-0.75	0
Potato	Central America	EC	350 g/L	Spray		NS	0.52-0.70	0
Potato	Chile	EC	320 g/L	Spray		400 to NS	0.24-0.40	7
Potato	Chile	WP	48.25%	Spray		NS	0.48-0.72	7
Potato	Iran	EC	350 g/L	Spray		NS	0.35-0.70	15
Potato	Japan	EMU	30%	Spray	0.03-0.04%	NS		7
Potato	New Zealand	EC	350 g/L	Spray		NS	0.70	0
Potato	Peru	EC	355g/L	Spray	88	NS		21
Potato	Turkey	EC	360 g/L	Spray	108	NS		14
Potato	USA	EC	360 g/L	Spray		93 (air 187)	0.56 to 1.12	1
Potato	USA, exc CA	EC	360 g/L	Chemigation		NS		1
Potato	USA,	WSB	50%	Spray		93 (air 9.3)	0.56-1.12	1
Potato	Zimbabwe	EC	35%	Spray		225 to NS	0.70	14
Pumpkins	Australia	EC	350 g/L	Spray	66.5-70		0.735	3
Rape seed	Australia	EC	350 g/L				0.175-0.35	NR
Rambutans	Australia	EC	350 g/L	Spray	70			7
Safflower	Australia	EC	350 g/L	Spray			0.175-0.35	NR
Sapodillas	Australia	EC	350 g/L	Spray	70			14
Soybean	Australia	EC	350 g/L	Spray		50 to NS	0.175-0.35	NR
Soybean	Central America	EC	350 g/L			NS	0.52-0.70	0
Soybean	Chile	WP	48.25%			NS	0.48-0.73	NS
Soybean	Iran	EC	350 g/L			NS	1.05	15
Soybean	Zimbabwe	EC	35%			200 to NS	0.10-0.70	21
Soybean	Zimbabwe	MO	35%			200	0.10-0.35	21
Soybean	Brazil	EC	350 g/L			100 to 250	0.17-0.52	30
Squash	Australia	EC	350 g/L	Spray	66.5-70		0.735	3
Squash	Canada	EC	400 g/L	Spray		NS	0.60	2
Squash	Canada	WP	50%	Spray		NS	0.5-0.55	2
Squash, summer	USA, exc CA	EC	360 g/L	Spray		93 (air 187)	0.56 to 1.12	2
Squash, summer	USA, exc CA	WSB	50%	Spray		93 (air 9.3)	0.56-1.12	2
Squash, summer	USA-CA	EC	360 g/L	Spray		NS	0.56-1.12	2
Squash, summer	USA-CA	WSB	50%	Spray		93 (air 9.3)	0.56-1.12	2
Sunflower	Australia	EC	350 g/L	Spray			0.175-0.35	NR
Sugarbeet	Canada	EC	400 g/L	Spray		NS	0.8-1.10	45
Sugarbeet	Chile	WP	48.25%	Spray		NS	0.48-0.72	NS
Sugarbeet	Japan	EC	30%	Spray	0.03-0.07%	NS		30
Sw. potato	Australia	EC	350 g/L	Spray		NS	0.735	14
Sw. potato	Japan	EC	30%	Spray	0.06-0.07%	NS		7
Sw. potato	Japan	GR	3,3%	Spray		NS	1.32-1.9	7
Sw. potato	Japan	DP	5%	Spray		NS	0.15-0.20	7

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Sw. potato	USA, exc CA	EC	360 g/L	Spray		93 (air 187)	0.56 -1.12	1
Sw. potato	USA, exc CA	EC	360 g/L	Soil		93 (air 187)	1.12-2.24	NS
Sw. potato	USA, exc CA	WSB	50%	Spray		93 (air 9.3)	0.563-1.12	1
Sw. potato	USA-CA	EC	360 g/L	Spray		93 (air 9) to NS	0.56 to NS	1
Sw. potato	USA-CA	WSB	50%	Spray		93 (air 9.3)	0.56	1
Tamarillo	Australia	EC	350 g/L	Spray	70			7
Taro	Australia	EC	350 g/L	Spray	70			14
Tea	China	EC	350 g/L	Spray		NS	0.06-0.08	NS
Tea	Japan	EC	30%	Spray	0.04-0.06%	NS		GS
Tea	Malaysia	EC	33%	Spray		NS	0.59	30
Tomato	Angola	EC	475g/L	Spray		500-1500	0.23-0.70	NS
Tomato	Australia	EC	350 g/L	Spray	66.5	NS	0.735	3
Tomato	Canada	G	400 g/L	Spray	50-60	NS		2
Tomato	Canada	EC	400 g/L	Spray		NS	0.60-1.10	2
Tomato	Canada	WP	50%	Spray		NS	0.50-1.12	2
Tomato G	Canada	G	50%	Spray		NS	0.50-0.75	2
Tomato	Central America	EC	350 g/L	Spray		NS	0.52-0.70	1
Tomato	Chile	EC	320 g/L	Spray		400 to NS	0.24-0.40	5
Tomato	Chile	WP	48.25%	Spray		NS	0.48-0.72	NS
Tomato	Cyprus	WP	470 g/kg	Spray	70-94	NS		4
Tomato	Cyprus	EC	350 g/L	Spray	52-122	NS		1
Tomato	Ecuador	CE	350 g/L	Spray		NS	0.35-0.52	14
Tomato	Greece	EC	350 g/L	Spray	52-122	NS		1
Tomato	Greece	WP	470 g/kg	Spray	70-94	NS		4
Tomato	Morocco	CS	330 g/L	Spray	57	NS		NS
Tomato	Japan	EC	30%	Spray	0.03-0.06%	NS		14
Tomato	Japan	EC	35%	Spray	0.035%	NS		14
Tomato	Mozambique	SC	47.5%	Spray		62.5 -375	0.47-0.72	NS
Tomato	Namibia	SC	475 g/L	Spray	47.5	30 to NS		1
Tomato	N. Zealand	EC	350 g/L	Spray		NS	0.42-0.70	2
Tomato	South Africa	SC	475 g/L	Spray		62 to 1500	0.24-0.71	1
Tomato	Southern EU	SC	330 g/L	Spray		NS	< 0.53	3
Tomato	Spain	EC	350 g/L	Spray	0.15-0.30%	NS		3
Tomato	Spain	EC	350 g/L	Spray	52-122	NS		3
Tomato F/G	USA, exc CA	EC	360 g/L	Spray		93 (air 187)	0.56 to 1.12	2
Tomato F/G	USA, exc CA	EC	360 g/L	Spray		As above		2
Tomato F/G	USA, exc CA	WP	50%	Spray		93-187 (air 9)	0.56-1.12	2
Tomato F/G	USA, exc CA	WP	50%	Spray	58	As above		2
Tomato F/G	USA-CA	EC	360 g/L	Spray		935-1870	0.56 to 1.12	2
Tomato F/G	USA-CA	EC	360 g/L	Spray	2.3 qt /378l	As above		2
Tomato F/G	USA-CA	WP	50%	Spray		93 (air 9.3)	0.56-1.12	2
Tomato F/G	USA-CA	WP	50%	Spray	58	As above		2
Tomato	Venezuela	EC	350 g/L	Spray		NS	0.35-0.70	7
Tomato	Venezuela	SC	350 g/L	Spray		NS	0.35	NS
Tomato	Zimbabwe	EC/	35 -30%	Spray	35-67	NS		7
Vegetables	Algeria	EC	350 g/L	Spray	52	NS		15
Vegetables	Cameroon	EC	350 g/L	Spray		NS	0.26-	28
Vegetables	Ecuador	EC	350 g/L	Spray		NS	0.35-0.52	14
Vegetables	Ethiopia	ULV	250 g/L	Spray		NS	0.61-0.75	7 -14
Vegetables	Ethiopia	EC	350 g/L	Spray		20 to 300	0.70	7 -14
Vegetables	Morocco	EC	330 g/L	Spray	57	NS		30
Vegetables	Sudan	EC	500 g/L	Spray	NS	NS		NS
Vegetables	Turkey	EC	360 g/L	Spray		NS	0.54	14
Vegetables	Turkey	WP	32.9%	Seed	5 g//kg seed	NS		NA
Vegetables	Turkey	WP	32.9%	Soil app		NS	5	NS
Vegetables	Turkey	WP	32.9%	Bait		NS	26	NS
Vegetables	Turkey	WP	32.9%	Spray		NS	0.50-0.66	15
Vegetables	Turkey	EC	360 g/L	Bait	350ml/500g	NS		3wp

Crop	Country	Formulation		Application				PHI
		Type	Conc	Method	Rate g/hL	Water L/ha	Rate kg ai/ha	day
Vegetables	Turkey	EC	360 g/L	Spray		NS	0.35-1.08	7wp
Vegetables	Venezuela	CE	350 g/L	Spray		NS	0.52-0.87	21
Watermelon	Chile	EC	320 g/L	Spray		400 to NS	0.24-0.40	7
Watermelon	Cyprus, Greece	WP	470 g/kg	Spray	70-94	NS		7
Watermelon	Greece	EC	350 g/L	Spray	52-122	NS		1
Watermelon	Japan	EC	30%	Spray	0.03-0.06%	NS		14
Watermelon	Japan	GR	3.3%	Spray		NS	1-2	GS

RESIDUES RESULTING FROM SUPERVISED TRIALS

The Meeting received information on supervised trials for the following commodities:

Commodity	Table
Lemon	33
Mandarin	34
Orange	35
Apple	36
Pear	37
Cherry	38
Apricot	39
Nectarine	40
Peach	41
Grapes	42
Avocado	43
Custard apple	44
Litchi	45
Mango	46
Papaya	47
Persimmon	48
Pineapple	49
Cabbage, head	50
Cabbage, Savoy	51
Broccoli	52
Brussels sprouts	53
Cauliflower	54
Cucumber	55
Melons (Australia)	56
Melons (Europe, USA)	57
Squash, summer	58
Zucchini	59
Peppers, sweet (Spain, USA)	60
Peppers, sweet (Australia)	61
Tomato (field)	62
Tomato (indoor)	63
Eggplant	64
Sweet corn	65
Beans	66
Peas	67
Soybean	68
Beetroot	69
Carrot	70

Commodity	Table
Potato	71
Sweet potato	72
Sugar beet	73
Celery	74
Rhubarb	75
Hazelnut	76
Macadamia	77
Cotton	78
Cocoa	79
Coffee	80
Tea	81
Sugar beet leaves and head	82
Forage and vines beans	83
Pea hay	84
Cocoa shell	85
Cotton lint	86

Trials were well documented. The residues were expressed for the total compound endosulfan and in the majority of cases for alpha, beta and endosulfan sulfate. Laboratory reports included method validation and recoveries with spiking at residue levels. Dates of analysis or duration of analysis were reported.

In cases where the result was reported as ND, the LOQ of 0.02 mg/kg was usually applicable. For the total in the case of the LOQ of each metabolite, the residue was reported according to the FAO guideline as indicated in the Table 32 below.

Table 32. Reported residue where one or more of the analytes was present at the relevant LOQ.

alpha endosulfan	beta endosulfan	endosulfan sulfate	residue total
< 0.0X	< 0.0X	< 0.0X	< 0.0X
< 0.0X	0.10	0.05	0.15
< 0.0X	< 0.0Y	0.03	0.03
< 0.0X	< 0.0Y	< 0.0Z	< maximum but < 0.05
alpha endosulfan	beta endosulfan	endosulfan sulfate	residue total
< 0.005	< 0.005	< 0.005	< 0.005
< 0.01	< 0.01	< 0.01	< 0.01
< 0.02	< 0.02	< 0.02	< 0.02
< 0.05	< 0.05	< 0.05	< 0.05

In the case where the LOQs were different, the higher level was taken into account with a limit of 0.05 mg/kg

No conversion of the content of endosulfan sulfate to endosulfan was introduced due to the fact that the molecular weights are almost identical.

Indices were “c” for calculated, “d” for determined and “co” for control trial for the raw material when the trials were conducted for processed studies.

Table 33. Endosulfan residues in lemons resulting from supervised trials in Australia.

LEMONS	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hL	L/ha	No.	days	analysed		
Australia	EC	spray	10.5	2000	4	0	fruit	0.10, 0.14, 0.012	0.25
2000						1	fruit	0.049, 0.10, 0.008	0.16
Beverford						3	fruit	0.052, 0.12, 0.007	0.17
lisbon						7	fruit	0.038,0.14, 0.012	0.19
N° 1/10/543									
Australia	EC	spray	21	2000	4	0	fruit	0.36, 0.35, 0.013	0.72
2000						3	fruit	0.21, 0.47, 0.024	0.70
Beverford									
lisbon						0	fruit	0.007,< 0.005,< 0.005	0.007co
N° 1/10/543									
Australia	EC	spray	10.5	1428	4	0	fruit	0.064, 0.069, 0.021	0.15
2000						1	fruit	0.014, 0.021, 0.013	0.05
Koah						3	fruit	0.006, 0.014,0.013	0.03
lisbon						7		< 0.005, 0.008, 0.013	0.02
N° 1/10/543									
Australia	EC	spray	21.	1428	4	0	fruit	0.068, 0.072, 0.021	0.16
2000									
Koah						+3	peel	0.063, 0.20, 0.10	.0.36
lisbon						+3	flesh	< 0.005,< 0.005, < 0.005	< 0.005
N° 1/10/543						0co	fruit	0.019, 0.012,0.005	0.04
Australia	EC	spray	10.5	2000	4	0	fruit	0.082, 0.095., 0.016	0.19
2000						1	fruit	0.058, 0.099, 0.021	0.18
Montacute						3	fruit	0.045, 0.090, 0.029	0.16
lisbon						7	fruit	0.024, 0.074,0.033	0.13
N° 1/10/543									
Australia	EC	spray	21	2000	4	0	fruit	0.18,0.23, 0.028	0.44
2000						3	fruit	0.088, 0.22, 0.034	0.34
Montacute									
lisbon									
N° 1/10/543									

co control trial

Table 34. Endosulfan residues in mandarins resulting from supervised trials in Spain, Italy, Greece, and Australia.

MANDARINS	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.	days	analysed		
Spain1999	CS*	Spray	1.05	3000	2	0	Fruit	0.46, 0.25, 0.042	0.75
Clemenules		Interval		(0.035% ai)		22	Fruit	0.089, 0.063, 0.048	0.20
		12d							
C016672		BBCH 79							
ER 99 ECS 751									
Spain1999	CS*	Spray	1.05	3000	2	0	Fruit	0.48, 0.29, 0.047	0.82
Clemenules		Interval		(0.035% ai)		21	Fruit	0.20, 0.15, 0.11	0.46
		15d							
C016672		BBCH 79							
ER 99 ECS 751									
Spain1999	CS*	Spray	1.05	3000	2	0	Fruit	0.32, 0.21, 0.066	0.60
Clemenules		Interval		(0.035% ai)		21	Fruit	0.088, 0.079, 0.087	0.25
C016672		14 d							
ER 99 ECS 751		BBCH 79							

MANDARINS	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.	days	analysed		
Italy1999	CS*	Spray	1.05	3000	2	0	Fruit	0.52. 0.32, 0.046	0.89
Oroval		Interval		(0.035% ai)		21	Fruit	0.24, 0.16, 0.044	0.44
C016672		13 d							
ER 99 ECS 751		BBCH 79							
Italy1999	CS*	Spray	1.05	3000	2	0	Fruit	0.62, 0.41, 0.13	1.16
Comune		Interval15 d		(0.035% ai)		20	Fruit	0.29, 0.26, 0.17	0.72
C016672		BBCH 79, 81							
ER 99 ECS 751									
Spain1998	CS*	Spray	1.05	3000	2	0	Peel	2.4, 1.4, 0.11	3.91
Clemenules		Interval		(0.035%		7	Peel	2.3, 1.4, 0.21	3.91
C005296		14 d		ai)		14	Peel	1.6, 0.92, 0.21	2.73
ER 98 ECS		BBCH 75,				20	Peel	0.79, 0.54, 0.24	1.57
751		81				29	Peel	0.65, 0.43, 0.27	1.30
						0	Pulp	< 0.02, ND, ND	< 0.02
						7	Pulp	< 0.02, < 0.02, ND	< 0.02
						14	Pulp	< 0.02, ND, ND	< 0.02
						20	Pulp	ND, ND, ND	< 0.02
						29	Pulp	< 0.02, ND, ND	< 0.02
						0	Fruit[c]	0.56, 0.33, 0.03	0.92
						7	Fruit[c]	0.58, 0.36, 0.06	1.0
						14	Fruit[c]	0.41, 0.24, 0.06	0.71
						20	Fruit[c]	0.2, 0.14, 0.06	0.40
						29	Fruit[c]	0.17, 0.12,0.08	0.37
Spain1998	CS*	Spray	1.05	3000	2	0	Peel	1.8, 0.97, 0.15	2.92
Ortanique		Interval		(0.035%		7	Peel	2.1, 1.3, 0.22	3.62
C005296		14 d		ai)		14	Peel	0.95, 0.68, 0.26	1.89
ER 98 ECS 751		BBCH 75, 79				20	Peel	0.80, 0.51, 0.22	1.53
						29	Peel	0.59, 0.46, 0.27	1.32
						0	Pulp	< 0.02, ND, ND	< 0.02
						7	Pulp	< 0.02, ND, ND	< 0.02
						14	Pulp	ND, ND, ND	< 0.02
						20	Pulp	ND, ND, ND	< 0.02
						29	Pulp	ND, ND, ND	< 0.02
						0	Fruit[c]	0.42, 0.23, 0.04	0.69
						7	Fruit[c]	0.47, 0.29, 0.06	0.82
						14	Fruit[c]	0.22, 0.16, 0.06	0.44
						20	Fruit[c]	0.18, 0.12, 0.05	0.35
						29	Fruit[c]	0.13,0.11, 0.06	0.30
Spain1998	CS*	Spray	1.05	3000	2	0	Peel	1.8,1.1, 0.13	3.03
Clemenules		Interval		(0.035%		7	Peel	1.5,0.86, 0.19	2.55
C005296		14 d		ai)		14	Peel	0.83, 0.50, 0.19	1.52
ER 98 ECS 751		BBCH 75, 79				22	Peel	0.65, 0.44, 0.26	1.35
						29	Peel	0.33, 0.24, 0.20	0.77
						0	Pulp	< 0.02, ND, ND	< 0.02
						7	Pulp	ND, ND, ND	< 0.02
						14	Pulp	< 0.02, ND, ND	< 0.02
						22	Pulp	ND, ND, ND	< 0.02
						29	Pulp	< 0.02, ND, ND	< 0.02
						0	Fruit[c]	0.47, 0.29, 0.04	0.80
						7	Fruit[c]	0.41, 0.24, 0.06	0.71
						14	Fruit[c]	0.22, 0.13, 0.06	0.41
						22	Fruit[c]	0.17, 0.12, 0.07	0.36
						29	Fruit[c]	0.09, 0.07, 0.06	0.22

MANDARINS	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.	days	analysed		
Italy1998	CS*	Spray	1.05	3000	2	0	Peel	2.6, 1.4, 0.33	4.33
Clementino Comun		Interval		(0.035% ai)		7	Peel	1.6, 0.88, 0.25	2.73
C005296		14 d				14	Peel	1.6, 0.91, 0.30	2.81
ER 98 ECS 751		BBCH 81, 81				21	Peel	0.86, 0.55, 0.24	1.65
						28	Peel	1.1, 0.69, 0.25	2.04
						7	Pulp	0.03, 0.02, ND	0.05
						14	Pulp	0.04, 0.03, ND	0.07
						21	Pulp	0.05, 0.03, ND	0.08
						28	Pulp	0.06, 0.04, ND	0.10
						0	Fruit[c]	0.74, 0.4, 0.10	1.24
						7	Fruit[c]	0.51, 0.28, 0.08	0.87
						14	Fruit[c]	0.58, 0.34, 0.11	1.03
						21	Fruit[c]	0.26, 0.16, 0.07	0.49
						28	Fruit[c]	0.34, 0.22, 0.08	0.64
Italy1998	CS*	Spray	1.05	3000	2	0	Peel	2.6, 1.5, 0.11	4.21
Oroval		Interval		(0.035% ai)		7	Peel	2.1, 1.2, 0.21	3.51
C005296		14 d				14	Peel	1.2, 0.75, 0.28	2.23
ER 98 ECS 751		BBCH 79, 81				21	Peel	0.43, 0.33, 0.25	1.01
						28	Peel	0.15, 0.12, 0.13	0.40
						0	Pulp	0.03, < 0.02, ND	0.03
						7	Pulp	0.03, < 0.02, ND	0.03
						14	Pulp	0.05, 0.02, ND	0.07
						21	Pulp	0.02, < 0.02, ND	0.02
						28	Pulp	< 0.02, < 0.02, ND	< 0.02
						0	Fruit[c]	0.72, 0.41, 0.04	1.17
						7	Fruit[c]	0.68, 0.38, 0.07	1.13
						14	Fruit[c]	0.41, 0.25, 0.1	0.76
						21	Fruit[c]	0.12, 0.09, 0.07	0.28
						28	Fruit[c]	0.04, 0.04, 0.04	0.12
Spain1998	33EC	Spray	1.05	3000	2	0	Peel	1.4, 1.4, 0.48	3.28
Clemenules		Interval		(0.035% ai)		0	Pulp	< 0.02, < 0.02, ND	< 0.02
C003107		14 d				20	Peel	0.06, 0.21, 0.52	0.79
ER 98 ECS 741		BBCH 75, 81				20	Pulp	ND, ND, ND	< 0.02
						0	Fruit[c]	0.35, 0.35, 0.12	0.82
						20	Fruit[c]	0.02, 0.06, 0.14	0.22
Spain1998	33EC	Spray	1.05	3000	2	0	Peel	1.10, 0.96, 0.24	2.30
Ortanique		Interval		(0.035% ai)		0	Pulp	< 0.02, ND, ND	< 0.02
C003107		14 days				20	Peel	0.04, 0.15, 0.36	0.55
ER 98 ECS 741		BBCH 75, 79				20	Pulp	ND, ND, ND	< 0.02
						0	Fruit[c]	0.28, 0.24, 0.07	0.59
						20	Fruit[c]	0.02, 0.04, 0.10	0.16
Italy1998	33EC	Spray	1.05	3000	2	0	Peel	1.10, 1.20, 0.49	2.79
Clementino comune		Interval		(0.035% ai)		0	Pulp	< 0.02, < 0.02, ND	< 0.02
C003107		14 d				21	Peel	0.17, 0.34, 0.58	1.09
ER 98 ECS 741		BBCH 81, 81				21	Pulp	< 0.02, < 0.02, ND	< 0.02
						0	Fruit[c]	0.27, 0.29, 0.12	0.68
						21	Fruit[c]	0.05, 0.09, 0.14	0.28
Italy1998	33EC	Spray	1.05	3000	2	0	Peel	1.10, 1.10, 0.42	2.62
Oroval		Interval		(0.035% ai)		0	Pulp	0.03, 0.03, ND	0.06
C003107		14 d				21	Peel	0.13, 0.29, 0.58	1.00
ER 98 ECS 741		BBCH 79, 81				21	Pulp	< 0.02, < 0.02, ND	< 0.02
						0	Fruit[c]	0.38, 0.38, 0.15	0.91
						21	Fruit[c]	0.05, 0.10, 0.19	0.34

MANDARINS	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.	days	analysed		
Spain1997	35EC	Spray	1.05	3000	2	0	Peel	1.10, 0.89, 0.69	2.68
Clemenvilla		Interval		(0.035% ai)		0	Pulp	ND, < 0.02, < 0.02	< 0.02
C001465		14 d				7	Peel	0.28, 0.47, 1.10	1.85
ER 97 ECS741		BBCH 77, 78				7/14	Pulp	ND, ND, < 0.02	< 0.02
						14	Peel	0.17, 0.31, 0.94	1.42
						21	Peel	0.12, 0.19, 1.20	1.51
						21	Pulp	ND, ND, < 0.02	< 0.02
						28	Peel	0.04, 0.05, 0.34	0.48
						28	Pulp	ND, ND, < 0.02	< 0.02
						0	Fruit[c]	0.27, 0.22, 0.17	0.65
						7	Fruit[c]	0.07, 0.12, 0.26	0.45
						14	Fruit[c]	0.05, 0.08, 0.22	0.35
						21	Fruit[c]	0.03, 0.05, 0.27	0.35
						28	Fruit[c]	< 0.02, < 0.02, 0.08	0.08
Spain1997	35EC	Spray	1.05	3000	2	0	Peel	0.76, 0.74, 0.32	1.82
Satsuma		Interval		(0.035%		0	Pulp	ND, ND, ND	< 0.02
C001465		14 d		ai)		7	Peel	0.08, 0.19, 0.46	0.73
ER 97 ECS741		BBCH 78, 78				7	Pulp	ND, ND, ND	< 0.02
						14	Peel	0.06, 0.12, 0.46	0.64
						14	Pulp	ND, ND, ND	< 0.02
						21	Peel	0.06, 0.13, 0.48	0.67
						21	Pulp	ND, ND, ND	< 0.02
						28	Peel	0.04, 0..07, 0.32	0.43
						28	Pulp	ND, ND, ND	< 0.02
						0	Fruit[c]	0.20, 0.20, 0.09	0.49
						7	Fruit[c]	0.03, 0.06, 0.13	0.22
						14	Fruit[c]	0.02, 0.04, 0.13	0.19
						21	Fruit[c]	0.02, 0.04, 0.14	0.20
						28	Fruit[c]	< 0.02, 0.03, 0.10	0.13
Greece1997	33EC	Spray	1.05	3000	2	0	Peel	1.20, 0.86, 0.41	2.47
Climentines		Interval		(0.035%		0	Pulp	ND, ND, < 0.02	< 0.02
C001465		14 d		ai)		7	Peel	0.14, 0.28, 0.36	0.78
ER 97 ECS 741		BBCH 79, 81				7/14	Pulp	ND, ND, < 0.02	< 0.02
						14	Peel	0.07, 0.17, 0.34	0.58
						21	Peel	0.05, 0.12, 0.28	0.45
						21	Pulp	ND, ND, < 0.02	< 0.02
						28	Peel	0.07, 0.14, 0.42	0.63
						28	Pulp	ND, < 0.02, < 0.02	< 0.02
						0	Fruit[c]	0.51, 0.36, 0.18	1.05
						7	Fruit[c]	0.07, 0.13, 0.16	0.36
						14	Fruit[c]	0.03, 0.07, 0.13	0.23
						21	Fruit[c]	0.02, 0.05, 0.10	0.17
						28	Fruit[c]	0.03, 0.06, 0.17	0.26
Italy1997	33EC	Spray	1.05	3000	2	0	Peel	0.87, 0.72, 0.18	1.77
Oroval		Interval		(0.106%)		0	Pulp	< 0.02, < 0.02, ND	< 0.02
C001465		14 days				7	Peel	0.05, 0.21, 0.33	0.59
ER 97 ECS 741		BBCH 75, 79				7	Pulp	ND, ND, ND	< 0.02
						14	Peel	0.02, 0.1, 0.26	0.38
						14	Pulp	ND, < 0.02, ND	< 0.02
						21	Peel	0.04, 0.11, 0.34	0.49
						21	Pulp	ND, ND, ND	< 0.02
						28	Peel	< 0.02, 0.04, 0.15	0.21
						28	Pulp	ND, ND, < 0.02	< 0.02
						0	Fruit[c]	0.19, 0.16, 0.04	0.39
						7	Fruit[c]	< 0.02, 0.05, 0.08	0.13
						14	Fruit[c]	< 0.01, 0.04, 0.09	0.13
						21	Fruit[c]	< 0.02, 0.04, 0.10	0.14
						28	Fruit[c]	< 0.01, < 0.02, 0.05	0.05

MANDARINS	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.	days	analysed		
Italy1997	33EC	Spray	1.05	3000	2	0	Peel	0.76, 0.64, 0.22	1.62
Clementino		Interval		(0.035%		0	Pulp	< 0.02, ND, ND	< 0.02
comune		14 days		ai)		7	Peel	0.07, 0.19, 0.26	0.52
C001465		BBCH 75,				7	Pulp	ND, ND, < 0.02	< 0.02
ER 97 ECS741		79				14	Peel	0.03, 0.08, 0.37	0.48
						14	Pulp	ND, ND, < 0.02	< 0.02
						21	Peel	0.02, 0.07, 0.34	0.43
						21	Pulp	ND, ND, < 0.02	< 0.02
						28	Peel	< 0.02,0.04, 0.24	0.28
						28	Pulp	ND, ND, < 0.02	< 0.02
						0	Fruit[c]	0.16, 0.14, 0.05	0.35
						7	Fruit[c]	0.03, 0.06, 0.08	0.17
						14	Fruit[c]	< 0.02, 0.03, 0.10	0.13
						21	Fruit[c]	< 0.02, 0.03, 0.10	0.13
						28	Fruit[c]	< 0.02, < 0.02, 0.08	0.08
Australia	EC	spray	0.067	645	4	0	fruit	0.034, 0.046, 0.012	0.09
2000				(10.4 g/hL)		1	fruit	0.031, 0.076, 0.040	0.15
Emerald Creek						3	fruit	0.025, 0.057, 0.024	0.11
imperial						7	fruit	0.011,0.039, 0.033	0.08
N° 1/10/542									
Australia	EC	spray	0.13	645	4	0	fruit	0.037, 0.099, 0.10	0.24
2000						3	fruit	0.039, 0.092, 0.048	0.18
Emerald Creek									
imperial									
N° 1/10/542									
Australia	EC	spray	0.21	2000	4	0	fruit	0.064,0.072., 0.018	0.15
2000				(10.5 g/hL)		1	fruit	0.021, 0.042, 0.026	0.09
Taylorville						3	fruit	0.013, 0.033, 0.025	0.07
kara						7	fruit	0.006, 0.014,0.015	0.04
N° 1/10/542									
Australia	EC	spray	0.42	2000	4	0	fruit	2.90, 1.90.0.11	4.91
2000						3	fruit	0.03, 0.067, 0.044	0.14
Taylorville									
kara									
N° 1/10/542									

Table 35. Endosulfan residues in oranges resulting from supervised trials in Spain, Italy, Greece, and Australia.

ORANGES	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial Variety Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
Spain1999	CS*	Spray	1.05	3000	2	0	Peel	1.7, 0.99, 0.043	2.73
Navelina		Interval		0.035%)		0	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
C016758		14 d				0	Fruitc	0.59, 0.35, 0.027	0.97
ER 99 ECS 758		BBCH 81,				7	Peel	1.5, 0.84, 0.059	2.40
		81				7	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						7	Fruitc	0.43, 0.25, 0.031	0.71
						14	Peel	1.1, 0.65, 0.067	1.82
						14	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						14	Fruitc	0.31, 0.20, 0.034	0.54
						21	Peel	0.73, 0.47, 0.058	1.26
						21	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						21	Fruitc	0.25, 0.16, 0.033	0.44
						28	Peel	0.86, 0.57, 0.077	1.51
						28	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						28	Fruitc	0.27, 0.18, 0.038	0.49

ORANGES	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial Variety Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	beta endosulfan, endosulfan sulfate, mg/kg	Residues, mg/kg
Italy1999	CS*	Spray	1.05	3000	2	0	Peel	1.6, 0.95, 0.087	2.64
Navelina		Interval		(0.035%		0	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
				)					
C016758		14 d				0	Fruitc	0.56, 0.34, 0.043	0.94
ER 99 ECS 758		BBCH 81,				7	Peel	1.80, 1.3, 0.13	3.23
		83				7	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						7	Fruitc	0.66, 0.45, 0.059	1.17
						14	Peel	1.2, 0.76, 0.08	2.04
						14	Pulp	0.038, 0.03, 0.027	0.10
						14	Fruitc	0.45, 0.28, 0.053	0.78
						21	Peel	1.1, 0.75, 0.12	1.97
						21	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						21	Fruitc	0.41, 0.28, 0.055	0.74
						28	Peel	0.95, 0.67, 0.16	1.78
						28	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						28	Fruitc	0.35, 0.25, 0.069	0.67
Italy1999	CS*	Spray	1.05	3000	2	0	Peel	1.9, 1.2, 0.068	3.17
Navelina		Interval		(0.035%		0	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
				)					
C016758		14 d				0	Fruitc	0.69, 0.42, 0.037	1.15
ER 99 ECS758		BBCH 81,				7	Peel	2.2, 1.4, 0.057	3.66
		81				7	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						7	Fruitc	0.77, 0.49, 0.033	1.29
						14	Peel	0.77, 0.49, 0.047	1.31
						14	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						14	Fruitc	0.28, 0.19, 0.029	0.50
						21	Peel	1.2, 0.82, 0.065	2.09
						21	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						21	Fruitc	0.45, 0.30, 0.036	0.79
						28	Peel	0.93, 0.64, 0.087	1.66
						28	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
						28	Fruitc	0.34, 0.24, 0.043	0.62
Spain1999	CS*	Spray	1.05	3000	2	0	Fruit	0.42, 0.23, 0.04	0.69
Navelina		Interval13 d		(0.035%		22	Fruit	0.17, 0.12, 0.07	0.36
				)					
C016112		BBCH 81,							
ER 99 ECS750		81							
Spain1999	CS*	Spray	1.05	3000	2	0	Fruit	0.27, 0.14, < 0.02	0.41
Newhall		Interval 14d		(0.035%		22	Fruit	0.31, 0.21, 0.06	0.58
				)					
C016112		BBCH 81,							
ER 99 ECS750		83							
Spain1999	CS*	Spray	1.05	3000	2	0	Fruit	0.51, 0.26, < 0.02	0.77
Navelina		Interval 14d		(0.035%		22	Fruit	0.46, 0.25, < 0.02	0.71
				.)					
C016112		BBCH 81,							
ER 99 ECS750		83							
Italy 2000	CS*	Spray	1.05	3000	2	0	Fruit	0.51, 0.35, 0.04	0.90
Navelina		Interval 14d		(0.035%		22	Fruit	0.34, 0.23, 0.03	0.60
				)					
C016112		BBCH 81,							
ER 99 ECS750		83							

ORANGES	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial Variety Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	beta endosulfan, endosulfan sulfate, mg/kg	Residues, mg/kg
Italy 2000	CS*	Spray	1.05	3000	2	0	Fruit	0.36, 0.26, 0.12	0.74
Navel		Interval14 d		(0.035% ai)		22	Fruit	0.28, 0.22, 0.10	0.60
C016112		BBCH 79,							
ER 99		81							
750ECS									
Spain 1998	CS*	Spray	1.05	3000	2	0	Peel	1.4, 0.81, 0.18	2.39
Navelina		Interval 15d		(0.035% ai)		7	Peel	0.90, 0.53, 0.27	1.68
C005108		BBCH 74,				14	Peel	0.50, 0.37, 0.35	1.22
ER 98 ECS		78				21	Peel	0.36, 0.29, 0.39	1.04
750						28	Peel	0.36, 0.30, 0.38	1.04
						0/7	Pulp	ND, ND, ND	< 0.02
						14/28	Pulp	< 0.02, < 0.02 ND	< 0.02
						21	Pulp	ND, ND, ND	< 0.02
						0	Fruitc	0.40, 0.23, 0.06	0.69
						7	Fruitc	0.22, 0.13, 0.07	0.42
						14	Fruitc	0.13, 0.10, 0.09	0.32
						21	Fruitc	0.09, 0.07, 0.09	0.25
						28	Fruitc	0.09, 0.08, 0.10	0.27
Spain1998	CS*	Spray	1.05	3000	2	0	Peel	0.79, 0.51, 0.07	1.37
Navelina		Interval		(0.035% ai)		7	Peel	0.63, 0.41, 0.17	1.21
C005108		16 d				14	Peel	0.50, 0.33, 0.23	1.06
ER 98 ECS		BBCH 75,				21	Peel	0.53, 0.37, 0.23	1.13
750		78				28	Peel	0.33, 0.25, 0.21	0.79
						0	Pulp	< 0.02, ND, ND	< 0.02
						7/14	Pulp	ND, ND, ND	< 0.02
						21/28	Pulp	ND, ND, ND	< 0.02
						0	Fruitc	0.21, 0.14, 0.03	0.38
						7	Fruitc	0.17, 0.11, 0.05	0.33
						14	Fruitc	0.13, 0.09, 0.07	0.29
						21	Fruitc	0.13, 0.10, 0.06	0.29
						28	Fruitc	0.08,0.07, 0.06	0.21
Spain1998	35EC	Spray	1.05	3000	2	0	Peel	0.85, 0.83, 0.30	1.98
Navelina		Interval		(0.035% ai)		0	Pulp	ND, ND, ND	< 0.02
C003108		14d				23	Peel	0.07, 0.11, 0.43	0.61
ER 98 ECS		BBCH 75				23	Pulp	ND, ND, ND	< 0.02
740		, 78				0	Fruitc	0.21, 0.20, 0.08	0.49
						23	Fruitc	0.02, 0.03, 0.11	0.16
Spain1998	35EC	Spray	1.05	3000	2	0	Peel	1.30, 0.93, 0.34	2.57
Navelina		Int ;14d		(0.035% ai)		0	Pulp	ND, ND, ND	< 0.02
C003108		BBCH 75,				23	Peel	0.11, 0.16, 0.71	0.98
ER 98 ECS		78				23	Pulp	ND, ND, < 0.02	< 0.02
740						0	Fruitc	0.34, 0.24, 0.09	0.67
						23	Fruitc	0.04, 0.05, 0.19	0.28
Italy1998	35EC	Spray	1.05	3000	2	0	Peel	0.85, 0.72, 0.31	1.88
Washington		Interval		(0.035% ai)		0	Pulp	< 0.02, < 0.02, ND	< 0.02
Navel		14 d				23	Peel	0.07, 0.13, 0.19	0.39
C003108		BBCH 77,				23	Pulp	ND, ND, ND	< 0.02
ER 98 ECS		81				0	Fruitc	0.21, 0.18, 0.08	0.47
740						23	Fruitc	0.03, 0.04, 0.06	0.13

ORANGES	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial Variety Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	beta endosulfan, endosulfan sulfate, mg/kg	Residues, mg/kg
Italy1998	35EC	Spray	1.05	3000	2	0	Peel	0.78, 0.66, 0.18	1.62
Tarocco		Interval		(0.035% ai)		0	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
C003108		14 d				21	Peel	0.09, 0.20, 0.27	0.56
ER 98 ECS 740		BBCH 77,				21	Pulp	ND, ND, ND	< 0.02
		81				0	Fruitc	0.20, 0.17, 0.07	0.44
						21	Fruitc	0.03, 0.04, 0.06	0.13
Spain1997	35EC	Spray	1.05	3000	2	0	Peel	1.1, 0.82, 0.58	2.50
Navel		Interval		(0.035% ai)		0	Pulp	ND, < 0.02, ND	< 0.02
C001464		14 d				7	Peel	0.42, 0.53, 0.83	1.78
ER 97 ECS 740		BBCH 78,				7	Pulp	ND, ND, ND	< 0.02
		78				14	Peel	0.22, 0.3, 0.64	1.16
						14	Pulp	ND, ND, ND	< 0.02
						21	Peel	0.22, 0.32, 0.69	1.23
						21	Pulp	ND, ND, < 0.02	< 0.02
						28	Peel	0.12, 0.19, 0.63	0.94
						28	Pulp	ND, ND, ND	< 0.02
Spain1997	35EC	Spray	1.05	3000	2	0	Fruitc	0.26, 0.20, 0.14	0.60
Navel		Interval		(0.035% ai)		7	Fruitc	0.08, 0.10, 0.15	0.32
C001464		14 d				14	Fruitc	0.05, 0.07, 0.14	0.26
ER 97 ECS 740		BBCH 78,				21	Fruitc	0.05, 0.07, 0.14	0.26
						28	Fruitc	0.03, 0.05, 0.13	0.21
Spain1997	35EC	Spray	1.05	3000	2	0	Peel	1.1, 0.72, 0.54	2.36
Navelina		Interval		(0.035% ai)		0	Pulp	ND, ND, ND	< 0.02
C001464		14 d				7	Peel	0.32, 0.45, 0.75	1.52
ER 97 ECS 740		BBCH 78,				7	Pulp	ND, ND, ND	< 0.02
		78				13	Peel	0.27, 0.36, 0.72	1.35
						13	Pulp	ND, ND, ND	< 0.02
						21	Peel	0.17, 0.24, 0.57	0.98
						21	Pulp	ND, ND, ND	< 0.02
						28	Peel	0.18, 0.23, 0.73	1.14
						28	Pulp	ND, ND, ND	< 0.02
						0	Fruitc	0.20, 0.13, 0.10	0.43
						7	Fruitc	0.07, 0.10, 0.16	0.33
						13	Fruitc	0.06, 0.08, 0.16	0.30
						21	Fruitc	0.04, 0.06, 0.13	0.23
						28	Fruitc	0.05, 0.06, 0.17	0.28
Greece1997	35EC	Spray	1.05	3000	2	0	Peel	0.4, 0.32, 0.16	0.88
Lutsiana		Interval		(0.035% ai)		0	Pulp	ND, < 0.02, ND	< 0.02
C001464		14 d				7	Peel	0.13, 0.24, 0.30	0.67
ER 97 ECS 740		BBCH 79,				7	Pulp	ND, ND, ND	< 0.02
Santa		81				14	Peel	0.07, 0.12, 0.21	0.40
						14	Pulp	ND, ND, ND	< 0.02
						21	Peel	0.1, 0.2, 0.32	0.62
						21	Pulp	ND, ND, ND	< 0.02
						28	Peel	0.07, 0.1, 0.27	0.44
						28	Pulp	ND, ND, ND	< 0.02
						0	Fruitc	0.17, 0.14, 0.11	0.42
						7	Fruitc	0.05, 0.09, 0.11	0.25
						14	Fruitc	0.03, 0.05, 0.09	0.17
						21	Fruitc	0.05, 0.09, 0.14	0.28
						28	Fruitc	0.03,0.04, 0.11	0.18

ORANGES	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial Variety Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	beta endosulfan, endosulfan sulfate, mg/kg	Residues, mg/kg
Spain1997	35EC	Spray	3.15	3000	2	21	Fruit	0.12, 0.18, 0.33	0.62
Navelina		Interval		(0.105%		21	Raw	ND, ND, ND	< 0.02
				ai)			juice		
C001464		14 d				21	Peel	0.32, 0.38, 0.74	1.44
							/pomace		
ER 97 ECS 740		BBCH 78,							
Spain1997	35EC	Spray	3.15	3000	2	21	Fruit	0.09, 0.14, 0.25	0.48
Navel		14 d		(0.105%		21	Raw	ND, ND, ND	< 0.02
Moncada,				ai)			juice		
C001464		BBCH 78,				21	Peel	0.14, 0.19, 0.51	0.84
							/pomace		
ER 97 ECS 740									
Italy1997	35EC	Spray	1.05	3000	2	0	Peel	0.57, 0.47, 0.04	1.08
Naveline		Interval		(0.035%		0	Pulp	< 0.02, < 0.02, ND	< 0.02
				ai)					
C001464		14 d				7	Peel	0.3, 0.37, 0.05	0.72
ER 97 ECS 740		BBCH 81,				7	Pulp	ND, < 0.02, ND	< 0.02
		81				14	Peel	0.19, 0.32, 0.10	0.61
						14	Pulp	< 0.02, < 0.02, ND	< 0.02
						19	Peel	0.13, 0.28, 0.06	0.47
						19	Pulp	< 0.02, < 0.02, ND	< 0.02
						28	Peel	0.13, 0.24, 0.06	0.43
						28	Pulp	ND, ND, ND	< 0.02
						0	Fruitc	0.02, 0.18, 0.02	0.22
						7	Fruitc	0.02, 0.11, 0.02	0.15
						14	Fruitc	0.03, 0.10, 0.03	0.16
						19	Fruitc	0.03, 0.10, 0.03	0.16
						28	Fruitc	0.02, 0.08, 0.02	0.12
Italy1997	35EC	Spray	3.15	3000	2	21	Fruit	0.15, 0.26, 0.04	0.45
Naveline		Interval		(0.105%		21	Raw	ND, < 0.02, < 0.02	< 0.02
				ai)			juice		
C001464		14 days				21	Peel/	0.46, 0.69, 0.08	1.23
							pomace		
ER 97 ECS 740		BBCH 81,							
Italy1997	35EC	Spray	1.05	3000	2	0	Peel	0.42, 0.38, 0.11	0.91
Navel		Interval		(0.035%		0	Pulp	< 0.02, < 0.02, ND	< 0.02
				ai)					
C001464		14 d				7	Peel	0.14, 0.27, 0.13	0.54
ER 97 ECS 740		BBCH 76,				7	Pulp	ND, < 0.02, ND	< 0.02
		79				14	Peel	0.11, 0.23, 0.14	0.48
						14	Pulp	ND, < 0.02, ND	< 0.02
						19	Peel	0.08, 0.15, 0.17	0.40
						19	Pulp	ND, ND, ND	< 0.02
						28	Peel	0.05, 0.08, 0.11	0.24
						28	Pulp	ND, ND, ND	< 0.02
						0	Fruitc	0.11, 0.10, 0.03	0.24
						7	Fruitc	0.04, 0.08, 0.04	0.16
						14	Fruitc	0.03, 0.06, 0.04	0.13
						19	Fruitc	0.03, 0.05, 0.05	0.13
						28	Fruitc	0.02, 0.03, 0.03	0.08
Australia	EC	spray	0.21	2000	4	0	Fruit	0.035, 0.052, 0.015	0.10
2000				(10.5		1	Fruit	0.02,0.044, 0.019	0.08
				g/hL)					
Beverford						3	Fruit	0.01, 0.025, 0.014	0.05
valencia						7	Fruit	0.007,0.024, 0.023	0.05
N° 1/10/544									

ORANGES	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial Variety Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	beta endosulfan, endosulfan sulfate, mg/kg	Residues, mg/kg
Australia	EC	spray	0.42	2000	4	0	Fruit	0.09, 0.097, 0.027	0.21
2000						3	Fruit	0.058, 0.12, 0.046	0.22
Beverford									
valencia									
N° 1/10/544									
Australia	EC	spray	0.21	2000	4	0	Fruit	0.081, 0.100, 0.008	0.19
2000				(10.5 g/hL)		1	Fruit	0.032, 0.077, 0.013	0.12
Taylorville						3	Fruit	0.018, 0.047,0.013	0.08
valencia						7	Fruit	0.007, 0.017, 0.009	0.03
N° 1/10/544									
Australia	EC	spray	0.42	2000	4	0	Fruit	0.17, 0.20, 0.029	0.40
2000									
Taylorville						+3	peel	0.10, 0.21, 0.067	0.38
valencia						+3	flesh	0.011, 0.016, 0.007	0.03
N° 1/10/544									

Table 36. Endosulfan residues in apple resulting from supervised trials in Europe, South Africa, USA and Australia.

APPLE	Application					PHI	Sample	Residues of alpha, beta	Total
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	endosulfan, endosulfan sulfate, mg/kg	Residues, mg/kg
Germany1989	35EC	Spray	0.40,	1140,	4	0	Fruit		0.42
Jonathan			0.47,	1330		21	Fruit		0.06
C004071			0.47,	1330		21	Mash		0.02
(A49973)			0.40	1140		21	Juice		0.005
PSR99/012				(0.035		21	Pomace		0.075
				% ai)		21	Wash w		0.006
Germany1989	35EC	Spray	0.53	1500	4	0	Fruit		0.76
James Greaves				0.035%a.i		21	Fruit		0.11
C004071						21	Mash		0.02
(A49972)						21	Juice		0.006
PSR99/012						21	Pomace		0.175
						21	Wash w		0.006
Germany1983	35 WP	Spray	0.74	500	5	0	Fruit	2.0, 1.2, 0.08	3.28
Golden Delicious		Interval		(0.148%a.i		7	Fruit	0.9, 0.9, 0.07	1.87
A28757		14 d				14	Fruit	0.8, 1.4, 0.09	2.29
DEU83171111						21	Fruit	0.3, 0.8, 0.1	1.20
Germany1983	35 WP	Spray	0.74	500	5	0	Fruit	0.8, 0.8, 0.1	1.7
Klarapfel		Interval		(0.148		7	Fruit	0.2, 0.3, 0.06	0.56
A28758		13-17 d		% ai)		14	Fruit	0.2, 0.4, 0.03	0.63
DEU83171121						21	Fruit	0.09, 0.2, 0.03	0.32
Germany1983	35 WP	Spray	0.74	500	5	0	Fruit	0.8, 0.6, 0.05	1.45
Golden Delicious		Interval		(0.148		7	Fruit	0.4, 0.6, 0.05	1.05
A28759		14-17d		% ai)		14	Fruit	1.1, 1.0, 0.06	2.16
DEU83171131		days				21	Fruit	0.09, 0.1, 0.03	0.22
Germany1983	35 EC	Spray	0.799	500	5	0	Fruit	0.4, 0.5, 0.07	0.97
Golden Delicious		Interval		(0.16%		7	Fruit	0.3, 0.5, 0.06	0.86
A28760		14-17d		ai)		14	Fruit	0.4, 0.6, 0.06	1.06
DEU83170131						21	Fruit	0.2, 0.4,0.07	0.67
Germany1983	35 EC	Spray	0.799	500	5	0	Fruit	0.8, 0.7, 0.1	1.60
Klarapfel		Interval		(0.16%		7	Fruit	0.2, 0.4, 0.09	0.69
A28761		13- 17d		ai)		14	Fruit	0.09, 0.3,0.1	0.49
DEU83170121						21	Fruit	0.05, 0.3, 0.1	0.45
Germany1983	35 EC	Spray	0.799	500	5	0	Fruit	3.0, 2.2, 0.1	5.30
Golden Delicious		Interval		(0.16		7	Fruit	1.7, 1.8, 0.1	3.6O
A28762		14 d		% ai)		14	Fruit	1.0, 1.5, 0.1	2.60
DEU83170111						21	Fruit	1.1, 1.2, 0.1	2.40

APPLE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
Germany1976	24EC*	Spray	0.96	2000	5	0	Fruit		1.20
Cox Orange		Interval		(0.048		10	Fruit		0.01
A08886		14, 21, 18,		% ai)		14	Fruit		1.0
LEA 1/48/01/02-76		10 d				21	Fruit		0.80
Germany1976	24EC*	Spray	0.96	2000	5	0	Fruit		1.10
James Grieve		Interval		(0.048		10	Fruit		1.00
A08888a		11, 23, 18,		% ai)		14	Fruit		0.70
LEA 2/48/01/02-76		11 d				21	Fruit		0.30
Germany1983	2.82	Spread	0.705	25 kg	5	0	Fruit	0.06, 0.08, 0.04	0.18
Golden Delicious	DP	Interval		Product		7	Fruit	0.06, 0.1, 0.06	0.22
A29493		14, 14, 14,				14	Fruit	0.03, 0.08, 0.06	0.17
DEU83172231		17 d				21	Fruit	0.1, 0.09, 0.05	0.24
Germany1983	2.82	Spread	0.705	25 kg	5	0	Fruit	0.2, 0.1, 0.4	0.68
Golden Delicious	DP	Interval		Product		7	Fruit	0.06, 0.04, 0.05	0.15
A29495		14 d				14	Fruit	0.04, 0.07, 0.04	0.15
DEU83172211						21	Fruit	0.08, 0.1, 0.05	0.23
Germany1983	2.82	Spread	0.705	25 kg	5	0	Fruit	0.1, 0.1, 0.06	0.26
James Grieve	DP	Interval		Product		7	Fruit	0.05, 0.08, 0.05	0.18
A29496		14 d				14	Fruit	0.05, 0.1, 0.05	0.20
DEU83172241						21	Fruit	0.02, 0.04, 0.04	0.10
Germany1983	2.82	Spread	0.705	25 kg	5	0	Fruit	0.2, 0.1, 0.05	0.35
Victoria	DP	Interval		Product		7	Fruit	0.04, 0.07, 0.05	0.16
A29494		14, 14, 13,				14	Fruit	0.04, 0.07, 0.05	0.16
DEU83172221		13 d				21	Fruit	0.03, 0.06, 0.07	0.16
Germany1976	24EC*	Spray	0.96	2000	5	0	Fruit		2.70
Cox Orange		Interval		(0.048		10	Fruit		0.80
A08889		14, 21, 14,		% ai)		14	Fruit		0.70
LEA 4/48/01/02-76		14 d				21	Fruit		0.60
Germany1975	24EC*	Spray	0.96	2000	4	0	Fruit	ND, ND, ND	< 0.02
Cox Orange		Interval		(0.048		7	Fruit	0.40, 0.60, 0.05	1.05
A04837		14 d		% ai)		14	Fruit	0.20, 0.20, 0.04	0.44
LEA 4/82/01/02-75						21	Fruit	0.09, 0.20, 0.03	0.32
(A)						28	Fruit	0.20, 0.20, 0.03	0.43
Germany1975	24EC*	Spray	0.96	2000	4	0	Fruit	0.30, 0.30, 0.05	0.65
Gold Parmane		Interval		(0.048		7	Fruit	0.20, 0.30, 0.07	0.57
A04838		14 d		% ai)		14	Fruit	0.50, 0.70, 0.20	1.40
LEA 4/82/02/02-75						21	Fruit	0.10, 0.30, 0.09	0.49
(A)						28	Fruit	0.10, 0.20, 0.09	0.39
Germany1975	24EC*	Spray	0.96	2000	4	0	Fruit	0.50, 0.50, ND	1.20
Freiherr von		Interval		(0.048		7	Fruit	0.40, 0.50, 0.04	0.94
Berlepsch		14 d		% ai)		14	Fruit	0.30, 0.50, 0.03	0.83
A04839						21	Fruit	0.10, 0.20, 0.02	0.32
LEA 4/82/03/02-75						28	Fruit	0.09, 0.10, 0.02	0.21
Germany1975	24EC*	Spray	0.96	2000	3	0	Fruit		0.30
Jonared 1975		Interval		(0.048		10	Fruit		0.30
A05860		13, 75 d		% ai)		20	Fruit		0.20
LEA 1/82/01/02-75						28	Fruit		0.07
Germany1975	24EC*	Spray	0.96	2000	3	0	Fruit		1.50
Golden 1975		Interval		(0.048		10	Fruit		0.90
A05861		13, 75 d		% ai)		20	Fruit		0.40
LEA 1/82/02/02-75						28	Fruit		0.20
Germany1975	24EC*	Spray	0.96	2000	4	0	Fruit		0.60
Cox Orange		Interval		(0.048		14	Fruit		0.10
A05862		14, 16, 12		% ai)		28	Fruit		0.06
LEA 2/82/01/02-75		d							
Germany1974	24EC*	Spray	0.72	2000	1	0	Fruit		0.58
Golden				(0.036		7	Fruit		0.27
Delicious				% ai)		14	Fruit		0.19
A02616						21	Fruit		0.21
1/90/02/02						28	Fruit		0.18

APPLE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
Germany1974	24EC*	Spray	0.96	2000	2	0	Fruit		0.76
Golden		Interval		(0.048		7	Fruit		1.00
Delicious		30 days		% ai)		14	Fruit		0.49
A02617						21	Fruit		0.51
1/90/02/04						28	Fruit		0.66
Germany1974	24EC*	Spray	0.96	2000	1	0	Fruit		0.71
Golden				(0.048		7	Fruit		0.39
Delicious				% ai)		14	Fruit		0.26
A02618						21	Fruit		0.36
1/90/02/03						28	Fruit		0.36
Germany1974	24EC*	Spray	0.96	2000	1	0	Fruit	0.30, ND	0.30
Goldparmane				(0.048		7	Fruit	0.26, ND	0.26
A02619				% ai)		14	Fruit	0.26, ND	0.26
4/90/01/03						21	Fruit	0.12, ND	0.12
						28	Fruit	0.11, 0.17	0.28
Germany1974	24EC*	Spray	0.96	2000	2	0	Fruit	0.57, 0.08	0.65
Goldparmane		Interval		(0.048		7	Fruit	0.36, 0.10	0.46
A02620		31 d		% ai)		14	Fruit	0.62, ND	0.62
4/90/01/04						21	Fruit	0.28, ND	0.28
						28	Fruit	0.45, 0.05	0.50
Germany1974	24EC*	Spray	0.72	2000	1	0	Fruit	0.28, ND	0.28
Cox Orange				(0.036		7	Fruit	0.18, ND	0.18
A02621				% ai)		14	Fruit	0.15, ND	0.15
4/90/02/02						21	Fruit	0.11, ND	0.11
						28	Fruit	0.13, ND	0.13
Germany1974	24EC*	Spray	0.96	2000	1	0	Fruit	0.22, ND	0.22
Cox Orange				(0.048		7	Fruit	0.29, ND	0.29
A02622				% ai)		14	Fruit	0.18, ND	0.18
4/90/02/03						21	Fruit	0.14, ND	0.14
						28	Fruit	0.17, ND	0.17
Germany1974	24EC*	Spray	0.96	2000	2	0	Fruit	0.31, ND	0.31
Cox Orange 1974		Interval		(0.048		7	Fruit	0.35, ND	0.35
A02623		31 days		% ai)		14	Fruit	0.33, ND	0.33
4/90/02/04						21	Fruit	0.25, ND	0.25
						28	Fruit	0.27, ND	0.27
Germany1974	24EC*	Spray	0.72	2000	1	0	Fruit	0.26, ND	0.26
Goldparmane 1974				(0.036		7	Fruit	0.17, ND	0.17
A02624				% ai)		14	Fruit	0.16, ND	0.16
4/90/01/02						21	Fruit	0.18, ND	0.18
						28	Fruit	0.18, ND	0.18
Germany1974	24EC*	Spray	0.72	2000	1	0	Fruit		0.82
Cox Orange				(0.036		7	Fruit		0.46
A03995				% ai)		14	Fruit		0.34
1/90/01/02						21	Fruit		0.37
						28	Fruit		0.22
Germany1974	24 EC	Spray	0.96	2000	1	0	Fruit		1.23
(Goldparmane)				(0.048		7	Fruit		0.96
1/90/01/03				% ai)		14	Fruit		0.61
						21	Fruit		0.27
						28	Fruit		0.31
Germany1974	24EC*	Spray	0.96	2000	2	0	Fruit		1.19
Cox Orange		Interval		(0.048		7	Fruit		1.07
1/90/01/04		30 d		% ai)		14	Fruit		0.84
A03997						21	Fruit		0.52
						28	Fruit		0.35
Germany1974	24EC*	Spray	0.72	2000	1	0	Fruit		0.60
Golden Delicious				(0.048		7	Fruit		0.30
2/90/01/02				% ai)		14	Fruit		0.15
A03998						21	Fruit		0.15
						28	Fruit		0.04

APPLE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
Germany1974	24EC*	Spray	0.96	2000	1	0	Fruit		0.90
Golden Delicious				(0.048		7	Fruit		0.40
A03999				% ai)		14	Fruit		0.25
2/90/01/03						21	Fruit		0.25
						28	Fruit		0.12
Germany1974	24EC*	Spray	0.96	2000	2	0	Fruit		1.70
Golden delicious		Interval		(0.048		7	Fruit		0.90
2/90/01/04		27 d		% ai)		14	Fruit		0.50
A04000						21	Fruit		0.30
						28	Fruit		0.12
Italy	35EC	(backpack)	0.66	1250	2	0	Apple	0.14, 0.15, < 0.01	0.29
1993		BBCH		(0.0528		7	fruit	0.03, 0.04, < 0.01	0.07
Baricella,		76-77		% ai)		14		0.03, 0.05, 0.03	0.11
Emiglia		and 81				14	"washed	0.02, 0.03, < 0.01	0.05
Romagna		interval				14	"unwashed	0.04, 0.05, 0.02	0.11
Cooper 4		sprays-55				14	cider	< 0.01, < 0.01, < 0.01	< 0.01
A54359						14	mash	< 0.01, 0.01, < 0.01	0.01
ER 93 ECS 705						14	pomace	0.04, 0.07, 0.01	0.12
						14	ww	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	(backpack)	1.3199	1250	2	0	Apple	0.44, 0.40, 0.02	0.86
1993		BBCH		(0.1056		7	fruit	0.06, 0.13, 0.02	0.21
Baricella,		76-77		% ai)		14		0.03, 0.045, 0.015	0.09
Emiglia		and 81				14	"washed	0.02, 0.05, < 0.01	0.07
Romagna		interval				14	"unwashed	0.04, 0.07, 0.02	0.13
Coope 4		sprays-55				14	cider	< 0.01, < 0.01, < 0.01	< 0.01
A54359						14	mash	< 0.01, 0.01, < 0.01	0.01
ER 93 ECS 705						14	pomace	0.10, 0.15, 0.04	0.29
						14	ww	< 0.01< 0.01, < 0.01	< 0.01
Spain1999	CS*	(knapsack)	1.05	1000	2	0	fruit	0.35, 0.24, < 0.02	0.59
Red chief		BBCH		(0.105		3		0.24, 0.19, < 0.02	0.43
C016113c		79 and 85		% ai)		7		0.28, 0.19, < 0.02	0.47
ER 99 ECS 755		Interval				14		0.16, 0.13, < 0.02	0.29
		15d							
Spain1999	CS*	(knapsack)	1.05	1000	2	0	Fruit	0.65, 0.44, < 0.02	1.09
Golden Smutte		BBCH		(0.105		3		0.89, 0.57, < 0.02	1.46
C016113		79 and 85		% ai)		7		0.49, 0.38, < 0.02	0.87
ER 99 ECS 755		Interval				14		0.21, 0.16, < 0.02	0.37
		13d							
Greece1999	CS*	Spray (gun)	1.05	1500	2	0	Fruit	1.20, 0.72, < 0.02	1.92
Golden		BBCH		(0.07		3		0.43, 0.27, < 0.02,	0.70
C016113		81 and 85		% ai)		7		0.84, 0.78, < 0.02	1.62
ER 99 ECS733		Interval				14		0.63, 0.46, < 0.02	1.09
		14d							
Italy1999	CS*	Spray (gun)	1.05	1500	2	0	Fruit	0.69, 0.43, < 0.02	1.12
Mondial gala		BBCH		(0.07		3		0.49, 0.32, < 0.02	0.81
C016113		77 and 77		% ai)		7		0.64, 0.40, < 0.02	1.04
ER 99 ECS 755		Interval				14		0.39, 0.23, < 0.02	0.62
		14d							
Portugal1999	CS*	(knapsack)	1.05	1100	2	0	Fruit	0.96, 0.57, < 0.02	1.53
Baby Gold		BBCH		(0.01		3		1.2, 0.71, < 0.02	1.91
ER 99 ECS		78 and 81		% ai)		7		0.99, 0.65, < 0.02	1.64
755		Interval				14		0.22, 0.19, < 0.02	0.41
		14d							
Spain1994	35EC	(backpack)	0.528	1000	2	0	Apple	0.05, 0.09, < 0.01	0.14
Golden Smuthe		BBCH		(0.0528		7		0.03, 0.02, < 0.01	0.05
Alfamen,		78 and 81		% ai)		~12		< 0.01, 0.02, < 0.01	0.02
A55874		interval				21		< 0.01, 0.01, < 0.01	0.01
ER 94 ECS 705		sprays-51				28		< 0.01, < 0.01, < 0.01	< 0.01
Spain1994	35EC	(backpack)	1.056	1000	2	0	Apple	0.26, 0.24, 0.02	0.52
Golden Smuthe		BBCH		(0.1056		7		0.04, 0.08, 0.02	0.14
A55874		78 and 81		% ai)		~12		0.02, 0.04, 0.02	0.08
ER 94 ECS 705		interval				21		0.02, 0.03, 0.02	0.07
		sprays-51				28		0.01, 0.015, 0.01	0.04

APPLE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
Spain1994	35EC	backpack)	0.528	1000	2	0	Apple	0.07, 0.09, < 0.01	0.16
Zaragoza		BBCH		(0.0528		7		0.01, 0.02, < 0.01	0.03
Starkingson		78 and 81		% ai)		12		0.02, 0.02, < 0.01	0.04
A55874		interval				21		0.02, 0.03, < 0.01	0.05
ER 94 ECS 705		sprays-51				28		< 0.01, < 0.01, < 0.01	< 0.01
Spain1994	35EC	backpack)	1.056	1000	2	0	Apple	0.15, 0.21, < 0.01	0.36
Zaragoza		BBCH	1.056	(0.1056		7		0.04, 0.06, 0.02	0.12
Starkingson		78 and 81		% ai)		12		0.02, 0.045, < 0.01	0.07
A55874		interval				21		0.02, 0.033, < 0.01	0.05
ER 94 ECS 705		sprays-51				28		0.023, 0.03, < 0.01	0.05
France1994	35EC		0.528	990,	2	0	Apple	< 0.01, < 0.01, < 0.01	< 0.01
South		(backpack)		972		7		0.02, 0.04, 0.01	0.07
Golden Spur		BBCH		(0.0533,		13		< 0.01, < 0.01, < 0.01	< 0.01
A55874		76 and 80		0.0543		21		< 0.01, < 0.01, < 0.01	< 0.01
ER 94 ECS 705		Interval		% ai)		28		< 0.01, < 0.01< 0.01	< 0.01
		71d							
France1994	35EC	(backpack	1.056	990,	2	0	Apple	0.34, 0.31, 0.02	0.67
South		BBCH		952		7		0.04, 0.06, 0.02	0.12
Golden Spur		76-And 8		(0.1067,		13		< 0.01, < 0.01, < 0.01	< 0.01
A55874		Interval		0.1109		21		0.04, 0.04, 0.05	0.13
ER 94 ECS 705		71d		% ai)		28		0.03, 0.06, 0.03	0.12
Italy1994	35EC	(backpack)	0.7922,	1500	2	0	Apple	0.33, 0.34, < 0.01	0.67
Golden Delicious		BBCH 77	0.7919	(0.0528		7		0.06, 0.095, 0.02	0.18
A55874		And na		% ai)		14		0.075, 0.12, 0.025	0.22
ER 94 ECS 705		Interval				21		0.04, 0.07, 0.03	0.14
		52d							
						28		0.03, 0.06, 0.02	0.11
Italy	35EC	(backpack)	1.5848,	1500	2	0	Apple	1.0, 0.71, 0.05	1.76
1994		BBCH	1.5841	(0.1056		7	fruit	0.135, 0.225, 0.035	0.40
(Golden Delicious)		77-78 and		% ai)		14	"	0.10, 0.133, 0.03	0.26
ER 94 ECS 705		na				14	"washed	0.07, 0.12, 0.03	0.22
		interval				14	"unwshd	0.10, 0.13, 0.04	0.27
		sprays-52				14	must	< 0.01, < 0.01, < 0.01	< 0.01
						14	puree	0.02, 0.03, 0.01	0.06
						14	pomace	0.24, 0.36, 0.09	0.69
						14	w, w	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	0.16, 0.26, 0.05	0.47
						28	Fruit	0.075, 0.135, 0.03	0.24
Italy	35EC	(backpack)	0.7922,	1500	2	0	Apple	0.35, 0.16, < 0.01	0.51
1994		BBCH	0.7919	(0.0528		7	fruit	0.04, 0.02, < 0.01	0.06
Imperatore		76 and 81		% ai)		14		0.01, 0.02, < 0.01	0.03
ER 94 ECS 705		interval				21		0.025, 0.04, < 0.01	0.07
		sprays-51				28		< 0.01, 0.02, < 0.01	0.02
Italy	35EC	Sprays	1.5848,	1500	2	0	Apple	0.62, 0.27, 0.01	0.90
1994		BBCH	1.5841	(0.1056		7	fruit	0.11, 0.12, 0.02	0.25
Imperatore		76-77 and		% ai)		14	"	0.13, 0.13, 0.01	0.27
ER 94 ECS 705		78-81				14	"washed	0.055, 0.075, 0.02	0.15
		interval				14	"unwshd	0.05, 0.09, 0.045	0.19
		sprays-51				14	must	< 0.01, < 0.01, < 0.01	< 0.01
						14	puree	< 0.01, 0.01, < 0.01	0.01
						14	pomace	0.17, 0.26, 0.07	0.50
						14	w, w	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	0.033, 0.046, 0.02	0.10
						28	Fruit	0.063, 0.07, 0.026	0.16
Spain	35EC	(backpack)	1.0419,	1973	2	0	Apple	0.26, 0.25, < 0.01	0.51
1993		BBCH	1.0238	1939		7	fruit	0.05, 0.06, < 0.01	0.11
Starking		77 and 81		(0.0528		14	Fruit	0.02, 0.03, < 0.01	0.05
A54359		interval		% ai)		14	"washed	0.04, 0.04, 0.01	0.08
ER 93 ECS 705		sprays-56				14	"unwshd	0.03, 0.04, 0.01	0.08
					2	14	mash	< 0.01, 0.01, < 0.01	0.01
						14	pomace	0.06, 0.10, 0.01	0.17
						14	ww	< 0.01, < 0.01, < 0.01	< 0.01
						14	cider	< 0.01, < 0.01, < 0.01	< 0.01

APPLE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
Spain	35EC	backpack)	2.3708,	2245	2	0	Apple	0.50, 0.41, < 0.01	0.91
1993		BBCH	2.4428	2313		7	fruit	0.12, 0.16, 0.03	0.31
Starking		77 and 81		(0.1056		14	Fruit	0.05, 0.07, 0.02	0.14
A54359		Interval		% ai)		14	"washed	0.03, 0.06, < 0.01	0.09
ER 93 ECS 705		sprays-56				14	"unwshd	0.03, 0.08, 0.03	0.14
						14	cider	< 0.01, < 0.01, < 0.01	< 0.01
						14	mash	0.01, 0.02, < 0.01	0.03
						14	pomace	0.07, 0.17, 0.025	0.27
						14	ww	< 0.01, < 0.01, < 0.01	< 0.01
France	35EC	(backpack)	0.528	1000	2	0	Apple	0.05, 0.08, < 0.01	0.13
1993		BBCH		(0.0528		7	fruit	0.015, 0.03, < 0.01	0.05
Golden Delicious		76-77		% ai)		13		0.02, 0.04, 0.01	0.07
A54359		and 81				13	"washed	< 0.01, 0.01, < 0.01	0.01
ER 93 ECS 705		Interval70				13	"unwshd	0.02, 0.03, < 0.01	0.05
						13	cider	< 0.01, < 0.01, < 0.01	< 0.01
						13	mash	< 0.01, < 0.01, < 0.01	< 0.01
						13	pomace	0.03, 0.07, < 0.01	0.10
						13	ww	< 0.01,< 0.01, < 0.01	< 0.01
France South	35EC	(backpack	1.0561	1000	2	0	Apple	0.34, 0.29, 0.02	0.65
1993		BBCH		(0.1056		7	fruit	0.06, 0.12, 0.04	0.22
Golden Delicious		76-77		% ai)		13		0.03, 0.04, < 0.01	0.07
A54359		and 81				13	"washed	0.01, 0.03, 0.01	0.05
ER 93 ECS 705		interval				13	"unwshd	0.04, 0.07, 0.02	0.13
		sprays-70				13	cider	< 0.01, < 0.01, < 0.01	< 0.01
						13	mash	< 0.01, 0.01, < 0.01	0.01
						13	pomace	0.06, 0.10, 0.035	0.20
						13	ww	< 0.01, < 0.01, < 0.01	< 0.01
France	35EC	(backpack	0.528	1000	2	0	Apple	0.09, 0.09, 0.01	0.19
1993		BBCH		(0.0528		7	fruit	0.115, 0.115, 0.01	0.24
Canada Gris		77-78		% ai)		13		0.085, 0.105, 0.01	0.20
A54359		and 81				13	"washed	0.04, 0.06, < 0.01	0.10
ER 93 ECS 705		interval				13	"unwshd	0.105, 0.12, 0.015	0.24
		sprays-55				13	cider	< 0.01, < 0.01, < 0.01	< 0.01
						13	mash	0.01, 0.02, < 0.01	0.03
						13	pomace	0.16, 0.18, 0.02	0.36
						13	ww	< 0.01, < 0.01, < 0.01	< 0.01
France	35EC	(backpack)	1.0561	1000	2	0	Apple	0.21, 0.26, 0.01	0.48
1993		BBCH		(0.1056		7	fruit	0.21, 0.62, 0.03	0.86
St Pardon de		77-78		% ai)		13		0.20, 0.23, 0.03	0.46
C.		and 81				13	"washed	0.13, 0.13, 0.01	0.27
Aquitaine		interval				13	"unwshd	0.12, 0.18, 0.04	0.34
Canada Gris		sprays-55				13	cider	< 0.01, < 0.01, < 0.01	< 0.01
A54359						13	mash	0.04, 0.06, < 0.01	0.10
ER 93 ECS 705						13	pomace	0.58, 0.77, 0.03	1.38
						13	ww	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	(backpack)	0.7922	1500	2	0	Apple	0.16, 0.15, 0.01	0.32
1993		BBCH		(0.0528		7	fruit	0.06, 0.08, 0.02	0.16
Gallo,		76-77		% ai)		14		0.025, 0.03, 0.02	0.08
Emiglia		and 81				14	"washed	0.05, 0.07, 0.03	0.15
Romagna		interval				14	"unwshd	0.05, 0.07, 0.02	0.14
Golden		sprays-59				14	cider	< 0.01, < 0.01, < 0.01	< 0.01
Delicious						14	mash	< 0.01, 0.02, < 0.01	0.02
A54359						14	pomace	0.04, 0.07, 0.02	0.13
ER 93 ECS 705						14	ww	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	(backpack)	1.5841	1500	2	0	Apple	0.58, 0.54, 0.02	1.14
1993		BBCH		(0.1056		7	fruit	0.10.0.16, 0.025	0.29
Gallo,		76-77		% ai)		14		0.07, 0.10, 0.04	0.21
Emiglia		and 81				14	"washed	0.04, 0.06, 0.01	0.11
Romagna		interval				14	"unwshd	0.06, 0.08, 0.04	0.18
Golden		sprays-59				14	cider	< 0.01, < 0.01, < 0.01	< 0.01
Delicious						14	mash	0.01, 0.02, < 0.01	0.03
A54359						14	pomace	0.13, 0.21, 0.06	0.40
ER 93 ECS 705						14	ww	< 0.01, < 0.01, < 0.01	< 0.01

APPLE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
S. Africa1978 *Starking* *ZA/77/03-02-02*	24EC*	Spray	0.24	2000 (0.012 % ai)	1	14	Fruit		0.07
S. Africa1978 *Starking* *ZA/77/03-02-03*	24EC*	Spray	0.48	2000 (0.024 % ai)	1	14	Fruit		0.05
S. Africa1978 *Starking* *ZA/77/03-02-04*	24EC*	Spray	0.72	2000 (0.036 % ai)	1	14	Fruit		0.10
S. Africa1978 *Golden Delicious* *ZA/77/01-04-06*	24EC*	Spray Interval 9, 18, 22, 22, 20 d	0.72	2000 (0.036 % ai)	7	13	Fruit		0.50
S. Africa1978 *Golden Delicious* *ZA/77/01-04-07*	24EC*	Spray Interval 9, 18, 21, 22, 20 d	0.96	2000 (0.048 % ai)	7	13	Fruit		0.60
USA1972 *McIntosh* C004071 (A30341) *M-3087*	2EC	Spray	4.48		2	16	Fruit w/Peel/ core dry/Peel/cor peeled/core Wet Pomace Dry Pomace Cider	0.045, 0.087, 0.092 0.20, 0.41, 0.26 0.47, 1.34, 0.95 ND, ND, ND 0.21, 0.42, 0.38 0.24, 1.22, 1.46 ND, ND, ND	0.22 0.87 2.76 < 0.02 1.01 2.92 < 0.02
USA1963 *Golden Delicious* A30339 R-677	50WP	Spray Interval 40 d	2.46	4200	3	0 7 14 22 29 37		1.66, 0.04* 1.04, 0.18 0.64, 0.14 0.64, 0.13 0.41, 0.10 0.34, 0.09	1.70 1.22 0.78 0.77 0.51 0.43
USA1963 *Golden Delicious* CA A30339 R-677	2 EC	Spray Interval 40 d	2.46	4200	3	0 7 14 22 29 37		1.33, 0.04 0.59, 0.09 0.56, 0.16 0.42, 0.12 0.38, 0.11 0.34, 0.12	1.37 0.68 0.72 0.54 0.49 0.46
USA1960 *Gravenstein* C009878 *R-385*	50WP	Spray Interval 33 d	3.36	5500	2	0 8 15 21			0.56 0.36
USA1960 *Golden Delicious* C009878 *R-385*	50WP	Spray Interval 33 d	3.36	5500	2	0 8 15 21 29			2.67 1.30 0.26 0.27 < 0.02
USA 1960 *Gravenstein* C009878 *R-385*	50WP	Spray Interval 33 d	3.36	5500	2	0 8 15 21			1.95 0.78 0.57 0.16
AUSTRALIA *2000* Bathurst *red delicious* *N° 1/10/563*	EC	spray	1.024	1541	6	0 7 14 21 14 14 14 14	Fruit w fruit juice D pomace W pomace	1.20, 0.90, 0.029 0.25,0.48, 0.036 0.084, 0.18,0.022 0.085,0.16,0.023 0.12, 0.23, 0.034, 0.005, 0.017, < 0.005 0.72, 1.40, 0.12 0.25, 0.46, 0.046	2.13 0.77 0.29 0.27 0.38 0.02 2.24 0.76
AUSTRALIA *2000* Bathurst *red delicious* *N° 1/10/563*	EC	spray	2.034	1541	6	0 7 14 21	Fruit	1.50, 1.30.0.065 0.35, 0.64, 0.052 0.24, 0.44,0.039 0.20, 0.34, 0.040	2.87 1.04 0.72 0.58

APPLE	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
AUSTRALIA *2000* Cottonvale *royal gala* *N° 1/10/563*	EC	spray	1.220	1833	6	14	Fruit	0.16, 0.22, 0.15	0.539

Table 37. Endosulfan residues in pear resulting from supervised trials in Australia.

PEARS	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.				
AUSTRALIA *2000* Ardmona *packham* *N° 1/10/548*	EC	spray	0.997	1500	6	0 7 14 21	Fruit	0.44, 0.45, 0.018 0.26,0.20, 0.38 0.22, 0.37,0.20 0.097,0.19,0.13	0.91 0.84 0.79 0.417
AUSTRALIA *2000* Ardmona *packham* *N° 1/10/548*	EC	spray	1.980	1500	6	0 7 14 21	Fruit	0.86, 0.74,0.23 0.57, 0.82, 0.30 0.48, 0.77,0.33 0.21, 0.40, 0.24	1.83 1.69 1.58 0.85
AUSTRALIA *2000* Paracombe *duchess* *N° 1/10/548*	EC	spray	1.330	2000	6	0 7 14	Fruit	0.74, 0.67, 0.32 0.34, 0.46, 0.35 0.062, 0.14, 0.24	1.73 1.15 0.44
AUSTRALIA *2000* Paracombe *duchess* *N° 1/10/548*	EC	spray	2.64	2000	6	14	Fruit	0.044, 0.10, 0.23	0.374

Table 38. Endosulfan residues in cherry resulting from supervised trials in USA.

CHERRY	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form	Method	kg ai/ha/ applic'n	L/ha	No.				
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	935 935	1 1	21 21	Sour cherry	0.10, 0.31, 0.22 < 0.05, 0.06, < 0.05	0.63 0.06
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	944 944	1 1	21 21	Sour cherry	0.05, 0.17, 0.07 < 0.05, 0.06, < 0.05	0.29 0.06
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	926 926	1 1	21 21	Sour cherry	0.09, 0.19, 0.06 < 0.05, < 0.05, < 0.05	0.34 < 0.05
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	944 935	1 1	21 21	Sour cherry	0.07, 0.18, 0.12 < 0.05, 0.09, < 0.05	0.37 0.09
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	944 944	1 1	21 21	Sour cherry	< 0.05, 0.06, 0.06 < 0.05, < 0.05, < 0.05	0.12 < 0.05
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	926 890	1 1	21 21	Sour cherry	0.23, 0.48, 0.14 < 0.05, < 0.05, < 0.05	0.85 < 0.05

CHERRY Country, Year of trial *Variety* Report	Application Form	Method	kg ai/ha/ applic'n	L/ha	No.	PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	935 953	1 1	21 21	Sour cherry	0.12, 0.24, 0.17 < 0.05, < 0.05, < 0.05	0.53 < 0.05
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	981 981	1 1	21 21	Sour cherry	0.11, 0.31, 0.21 < 0.05, < 0.05, < 0.05	0.63 < 0.05
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36	1000 990	1 1	21 21	Sour cherry	0.11, 0.30, 0.13 < 0.05, < 0.05, < 0.05	0.54 < 0.05
USA 1996 A57715 *B-J96R-04* US/FDA/PAM vol 1	EC WP	Airblast spray	3.36 3.36		1 1	21 21	Sour cherry	0.22, 0.60, 0.30 < 0.05, < 0.05, < 0.05	1.12 < 0.05
USA 1996 A57718 *B-J96R-04* *AL 6086*	EC WP	Airblast spray	3.36 3.36	936 944	1 1	21 21	Sweet cherry	0.14, 0.26, 0.12 < 0.05, 0.08, < 0.05	0.52 0.08
USA 1996 A57718 *B-J96R-04* *AL 6086*	EC WP	Airblast spray	3.36 3.36	963 953	1 1	21 21	Sweet cherry	0.36, 0.64, 0.38 < 0.05, 0.07, 0.07	1.38 0.14
USA 1996 CA A57718 *B-J96R-04* *AL 6086*	EC WP	Airblast spray	3.36 3.36	936 935	1 1	21 21	Sweet cherry	0.09, 0.20, 0.12 < 0.05, < 0.05, < 0.05	0.41 < 0.05
USA 1996 CA *Bing* A57718 *B-J96R-04* *AL 6086*	EC WP	Airblast spray	3.36 3.36	944 926	1 1	21 21	Sweet cherry	< 0.05, 0.08, 0.06 < 0.05, 0.06, < 0.05	0.14 0.06
USA 1996 W *Bing* A57718 *B-J96R-04* *AL 6086*	EC WP	Airblast spray	3.36 3.36	935 935	1 1	21 21	Sweet cherry	0.12, 0.32, 0.13 0.06, 0.23, 0.05	0.57 0.34
USA 1996 W *Bing* A57718 *B-J96R-04* *AL 6086*	EC WP	Airblast spray	3.36 3.36	944 944	1 1	21 21	Sweet cherry	0.11, 0.25, 0.08 < 0.05, 0.10, < 0.05	0.44 0.10
USA 1996 O *Lambert* A57718 *B-J96R-04* *AL 6086*	EC WP	Airblast spray	3.36 3.36	890 898	1 1	21 21	Sweet cherry	0.27, 0.42, 0.23 0.05, 0.09, 0.06	0.92 0.20
USA 1996 O A57718 *B-J96R-04* *AL 6086*	EC WP	Mist blower	3.36 3.36	963 972	1 1	21 21	Sweet cherry	< 0.05, 0.10, 0.05 0.08, 0.13, 0.10	0.10 0.31
USA 1996 O A57718 *B-J96R-04* *AL 6086*	EC WP	Mist blower	3.36 3.36	963 944	1 1	21 21	Sweet cherry	0.06,0.10, < 0.05 0.19, 0.37, 0.16	0.16 0.72
USA 1996 O A57718 *B-J96R-04* *AL 6086*	EC WP	Mist blower	3.36 3.36	730 740	1 1	21 21	Sweet cherry	< 0.05, 0.08, 0.06 0.22, 0.36, 0.20	0.14 0.78

Table 39. Endosulfan residues in apricots resulting from supervised trials in Australia.

APRICOTS Country, Year of trial *Variety* Report	Application Form.	Method	kg ai/ha/ applic'n	L/ha	No.	PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Australia *2000* Taylorville *storey* *N° 1/10/5641*	EC	spray	1.33	2000	3	0 14 28 35	Fruit	1.70, 1.50, 0.52 0.15,0.30, 0.36 0.11, 0.29, 0.63 0.012,0.043, 0.21	3.72 1.05 0.30 0.27

APRICOTS	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia	EC	spray	2.64	2000	3	0	Fruit	5.00, 4.1, 1.1	10.20
2000						14		1.00, 1.8, 1.3	4.10
Taylorville						28		0.33, 0.74, 1.1	2.17
storey						35		0.16, 0.34, 0.94	1.44
N° 1/10/5641									

Table 40. Endosulfan residues in nectarines resulting from a supervised trial in Australia.

NECTARINE	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia	EC	spray	1.33	2000	3	0	Fruit	1.70, 1.10, 0.031	2.83
2000						14		0.26, 0.34, 0.024	0.62
Montacute						28		0.038, 0.11, 0.029	0.18
tasty gold						35		0.099,0.27,0.059	0.43
N° 1/10/536									

Table 41. Endosulfan residues in peaches resulting from supervised trials in Europe, USA, and Australia.

PEACH	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany1974	EC*	Spray	0.96	2000	5	0	fruit	1.8, 0.004	1.80
Rekord von		Interval:		(0.048		7	fruit	0.04, 0.004	0.04
Alfter		7 days		% ai)		14	fruit	0.18, ND	0.18
A06462						21	fruit	0.11, 0.01	0.12
4/93/04/04[#]						28	fruit	0.01, 0.005	0.015
Germany1974	EC*	Spray	0.72	2000	5	0	fruit	0.90, ND	0.90
Rekord von		Interval:		(0.036		7	fruit	0.40, ND	0.40
Alfter		7 days		% ai)		14	fruit	0.005, ND	0.005
A06463						21	fruit	0.03, ND	0.03
4/93/04/02						28	fruit	0.01, 0.003	0.01
Germany1974	EC*	Spray	0.96	2000	1	0	fruit	1.80, 0.004	1.80
Rekord von				(0.048		7	fruit	0.04, 0.004	0.04
Alfter				% ai)		14	fruit	0.20, ND	0.20
A06464						21	fruit	0.10, 0.01	0.11
4/93/04/03						28	fruit	0.01, 0.005	0.015
Germany1974	EC*	Spray	0.72	2000	1	0	fruit	1.60, 0.005	1.61
Madame				(0.036		7	fruit	0.30, 0.01	0.31
Rogliat				% ai)		14	fruit	0.02, ND	0.02
A06465						21	fruit	0.05, 0.003	0.05
4/93/05/02						28	fruit	0.01, 0.003	0.01
Germany1974	EC*	Spray	0.96	2000	1	0	fruit	2.00, ND	2.00
Madame				(0.048		7	fruit	0.40, ND	0.40
Rogliat				% ai)		14	fruit	0.20, 0.003	0.203
A06466						21	fruit	0.10, 0.008	0.11
4/93/05/03						28	fruit	0.02, 0.003	0.02
Germany1974	EC*	Spray	0.96	2000	1	0	fruit	2.00, 0.01	2.01
Rogliat				(0.048		7	fruit	0.80, 0.005	0.805
A06467				% ai)		14	fruit	0.30, 0.02	0.32
4/93/05/04						21	fruit	0.10, 0.01	0.11

PEACH	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany1974	EC*	Spray	0.72	2000	1	0	fruit	2.30, ND	2.30
Dixired				(0.048		7	fruit	0.50, 0.01	0.51
A06468				% ai)		14	fruit	0.30, 0.01	0.31
4/93/02/02						21	fruit	0.10, 0.01	0.11
Germany1974	EC*	Spray	0.96	2000	1	0	fruit	4.60, 0.01	4.61
Dixired				(0.048		7	fruit	0.20, 0.01	0.21
A06469				% ai)		14	fruit	0.80, 0.007	0.81
4/93/02/03						21	fruit	0.20, 0.03	0.23
Germany1974	EC*	Spray	0.96	2000	1	0	fruit	4.40, 0.50	4.90
Dixired				(0.048		7	fruit	1.00, 0.20	1.20
A06470				% ai)		14	fruit	0.70, 0.20	0.90
4/93/02/04						21	fruit	0.10, 0.05	0.15
Germany1974	EC*	Spray	0.72	2000	1	0	fruit	1.30, 0.003	1.303
Red Heaven				(0.036		7	fruit	1.40, 0.01	1.41
A06471				% ai)		14	fruit	0.04, 0.006	0.05
4/93/01/02						21	fruit	0.08, 0.005	0.085
Germany1974	EC*	Spray	0.96	2000	1	0	fruit	2.40, ND	2.40
Red Heaven				(0.048		7	fruit	0.40, 0.005	0.405
A06472				% ai)		14	fruit	-, -	
4/93/01/03						21	fruit	0.08, ND	0.08
Germany1974	EC*	Spray	0.96	2000	2	0	fruit	2.10, 0.007	2.11
Red Heaven		Interval		(0.048		7	fruit	1.40, 0.06	1.46
A06473		29 days		% ai)		14	fruit	0.70, 0.01	0.71
4/93/01/04						21	fruit	0.20, 0.02	0.22
Spain 1999	CS*	Spray	0.7993	1500	3	0	fruit wo stone	1.90, 1.00, 0.08	2.98
Flordastar		,		(0.053		0	Fruit	1.50, 0.81, 0.06	2.37
C017102		BBCH 73,		% ai)		21	fruit wo stone	0.25, 0.18, 0.037	0.467
ER 99 ECS 754		75, 76				21	Fruit	0.23, 0.17, 0.34	0.74
DGM F01/97-0									
Spain 1999	CS*	handgun	0.7993	1500	3	0	fruit wo stone	1.30, 0.78, 0.03	2.11
Sudanell		BBCH 75		(0.053		0	fruit	1.00, 0.61, 0.02	1.63
C017102				% ai)		21	fruit wo stone	0.27, 0.20, 0.02	0.49
ER 99 ECS 754						21	fruit	0.22, 0.17, < 0.02	0.39
DGM F01/97-0									
France (S) 1999	CS*	handgun	0.7993	1500	3	0	fruit wo stone	0.80, 0.50, < 0.02	1.30
Orelie		BBCH 77		(0.053		0	fruit	0.77, 0.48, < 0.02	1.25
C017102		, 85, 85		% ai)		21	fruit wo stone	0.18, 0.18, < 0.02	0.36
ER 99 ECS 754						21	fruit	0.18, 0.18, < 0.02	0.36
DGM F01/97-0									
Italy 1999	CS*	Spray,	0.7993	1500	3	0	fruit wo stone	0.20, 0.12, < 0.02	0.32
Star red gold		BBCH 75,		(0.053		0	fruit	0.15, 0.10, < 0.02	0.25
C017102		75, 77		% ai)		21	fruit wo stone	0.09, 0.08, < 0.02	0.17
ER 99 ECS 754						21	fruit	0.083 0.074, < 0.02	0.16
DGM F01/97-0									
Italy1999	CS*	Spray,	0.7993	1500	3	0	fruit wo stone	2.10, 1.20, < 0.02	3.30
Federica		BBCH 73		(0.053		0	fruit	1.80, 1.10, < 0.02	2.90
ER 99 ECS 754		75, 76		% ai)		21	fruit wo stone	0.24, 0.20, < 0.02	0.44
DGM F01/97-0		,				21	fruit	0.22, 0.18, < 0.02	0.40
Spain1998	CS*	Spray	0.7993	1500	3	0	fruit wo stone	1.00, 0.53, 0.05	1.58
Flor Down				(0.053		7	fruit wo stone	0.52, 0.35, 0.04	0.91
Benifaio,				% ai)		13	fruit wo stone	0.27, 0.23, 0.04	0.54
Valencia		BBCH 71,				20	fruit wo stone	0.11, 0.10, 0.02	0.23
ER 98 ECS 754		73, 81				0	fruit	0.84, 0.45, 0.04	1.33
DGM F01/97-0.						7	fruit	0.45, 0.31, 0.04	0.80
						13	fruit	0.24, 0.21, 0.04	0.49
						20	fruit	0.10, 0.09, 0.02	0.21
Spain1988	CS*	Spray	0.7993	1500	3	0	fruit wo stone	0.92, 0.48, 0.04	1.44
Spind Graes				(0.053		7	fruit wo stone	0.51, 0.36, 0.03	0.90
ER 98 ECS 754				% ai)		14	fruit wo stone	0.23, 0.16, 0.02	0.51
DGM F01/97-0.		BBCH 71,				19	fruit wo stone	0.13, 0.08, < 0.02	0.23

PEACH	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Spind Graes		75, 81				0	fruit	0.83, 0.43, 0.04	1.30
ER 98 ECS 754						7	fruit	0.47, 0.33, 0.03	0.83
DGM F01/97-0.						14	fruit	0.22, 0.15, 0.02	0.39
						19	fruit	0.12, 0.08, < 0.02	0.20
Greece1998	CS*	Spray	0.7993	1500	3	0	fruit wo stone	0.60, 0.36, < 0.02	0.96
Louatel		(gun)		(0.053		7	fruit wo stone	0.74, 0.42, 0.02	1.18
ER 98 ECS 754				% ai)		14	fruit wo stone	0.14, 0.08, < 0.02	0.22
DGM F01/97-0.		BBCH 71,				21	fruit wo stone	0.16, 0.08, < 0.02	0.24
		73, 75				0	fruit	0.51, 0.31, < 0.02	0.82
						7	fruit	0.67, 0.38, 0.02	1.07
						14	fruit	0.13, 0.07, < 0.02	0.20
						21	fruit	0.15, 0.07, < 0.02	0.22
Italy1998	CS*	Mist r	0.7993	1500	3	0	fruit wo stone	1.20, 0.72, 0.03	1.95
Maria Luisa		blower		(0.053		7	fruit wo stone	0.70, 0.52, 0.03	1.25
ER 98 ECS 754		(knapsack		% ai)		14	fruit wo stone	0.32, 0.21, < 0.02	0.53
DGM F01/97-0.						21	fruit wo stone	0.23, 0.20, < 0.02	0.43
		BBCH 73,				0	fruit	1.10, 0.64, 0.03	1.77
		75, 77				7	fruit	0.63, 0.47, 0.03	1.13
						14	fruit	0.28, 0.19, < 0.02	0.47
						21	fruit	0.21, 0.18, < 0.02	0.39
Italy1998	CS*	Mist	0.7993	1500	3	0	fruit wo stone	1.50, 0.90, 0.08	2.48
Spring Bel		blower		(0.053		7	fruit wo stone	0.78, 0.54, 0.09	1.41
ER 98 ECS 754		(knapsack		% ai)		14	fruit wo stone	0.32, 0.27, 0.12	0.71
DGM F01/97-0.						21	fruit wo stone	0.15, 0.14, 0.08	0.37
		BBCH 73,				0	fruit	1.30, 0.81, 0.07	2.18
		75, 78				7	fruit	0.70, 0.49, 0.08	1.27
						14	fruit	0.30, 0.25, 0.11	0.66
						21	fruit	0.14, 0.13, 0.08	0.35
Spain1998	35EC	Spray	0.800	1500	3	0	fruit wo stone	1.40, 0.90, 0.14	2.44
Flor Down		(gun)		(0.053		20	fruit wo stone	0.08, 0.09, 0.04	0.21
C002960		BBCH 71,		% ai)		0	fruit	1.20, 0.75, 0.12	2.07
ER 98 ECS 742		73, 75				20	fruit	0.07, 0.08, 0.04	0.19
Spain1998		Spray	1.600	1500	3				
Flor Down		(gun)		(0.106		21	fruit	0.16,0.17,0.08	0.41
C002960		BBCH 71,		% ai)					
ER 98 ECS 742		73, 75							
Spain1998	35EC	Spray	0.800	1500	3	0	fruit wo stone	0.61, 0.43, 0.10	1.14
Spind graes				(0.053		19	fruit wo stone	0.04, 0.06, 0.04	0.14
C002960		BBCH 71,		% ai)		0	fruit	1.30, 0.17, 0.11	1.58
ER 98 ECS 742		75, 81				19	fruit	0.08, 0.05, 0.04	0.17
Spain1998		Spray	1.600	1500	3				
Spind graes		(gun)		(0.106		*21*	fruit	0.16,0.26,0.12	0.54
C002960		BBCH 71,		% ai)					
ER 98 ECS 742		75, 81							
Greece1998	35EC	Spray	0.800	1500	3	0	fruit wo stone	0.74, 0.42, 0.03	1.19
Louatel		(gun)		(0.053		21	fruit wo stone	0.07, 0.07, 0.02	0.16
C002960		BBCH 73,		% ai)		0	fruit	0.63, 0.36, 0.03	1.02
ER 98 ECS 742		73, 75				21	fruit	0.07, 0.07, 0.02	0.16
Italy1998	35EC	Mist	0.800	1500	3	0	fruit wo stone	1.00, 0.68, 0.05	1.73
Maris Luisa		blower		(0.053		21	fruit wo stone	0.08, 0.11, 0.05	0.24
C002960		(knapsack		% ai)		0	fruit	0.89, 0.60, 0.05	1.54
ER 98 ECS 742		BBCH 73				21	fruit	0.07, 0.10, 0.05	0.22
Italy1998		blower	1.600	1500	3				
Maris Luisa		(knapsack)		(0.053		13	fruit	0.26,0.34,0.12	0.72
C002960		BBCH 73,		% ai)					
ER 98 ECS 742		75, 77							
Italy1998	35EC	blower)	0.800	1500	3	0	fruit wo stone	0.53, 0.36, 0.02	0.91
Spring Bell		(knapsack		(0.053		21	fruit wo stone	0.14, 0.17, 0.09	0.40
C002960		BBCH 73		% ai)		0	fruit	0.48, 0.33, 0.02	0.83
ER 98 ECS 742		, 75, 78				21	fruit	0.13, 0.16, 0.09	0.38

PEACH	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Spain1997	35EC	Spray)	0.800	1500	3	0	fruit wo stone	0.49, 0.31, < 0.02	0.80
Baby Gold 6		(knapsack		(0.053		7	fruit wo stone	0.33, 0.37, 0.03	0.73
C001114b		BBCH		% ai)		14	fruit wo stone	0.23, 0.33, 0.04	0.60
ER 97 ECS		75, 77, 89				21	fruit wo stone	Sample na	
742						0	fruit	0.43, 0.27, < 0.02	0.70
						7	fruit	0.30, 0.34, 0.03	0.67
						14	fruit	0.21, 0.31, 0.04	0.56
						21	fruit	Sample na	
Spain1997	35EC	Spray)	0.800	1500	3	0	fruit wo stone	1.20, 0.87, 0.04	2.11
Sudanel		(knapsack		(0.053		7	fruit wo stone	0.28, 0.32, 0.03	0.63
C001114b		BBCH 75		% ai)		14	fruit wo stone	0.15, 0.24, 0.04	0.43
ER 97 ECS		75, 77				21	fruit wo stone	0.05, 0.13, 0.03	0.21
742						0	fruit	1.05, 0.76, 0.04	1.85
						7	fruit	0.26, 0.29, 0.03	0.58
						14	fruit	0.14, 0.22, 0.04	0.40
						21	fruit	0.05, 0.12, 0.03	0.20
Italy1997	35EC	Mist blower	0.800	1500	3	0	fruit wo stone	0.42, 0.32, < 0.02	0.74
Star Red Gold		(knapsack)		(0.053		7	fruit wo stone	0.14, 0.12, < 0.02	0.26
C001114b				% ai)		14	fruit wo stone	0.12, 0.16, < 0.02	0.28
ER 97 ECS						21	fruit wo stone	0.05, 0.08, < 0.02	0.13
742		BBCH 75, 75, 77				0	fruit	0.37, 0.28, < 0.02	0.65
						7	fruit	0.13, 0.11, < 0.02	0.24
						14	fruit	0.11, 0.15, < 0.02	0.26
						21	fruit	0.05, 0.07, < 0.02	0.12
Italy1997	35EC	Mist blower	0.800	1500	3	0	fruit wo stone	0.43, 0.25, < 0.02	0.68
Lafaiette		(knapsack)		(0.053		7	fruit wo stone	0.22, 0.22, < 0.02	0.44
C001114b				% ai)		14	fruit wo stone	0.04, 0.05, < 0.02	0.09
ER 97 ECS						21	fruit wo stone	0.04, 0.05, < 0.02	0.09
742		BBCH 75, 75, 78				0	fruit	0.38, 0.22, < 0.02	0.60
						7	fruit	0.21, 0.21, < 0.02	0.42
						14	fruit	0.04, 0.05, < 0.02	0.09
						21	fruit	0.04, 0.05, < 0.02	0.09
Italy1997	35EC	Mist	0.800	1500	3	0	fruit wo stone	0.75, 0.19, 0.02	0.96
Maycrest		blower)		(0.053		7	fruit wo stone	0.25, 0.27, 0.02	0.54
C001114b		(knapsack		% ai)		14	fruit wo stone	0.04, 0.10, 0.03	0.17
ER 97 ECS						21	fruit wo stone	0.03, 0.03, 0.02	0.08
742		BBCH 73, 75, 81				0	fruit	0.75, 0.19, 0.02	0.96
						7	fruit	0.23, 0.24, 0.02	0.49
						14	fruit	0.04, 0.09, 0.03	0.16
						21	fruit	0.03, 0.03, 0.02	0.08
USA1963	50WP		1.56+2.46	28618,	2	0	fruit	3.70, 0.20	3.90
Elberta				4114		6	fruit	1.58, 0.13	1.71
Rockville, CA				(0.05,		14	fruit	1.03, 0.16	1.19
				0.06		14	fruit	1.08, 0.18	1.26
C009876 R-689				% ai)		22	fruit	0.43, 0.11	0.54
						28	fruit	0.24, 0.05	0.29
						35	fruit	0.20, 0.04	0.24
Australia	EC	spray	1.33	2000	3	0	Fruit	0.13,0.085, < 0.005	0.22
2000						14		0.39,0.53, 0.13	1.05
GoulburnValley						28		0.079, 0.15, 0.069	0.30
Tatura						35		0.026,0.092, 0.07	0.19
N° 1/10/541									
Australia	EC	spray	1.98	1500	6	0	Fruit	2.90, 1.90.0.11	4.91
2000						14		0.29, 0.33, 0.05	0.67
GoulburnValley						28		0.09, 0.20.0.076	0.37
Tatura						35		0.033, 0.11, 0.065	0.21
N° 1/10/541									

PEACH	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia	EC	spray	0.651	980	6	0	Fruit	0.81, 0.68, 0.18	1.73
2000						14		0.26, 0.35, 0.14	1.15
Passchendale						28		0.06, 0.097, 0.053	0.21
Crown princess						35		0.027, 0.066,0.05	0.14
N° 1/10/541						0c		0.007, 0.007,< 0.005	0.02

No reference provided for analytical method.

Table 42. Endosulfan residues in grapes resulting from supervised trials in Europe and USA.

GRAPE	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha	L/ha	No				
Germany	33WP	Spray.	0.592,	300,	2	0	Fruit		9.20
1984		Interval	1.184	600		14	Fruit		1.88
MullerThurgau		63 days		(0.197% ai)		35	Fruit		0.68
PSR99/012						60	Fruit		0.55
						60	Must		0.04
						60	Wine		0.02
Germany	33WP	Spray.	1.184	600	2	0	Fruit		12.2
1984		Interval		(0.197% ai)		19	Fruit		1.26
(MullerThurgau)		51 days				35	Fruit		0.7
PSR99/012						62	Fruit		0.49
						62	Must		0.03
						62	Wine		0.02
Germany	35MC*	Spray	1.26	600	2	0	Fruit	10.0, 5.0, 0.01	15.01
1984		Interval		(0.21% ai)		19	Fruit	1.30, 1.10, 0.09	2.49
(MullerThurgau)		51 days				35	Fruit	0.70, 0.60, 0.06	1.36
						62	Fruit	0.20, 0.30, 0.09	0.59
Germany	35MC*	Spray	0.63,	300,	2	0	Fruit	9.00, 4.40, < 0.01	13.40
1984		Spray	1.26	600		14	Fruit	1.10, 0.70, 0.02	1.82
(MullerThurgau)		Interval		(0.21% ai)		35	Fruit	0.40, 0.40, 0.02	0.82
		63 days				60	Fruit	0.20, 0.30, 0.10	0.60
Spain	CS*	Foliar	1.05	800, 1000	2	0	Fruit	2.50, 1.30, < 0.02	3.80
1999		Interval		(0.105% ai)		7	Fruit	1.70, 1.00, < 002	2.70
(Italia)		14 days				14	Fruit	0.78, 0.43,< 0.02	1.21
		BBCH 79,				28	Fruit	0.54, 0.33, < 0.02	0.87
Spain	CS*	Spray	1.05	800, 1000	2	0	Fruit	1.1, 0.62, < 0.02	1.72
1999		Interval		(0.105% ai)		7	Fruit	0.35, 0.21, < 0.02	0.56
(Alfonso Labale)		15 days				14	Fruit	0.37, 0.25, < 0.02	0.62
		BBCH 77,				28	Fruit	0.11, 0.077, < 0.02	0.19
Greece	CS*	Foliar	1.05	1035	2	0	Fruit	0.44, 0.22, < 0.02	0.66
1999		Interval 13 d		(0.101% ai)		7	Fruit	0.20, < 0.02, < 0.02	0.20
Xinimavro		BBCH 79, 83				14	Fruit	0.17, 0.14, < 0.02	0.31
ER 99 ECS 756						28	Fruit	0.23, 0.17, < 0.02	0.40
Italy1999	CS*		1.05	1000	2	0	Fruit	0.57, 0.29, < 0.02	0.86
(Trebbiano di				(0.105% ai)		7	Fruit	0.54, 0.33, < 0.02	0.87
Romagna)						15	Fruit	0.44, 0.30, ,0.02	0.76
ER 99 ECS 756						28	Fruit	0.41, 0.28, 0.027	0.72
Italy 1999	CS*	Foliar	1.05	1000	2	0	Fruit	4.60, 2.50, < 0.02	7.10
Vittora		Interval 14 d		(0.105% ai)		7	Fruit	2.50, 1.50, < 0.02	4.00
ER 99 ECS		BBCH 75, 79				14	Fruit	1.50, 1.10, 0.02	2.62
756		BBCH 75, 79				28	Fruit	0.47, 0.31, < 0.02	0.78
Italy1997	35 EC	Mist blower	1.05	1000	2	0	Fruit	1.70, 1.10, < 0.02	2.80
Italia		Interval14 d		(0.105% ai)		7	Fruit	0.31, 0.49, < 0.02	0.80
ER 97 ECS 744		BBCH 79, 83				14	Fruit	0.30, 0.43, < 0.02	0.73
						22	Fruit	0.29, 0.43, < 0.02	0.72
						28	Fruit	0.10, 0.17, < 0.02	0.27

GRAPE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha	L/ha	No	days	analysed		
Spain	35 EC	Foliar Spray	1.05	1000	2	0	Fruit	0.59, 0.38, < 0.02	0.97
1997		Interval		(0.105% ai)		7	Fruit	0.07, 0.12, 0.02	0.21
Macabeo		13 days				14	Fruit	0.07, 0.11, 0.03	0.21
ER 97 ECS 744		BBCH 81, 83				22	Fruit	0.04, 0.06, < 0.02	0.10
						28	Fruit	0.03, 0.03, < 0.02	0.06
Spain	35 EC	Foliar Spray	1.05	1000	2	0	Fruit	0.57, 0.31, < 0.02	0.88
1997		Interval		(0.105% ai)		7	Fruit	0.19, 0.25, 0.03	0.47
Bobal		13 days				14	Fruit	0.05 0.07, 0.02	0.14
ER 97 ECS 744		BBCH 81, 83				22	Fruit	0.03, 0.06, 0.02	0.11
						28	Fruit	0.31, ND, ND	0.31
Spain	35 EC	Foliar Spray	1.05	1000	2	0	Fruit	0.31, 0.20, < 0.02	0.51
1997		Interval		(0.105% ai)		7	Fruit	0.07, 0.12, < 0.02	0.19
Bobal		13 days				14	Fruit	0.08, 0.16, 0.02	0.26
ER 97 ECS 744		BBCH 81, 83				22	Fruit	0.04, 0.06, < 0.02	0.10
						28	Fruit	< 0.02, 0.02, < 0.02	0.02
Italy	35 EC	Mist blower	1.05	1000	2	0	Fruit	1.10, 0.57, < 0.02	1.67
1997		Interval		(0.105% ai)		7	Fruit	0.08, 0.21, < 0.02	0.29
Regina		14 days				14	Fruit	0.07, 0.27, 0.03	0.37
ER 97 ECS 744		BBCH 79, 83				21	Fruit	< 0.02, 0.04, < 0.03	0.04
						28	Fruit	< 0.02, 0.07, 0.02	0.09
Spain	35 EC	2.408	0.792	750	3	0	Fruit	0.16, 0.20, < 0.05	0.36
1994				(0.1056		8	Fruit	< 0.05, 0.08, < 0.05	0.08
Cencibel				% ai)		15	Fruit	< 0.05, 0.07, < 0.05	0.07
ER 94 ECS						22	Fruit	< 0.05, < 0.05, < 0.05	< 0.05
730						29	Fruit	< 0.05, < 0.05, < 0.05	< 0.05
						15	Juice	ND, < 0.05, < 0.05	< 0.05
						15	Pomace	0.07, 0.20, 0.06	0.33
						15	Young wine	< 0.05, < 0.05, < 0.05	< 0.05
						15	Wine	< 0.05, < 0.05, < 0.05	< 0.05
Spain	35 EC		0.792	750	3	0	Fruit	< 0.05, < 0.05, < 0.05	< 0.05
1994				(0.1056		8	Fruit	< 0.05, 0.10, < 0.05	0.10
Bobal				% ai)		15	Fruit	< 0.05, 0.105, < 0.05	0.11
ER 94 ECS						22	Fruit	< 0.05, < 0.05, < 0.05	< 0.05
730						29	Fruit	< 0.05, 0.05, < 0.05	0.05
						15	Juice	< 0.05, < 0.05, < 0.05	< 0.05
						15	Pomace	< 0.05, 0.17, 0.07	0.24
						15	Young wine	< 0.05, < 0.05, < 0.05	< 0.05
						15	Wine	< 0.05, < 0.05, < 0.05	< 0.05
Spain	35 EC		0.317	300	3	0	Fruit	0.13, 0.12, < 0.05	0.25
1994				(0.1056		7	Fruit	< 0.05, < 0.05, < 0.05	< 0.05
Garrida				% ai)		13	Fruit	< 0.05, < 0.05, 0.09	0.09
ER 94 ECS						20	Fruit	< 0.05, < 0.05, < 0.05	< 0.05
730						13	Juice	< 0.05, < 0.05, < 0.05	< 0.05
						13	Pomace	< 0.05, < 0.05, < 0.05	< 0.05
						13	Young wine	< 0.05, < 0.05, < 0.05	< 0.05
						13	Wine	< 0.05, < 0.05, < 0.05	< 0.05
Italy	35 EC		1.267	1200	3	0	Fruit	0.84, 0.685, < 0.05	1.53
1994				(0.1056		7	Fruit	0.91, 0.70, < 0.05	1.61
Sangiovese				% ai)		13	Fruit	0.10, 0.25, < 0.05	0.35
ER 94 ECS						21	Fruit	< 0.05, 0.12, < 0.05	0.12
730						28	Fruit	0.05, 0.13, < 0.05	0.18
						14	Juice	< 0.05, < 0.05, < 0.05	< 0.05
						14	Pomace	0.13, 0.48, 0.07	0.68
						14	Young wine	0.065, < 0.05, < 0.05	0.07
						14	Wine	< 0.05,< 0.05, < 0.05	< 0.05

GRAPE	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha	L/ha	No	days	analysed		
Italy	35 EC		1.584	1500	3	0	Fruit	0.80, 0.75, < 0.05	1.55
1994				(0.1056		7	Fruit	0.26, 0.37, < 0.05	0.63
Trebbiano				% ai)		14	Fruit	0.20, 0.31, < 0.05	0.51
TR 3T						21	Fruit	0.11, 0.17, < 0.05	0.28
ER 94 ECS						28	Fruit	0.12, 0.19, < 0.05	0.31
730						14	Juice	< 0.05, < 0.05, < 0.05	< 0.05
						14	Pomace	0.38, 0.57, < 0.05	0.95
						14	Young wine	< 0.05, < 0.05, < 0.05	< 0.05
						14	Wine	< 0.05, < 0.05, < 0.05	< 0.05
USA (FL) 1995	3EC	Airblast	3.36	728,	2	4	Fruit (a)		0.45
Thompson		spray		637			Fruit (b)		0.71
Seedless									
BJ-95R-				(0.46-0.49%			Juice		< 0.05
0744346915				ai)			Raisins		0.72
USA1972	50WP	Spray	1.68	2800	2	7	Wh grape	0.75, ND*	0.75
Thompson				(0.06%			W Pomace	0.19, ND	0.19
seedless				ai)			D. Pomace	0.58, ND	0.58
A30342 *R-119B*									

Table 43. Endosulfan residues in avocados resulting from supervised trials in Australia.

AVOCADOS	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL/	L/ha	No.	days	analysed		
Australia	EC	spray	70	640	6	0		0.011, 0.021, 0.040	0.07
2000						14		< 0.005, < 0.005, 0.010	0.01
Tolga						21		< 0.005, < 0.005, < 0.005	< 0.005
Shephard						28		< 0.005, < 0.005, < 0.005	< 0.005
N° 1/10/554									
Australia	EC	spray	70	1000	5	0		0.32, 0.29, 0.049	0.66
2000						14		0.008, 0.031, 0.026	0.07
Glasshouse Mtns						21		0.009, 0.035, 0.057	0.10
Wurtz						28		0.015, 0.048, 0.044	0.11
N° 1/10/554							co	< 0.005, 0.005,0.007	0.12
Australia	EC	spray	140	1000	5	0		0.55, 0.50, 0.12	1.17
2000						14**		0.063, 0.20, 0.10	0.36
Glasshouse Mtns						21		0.016, 0.08, 0.066	0.16
Wurtz						28**		0.053, 0.472, 0.475	1.00
N° 1/10/554						14	peel	0.19, 0.70, 0.35	1.24
						14	flesh	< 0.005, 0.007, 0.018	0.03
						28	peel	0.053, 0.46, 0.44	0.95
						28	flesh	< 0.005, 0.012, 0.035	0.05
Australia	EC	spray	70	700	6	28		< 0.005,< 0.005,< 0.005	< 0.005
2000									
Tolga									
Hass									
N° 1/10/554									

** in the report we have ratio skin+flesh/ seed and not peel+seed /flesh

co control sample

Table 44. Endosulfan residues in custard apple resulting from supervised trials in Australia.

CUSTARD APPLE	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL/	Water volume	No.				
Australia *2000* Nambour *African pride* *N° ½/500*	EC	spray	70	8.6L/Tree	3	0 7 14 28	Fruit	0.71 ,0.39, 0.22 0.02, 0.03, 0.05 0.01, 0.01, 0.07 ND, 0.01, 0.04	1.32 <u>0.10</u> 0.09 0.05
Australia *2000* Nambour *African pride* *N° ½/500*	EC	spray	140	8.6L/Tree	3	0 7 14 28	Fruit	0.84, 0.5 , 0.29 0.03, 0.08, 0.16 0.01, 0.04, 0.20 ND, 0.01, 0.06	1.63 0.27 0.25 0.07
Australia *2000* Alstonville *Pinks mammoth* *N° ½/500*	EC	spray	70	8.6L/Tree	3	0 7 14 28	Fruit	0.62, 0.35, 0.17 0.11, 0.14, 0.10 0.05, 0.07, 0.06 0.01, 0.02, 0.04	1.14 <u>0.35</u> 0.18 0.07
Australia *2000* Alstonville *Pinks mammoth*	EC	spray	140	8.6L/Tree	3	0 7 14 28	Fruit	0.37, 0.62, 0.36 0.30, 0.49, 0.17 0.22, 0.32, 0.22 0.03, 0.08, 0.12	1.35 0.96 0.76 0.23

Table 45. Endosulfan residues in litchi resulting from supervised trials in Australia.

LITCHI	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hl/	L/ha	No.				
Australia *NORTH* QUEENSLAND	EC	spray	52.5		4	0 3 7 14		1.63, 1.00 ,0.69 0.51, 0.42, 0.67 0.33, 0.29, 0.66 0.11, 0.083, 0.26	3.32 1.60 <u>1.28</u> 0.45
Australia *NORTH* QUEENSLAND	EC	spray	104		4	0 3 7 14		2.65, 1.28 ,0.75 0.60, 0.54, 0.77 0.33, 0.32, 0.64 0.30, 0.24, 0.57	4.68 1.91 1.29 1.11
Australia *SOUTH* QUEENSLAND	EC	spray	52.5		4	7		0.24, 0.24, 0.53	<u>1.01</u>

Table 46. Endosulfan residues in mangoes resulting from supervised trials in Australia.

MANGOES	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hl/	L/ha	No.				
Australia *2000* Dorroughby *Bowen* *N° 1/10:537*	EC	spray	70	8.00	2	0 7 14 28		0.24, 0.17, 0.007 0.071, 0.067, 0.060 0.026, 0.025, 0.049 0.012, 0.015, 0.063	0.42 <u>0.20</u> 0.10 0.09
Australia *2000* Tolga *Palmer* *N° 1/2/500*	EC	spray	70	493	2	0 7 14 28		0.17, 0.15, 0.034 0.035, 0.035, 0.10 0.015, 0.013, 0.12 0.009, 0.006, 0.15	0.35 <u>0.17</u> 0.15 0.17

MANGOES	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hl/	L/ha	No.				
Australia *2000* Tolga *Palmer* *N° 1/2/500*	EC	spray	140	667	2	0 7 14 28		0.26,0.18, 0.048 0.11, 0.11, 0.28 0.051, 0.055, 0.34 0.005, 0.005, 0.089	0.49 0.50 0.45 0.10
Australia *2000* Wamuran *Kent* *1/10/537*	EC	spray	70	400	2	28 28	 co	0.014, 0.011, 0.20 0.008, 0.006, 0.031	0.22 0.05

Table 47. Endosulfan residues in papaya resulting from supervised trials in Australia.

PAWPAW	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hl/		No.				
Australia *2000* Walkamin *Ruby red* *N° 1/10/539*	EC	spray	70	933	4	0 7 14 21	Fruit	0.16, 0.12, 0.088 0.03, 0.053, 0.10 0.013, 0.024, 0.094 < 0.005, 0.005, 0.09	0.37 <u>0.18</u> 0.12 0.10
Australia *2000* Walkamin *Ruby red* *N° 1/10/539*	EC	spray	140	1100	4	0 7 14 21 0	Fruit	0.37, 0.33, 0.18 0.09, 0.11, 0.13 0.025, 0.074, 0.13 < 0.005, 0.010, 0.074 0.007, 0.006, 0.01	0.88 0.33 0.23 0.08 0.02c
Australia *2000* Mareeba *Hybrid 1B* *N° 1/10/539* *N° 1/10/539*	EC	spray	70	933	4	0 7 14 21	Fruit	0.11,0076,0.051 0.005, 0.011, 0.079 < 0.005, 0.006, 0.047 < 0.005, < 0.005, 0.045	0.24 <u>0.10</u> 0.06 0.05

Table 48. Endosulfan residues in persimmon resulting from supervised trials in Australia.

PERSIMMON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hl/		No.				
Australia *2001* Wollongbar *Fuji* *N° 1/10/545*	EC	spray	70	500	2	0 7 14 28		0.45, 0.37, 0.11 0.17,0.24, 0.12 0.17, 0.23, 0.15 0.53, 0.58, 0.65	0.93 0.53 <u>0.55</u> 1.80 **
Australia *2001* The Summit *Fuyu* *N° 1/10/545*	EC	spray	70	1719	2	0 7 14 28		0.49, 0.48, 0.057 0.38, 0.42, 0.086 0.27,0.34, 0.08 0.14, 0.21, 0.15	1.03 <u>0.89</u> 0.69 0.50
Australia *2001* The Summit *Fuyu* *N° 1/10/545*	EC	spray	140	2131	2	0 7 14 14 28 28	 peel flesh peel flesh	1.4, 1.2 ,0.08 0.71, 0.81, 0.18 2.60, 2.80, 0.87 0.13, 0.086, 0.028 1.70, 1.90, 1.40 0.014, 0.015, 0.016	2.68 1.70 6.27 0.24 5.00 0.05

PERSIMMON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hl/		No.				
Australia *2000* Glasshouse Mtns *Fuji* *N° 1/10/545*	EC	spray	70	680	2	28 28	co	0.14, 0.13, 0.45 0.17, 0.16, 0.46	0.72 0.79

** no clear comments were including in the report (sampling)

Table 49. Endosulfan residues in pineapple resulting from supervised trials in USA.

PINEAPPLE	Application					DALA	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	Kg ai/ha/ applic'n	L/ha	No.				
USA (HI) 1996 *Smooth Cayenne* *PGAAH950001P*	3EC	Spray interval 7 d	1.68	1870	2	60 60 60	Wh. Fruit Wet Pulp Juice	(0.03), 0.05, 0.03 0.07, 0.09, 0.16 (0.01), (0.01), < 0.01	0.11 0.32 0.02
USA (HI) 1996 *Smooth Cayenne* *PGAAH950001*	3EC	Spray (interval 7 d)	1.68	1870	2	60 60 60	Wh. Fruit Wet Pulp Juice	0.14, 0.23, 0.18 0.26, 0.33, 0.58 (0.04), 0.07, < 0.01	0.55 1.17 0.11
USA (HI) 1996 *Smooth Cayenne* *PGAAH950001P*	3EC	Spray (interval 7 d)	1.68	1870	2	61 61 61	Wh. Fruit Wet Pulp Juice	(0.04), 0.06, 0.07 0.25, 0.29, 0.55 (0.02), (0.04), < 0.01	0.17 1.09 0.06
USA (HI) 1996 *Smooth Cayenne* *PGAAH950001P*	3EC	Spray (interval 7 d)	5.04	1870	2	61 61 61	Wh. Fruit Wet Pulp Juice	0.19, 0.26, 0.16 0.47, 0.53, 0.79 0.07, 0.10, < 0.01	0.61 1.79 0.17
USA (HI) 1968 Oahu, HI *R-1097*	3EC	Spray (interval 7 d)	2.24	2800	4	0 7 0 7*	Wh. Fruit Wh. Fruit Bran w/o molasses Bran w molasses		0.25 0.20 2.56 1.75
USA (HI) 1968 Oahu, HI *R-1097*	3EC	Spray (interval 7, 7, 8 d)	2.24	2800	4	0 0 21 21*	Wh. Fruit Wh. Fruit Bran w/o molasses Bran w molasses		0.09 0.08 1.1 1.3
USA (HI) 1968 Oahu, HI *R-1097*	3EC	Spray (interval 7, 10, 7 d)	2.24	2800	4	0 0 53 53*	Wh. Fruit Wh. Fruit Bran w/o molasses Bran w molasses		0.13 0.22 0.93 1.1
USA (HI) 1968 Oahu, HI *R-1097*	3EC	Spray (interval 7 d)	4.48	2800	4	0 7 0 7*	Wh. Fruit Wh. Fruit Bran w/o molasses Bran w molasses		0.72 0.62 2.8 4.1
USA (HI) 1968 Oahu, HI *R-1097*	3EC	Spray (interval 7, 7, 8 d)	4.48	2800	4	0 0 21 21*	Wh. Fruit Wh. Fruit Bran w/o molasses Bran w molasses		0.33 0.23 5.2 2.3

PINEAPPLE	Application					DALA	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	Kg ai/ha/ applic'n	L/ha	No.				
USA (HI) 1968 Oahu, HI *R-1097*	3EC	Spray (interval 7, 10, 7 d)	4.48	2800	4	0 0 53 53*	Wh. Fruit Wh. Fruit Bran w/o molasses Bran w molasses		0.43 0.18 2.2 1.8

Table 50. Endosulfan residues in head cabbage from supervised trials in Australia and USA.

CABBAGE	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.				
Australia *2000* Darling Downs *Neptune* *N° 1/10/564*	EC	spray	0.665	1000	3	0 3 7 14		0.31, 0.20.0.019 0.13,0.15,0.035 0.026, 0.029,0.043 0.007,0.007,0.038	0.53 0.32 <u>0.10</u> 0.05
Australia *2000* Darling Downs *neptune* *N° 1/10/564*	EC	spray	1.32	1000	3	0 3 7 14		0.84, 0.49,0.041 0.21, 0.24,0.062 0.09, 0.10, 0.11 0.014,0.014, 0.045	1.37 0.51 0.30 0.07
Australia *2000* Werribee *green coronet* *N° 1/10/564*	EC	spray	0.332	500	3	0 3 7 14		0.035, 0.023, 0.006 0.008, 0.01, 0.008 0.006, 0.008, 0.017 < 0.005,< 0.005,< 0.005	0.06 0.03 0.03 < 0.005
Australia *2000* Werribee *green coronet* *N° 1/10/564*	EC	spray	0.56	500	3	0 3 7 14		0.033, 0.019, 0.006 0.012, 0.011, 0.007 0.006, 0.012, 0.008 < 0.005,< 0.005,< 0.005	0.058 0.030 <u>0.026</u> < 0.005
USA1960 San Jose, CA *Green cabbage* *R-470*	2EC	Spray. Interval 21 d	<u>1.12</u>	701 (0.16% ai)	2	0 7 14	Leaves Leaves Leaves		20.00 3.20 2.80
USA1960 San Jose, CA *Green cabbage* *R-470*						0 <u>7</u> 14 0 7 14	Heads Heads Heads Wh Heads Wh Heads Wh Heads		0.59 <u>≤ 0.05</u> < 0.05 6.70 0.60 0.45
USA1960 Moon Bay, CA *Red cabbage* R-470	2EC	Spray. Interval 7 d	<u>0.56,1.12</u>	701 (0.16% ai)	2	0 16 28 0 16 28 0 16 28	Leaves Leaves Leaves Heads Heads Heads Wh Heads Wh Heads Wh Heads		22.00 3.70 0.56 0.52 < 0.05 < 0.05 6.20 1.12 0.11

CABBAGE	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.				
USA1960	2EC	Spray.	0.56,1.12	701	2	0	Leaves		14.00
Half Moon		Interval		(0.16%		12	Leaves		1.84
Bay, CA		23d		ai)					
Red cabbage						0	Heads		0.28
R-470						12	Heads		0.03
						0	Wh Heads		
						12	Wh Heads		0.53
USA	2EC	Spray.	1.12	467	1	0	Leaves		12.7
1960				(0.24		7	Leaves		2.2
R-470				% ai)		14	Leaves		0.95
						0	Heads		0.23
						7	Heads		0.24
						14	Heads		< 0.05
						0	Wh Heads		2.5
						7	Wh Heads		0.69
						14	Wh Heads		0.18
USA1960	2EC	Spray.	1. 12	701	2	0	Leaves		25.00
Half Moon				(0.16%		12	Leaves		5.50
Bay, CA		Interval		ai)					
Red cabbage		16d				0	Heads		0.33
R-470						12	Heads		0.09
						0	Wh Heads		6.30
						12	Wh Heads		1.45

Table 51. Endosulfan residues in Savoy cabbage (head) from supervised trials in Germany.

SAVOY CABBAGE	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany	Dust	Spread	0.705		3	0	Head	0.5, < 0.01, < 0.01	0.50
1983	2.82%	Interval				5	Head	0.07, < 0.01, < 0.01	0.07
Gruenkopf		16, 14 days				10	Head	< 0.01, < 0.01, < 0.01	< 0.01
DEU83172611						14	Head	< 0.01, < 0.01, < 0.01	< 0.01
Germany	Dust	Spread	0.705		3	0	Head	3.8, 1.7, < 0.01	5.50
1983	2.82%	Interval				5	Head	1.2, 0.7, 0.03	1.93
Vertus		14 days				10	Head	0.07, 0.07, < 0.01	0.14
DEU83172641						14	Head	0.3, 0.1, 0.02	0.42
Germany	Dust	Spread	0.705		3	0	Head	0.3, 0.1, < 0.01	0.40
1983	2.82%	Interval				5	Head	0.03, 0.02, < 0.01	0.05
Wirosa		14 days				10	Head	0.05, 0.04, < 0.01	0.09
DEU83172631						14	Head	0.08, 0.09, 0.02	0.19
Germany1974	35EC	Spray	0.35	1000	1	0	Head		2.84
Marner				(0.035%		7	Head		0.58
PSR94/024				ai)		14-28	Head	< 0.02, < 0.01, < 0.01	< 0.01
Germany1974	35EC	Spray	0.35	1000	1	0	Head		2.69
Marner				(0.035%		7	Head		0.47
PSR94/024				ai)		14-28	Head	< 0.02, < 0.01, < 0.01	< 0.01

SAVOY CABBAGE	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany	35EC	Spray	0.35	1000	1	0	Head		21.46
1974				(0.035%		7	Head		2.73
Novum				ai)		14	Head		0.63
PSR94/024						21	Head		0.40
						28	Head		0.13
Germany	35EC	Spray	0.35	1000	1	0	Head		15.25
1974				(0.035%		7	Head		2.16
Bonn				ai)		14	Head		0.40
Novum						21	Head		0.28
PSR94/024						28	Head		0.11
Germany	35EC	Spray	0.35	1000	1	0	Head		3.73
1974				(0.035%		7	Head		0.44
Gruenkopf				ai)		14	Head	< 0.008, < 0.04, < 0.05	< 0.05
PSR94/024						21	Head	< 0.008, < 0.04, < 0.05	< 0.05
						28	Head	< 0.008, < 0.04, < 0.05	< 0.05
Germany	35EC	Spray	0.35	1000	1	0	Head		3.73
1974				(0.035%		7	Head		0.07
Boeckelmanns				ai)		14	Head	< 0.008, < 0.04, < 0.05	< 0.05
PSR94/024						21	Head	< 0.008, < 0.04, < 0.05	< 0.05
						28	Head	< 0.008, < 0.04, < 0.05	< 0.05
Germany	35EC	Spray	0.35	1000	1	0	Head		---
1974				(0.035%		7	Head		0.23
Gruener				ai)		14	Head		0.28
PSR94/024						21	Head	< 0.08, < 0.04, < 0.05	< 0.05
						28	Head	< 008, < 0.04, < 0.05	< 0.05
Germany	35EC	Spray	0.35	1000	1	0	Head		---
1974				(0.035%		7	Head		0.30
Gruener				ai)		14	Head		0.14
PSR94/024						21	Head	< 0.08, < 0.04, < 0.05	< 0.05
						28	Head		0.14
Germany	35EC	Spray	0.53	1000	1	0	Head		7.63
1974				(0.053%		7	Head		0.06
Gruenkopf				ai)		14	Head	< 0.08, < 0.04, < 0.05	< 0.05
PSR94/024						21	Head	< 0.08, < 0.04, < 0.05	< 0.05
						28	Head	< 0.08, < 0.04, < 0.05	< 0.05
Germany	35EC	Spray	0.53	1000	1	0	Head		3.83
1974				(0.053%		7	Head		0.05
Boeckelmanns				ai)		14	Head	< 0.008, < 0.04, < 0.05	< 0.05
PSR94/024						21	Head	< 0.008, < 0.04, < 0.05	< 0.05
						28	Head	< 0.008, < 0.04, < 0.05	< 0.05
Germany	35EC	Spray	0.53	1000	1	0	Head		---
1974				(0.053%		7	Head		1.20
Dr Neuers				ai)		14	Head		0.13
Gruener									
PSR94/024						21	Head	< 0.08, < 0.04, < 0.05	< 0.05
						28	Head	< 0.08, < 0.04, < 0.05	< 0.05

SAVOY CABBAGE	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany 1974 *Dr Neuers* *Gruener* PSR94/024	35EC	Spray	0.53	1000 (0.053% ai)	1	0 7 14 21 28	Head Head Head Head Head	 < 0.08, < 0.04, < 0.05 < 0.08, < 0.04, < 0.05	6.90 1.10 < 0.05 < 0.05 0.14
Germany 1976 *Vorbote* *PSR94/024*	35EC	Spray Spray Intvl 22, 21 days	0.21	600 (0.035% ai)	3	0 7 14 21	Head Head Head Head	 < 0.005, < 0.005, < 0.005	1.90 0.40 0.04 < 0.005
Germany 1976 *Iceking* *PSR94/024*	35EC	Spray Spray Intvl 18, 43 days	0.21	600 (0.035% ai)	3	0 7 14 21	Head Head Head Head		0.20 0.20 0.20 < 0.01
Germany1976 *Boeckelmanns* *Westfalia* *PSR94/024*	35EC	Spray Spray Intvl 28 days	0.21	600 (0.035% ai)	3	0 7 14 21	Head Head Head Head		0.30 0.10 0.10 < 0.01
Germany 1983 *Gruenkopf* *PSR94/024*	33WP	Spray Spray Intvl 15 days	0.20	600 (0.033% ai)	3	0 5 10 14	Head Head Head Head	 < 0.01, < 0.01, < 0.01	0.605 0.110 0.065 < 0.01
Germany 1983 *Wirosa* *PSR94/024*	33WP	Spray Spray Intvl 14 days	0.20	600 (0.033% ai)	3	0 5 10 14	Head Head Head Head		1.71 1.22 0.09 0.34
Germany 1983 *Vertus* *PSR94/024*	33WP	Spray Spray Intvl 14 days	0.20	600 (0.033% ai)	3	0 5 10 14	Head Head Head Head		-- 0.10 0.025 0.035
Germany 1976 *Vorbote* *PSR94/024*	35WP	Spray Spray Intvl 21, 22 days	0.21	600 (0.035% ai)	3	0 7 14 21	Head Head Head Head		2.10 0.20 0.20 0.04
Germany 1976 *Iceking* *PSR94/024*	35WP	Spray Spray Intvl 18, 43 days	0.21	600 (0.035% ai)	3	0 7 14 21	Head Head Head Head	 < 0.01, < 0.01, 0.01	2.00 0.20 0.07 < 0.01
Germany 1976 *Boeckelmanns* *PSR94/024*	35WP	Spray Spray Intvl 28 days	0.21	600 (0.035% ai)	3	0 7 14 21	Head Head Head Head		1.00 0.10 0.02 0.04
Germany *1974* *Marner* *PSR94/024*	35WP	Spray	0.35	1000 (0.035% ai)	1	0 7 14-28	Head Head Head	 < 0.02, < 0.01, < 0.01	0.88 0.17 < 0.02
Germany 1974 *Novurn* *PSR94/024*	35WP	Spray	0.35	1000 (0.035% ai)	1	0 7 14 21 28	Head Head Head Head Head		17.62 2.92 1.22 1.10 0.08
Germany 1974 *Gruenkopf* *PSR94/024*	35WP	Spray	0.35	1000 (0.035% ai)	1	0 7 14-28	Head Head Head	 < 0.008, < 0.04, < 0.05	4.13 0.07 < 0.05

SAVOY CABBAGE	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany	35WP	Spray	0.35	1000	1	0	Head		1.03
1974				(0.035%		7	Head		0.04
Boeckelmanns				ai)		14	Head	< 0.008, < 0.04, < 0.05	< 0.05
PSR94/024						21	Head	< 0.008, < 0.04, < 0.05	< 0.05
						28	Head		0.04
Germany	35WP	Spray	0.35	1000	1	0	Head		3.30
1974						7	Head		0.13
Dr Neuers Gruener				(0.035%		14	Head		0.12
PSR94/024				ai)		21	Head	< 0.08, < 0.04, < 0.05	< 0.05
						28	Head	< 0.08, < 0.04, < 0.05	< 0.05
Germany	35WP	Spray	0.35	1000	1	0	Head		----
1974				(0.035%		7	Head		0.70
Dr Neuers Gruener PSR94/024				ai)		14-28	Head	< 0.08, < 0.04, < 0.05	< 0.05
Germany	35WP	Spray	0.53	1000	1	0	Head		0.59
1974				(0.053%		7	Head		0.18
Marner				ai)		14-28	Head	< 0.02, < 0.01, < 0.01	< 0.02
PSR94/024									
Germany	35WP	Spray	0.53	1000	1	0	Head		19.46
1974				(0.053%		7	Head		3.43
Novum				ai)		14	Head		1.17
PSR94/024						21	Head		0.80
						28	Head		0.09
Germany	35WP	Spray	0.53	1000	1	0	Head		6.03
1974				(0.053%		7	Head		0.07
Gruenkopf				ai)		14	Head	< 0.008, < 0.04, < 0.05	< 0.05
*P*SR94/024						21	Head		< 0.05
						28	Head	< 0.008, < 0.04, < 0.05	< 0.05
Germany	35WP	Spray	0.53	1000	1	0	Head		2.13
1974				(0.053%		7	Head		0.075
Boeckelmanns				ai)		14-28	Head	< 0.008, < 0.04, < 0.05	< 0.05
PSR94/024									
Germany	35WP	Spray	0.53	1000	1	0	Head		4.90
1974				(0.053%		7	Head		0.06
Dr Neuers Gruener				ai)		14	Head		0.18
PSR94/024						21	Head		< 0.05
						28	Head		< 0.05
Germany	35WP	Spray	0.53	1000	1	0	Head		3.00
1974				(0.053%		7	Head		0.70
Dr Neuers Gruener				ai)		14	Head		0.08
PSR94/024						21	Head	< 0.08, < 0.04, < 0.05	< 0.05
						28	Head	< 0.08, < 0.04, < 0.05	< 0.05

SAVOY CABBAGE	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany 1975 *Vorbote* LEA 2/83/01/02-75)	EC*	Spray Interval 14d	0.216	(0.036 % ai)	2	0 5 10 14	Head Head Head Head		0.50 < 0.05 < 0.05 < 0.05
Germany1975 *Hammer* LEA 2/83/01/02-75)	EC*	Spray, 0.15% Interval 14d	0.216	600 (0.036 % ai)	2	0 7 10 14	Head Head Head Head		0.90 0.60 0.40 0.20
Germany1975 *King* LEA3 /83/01/02-75	EC*	Spray, 0.15% Interval 14d	0.216	600 (0.036 % ai)	2	0 7 10 14	Head Head Head Head	0.05, ND, ND 0.007, ND, ND ND, ND,ND ND, ND, ND	0.05 0.01 < 0.02 < 0.02
Germany1975 *Boeckelmanns Westfalia* LEA 4/83/01/02-75	EC*	Spray, 0.15% Interval 14d	0.216	600 (0.036 % ai)	2	0 7 10 14	Head Head Head Head	0.1, 0.1, ND 0.01, ND, ND 0.006, ND, ND 0.01, ND, ND	0.20 0.01 0.01 0.01

Table 52. Endosulfan residues in broccoli resulting from supervised trials in USA and Australia.

BROCCOLI	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	Kg ai/ha/ applic'n	L/ha	No.				
USA CA 1995/6 *BJ-95R-03*	3EC* 50WP	Spray. interval 4 days	1.12 1.12	323-330 323-326	3 3	7 7	Broccoli Broccoli	0.33, 0.25, 0.21 0.59, 0.57, 0.16	0.79 1.32
USA CA1995/6 *BJ-95R-03*	3EC 50WP	Spray. interval 4 days	1.12 1.12	647-655 616-640	3 3	7 7	Broccoli Broccoli	0.33, 0.33, 0.08 0.14, 0.16, 0.07	0.74 0.37
USA CA1995/6 *BJ-95R-03*	3EC 50WP	Spray. interval 4 days	1.12 1.12	640-668 649-668	3 3	7 7	Broccoli Broccoli	0.12, 0.16, < 0.05 0.13, 0.16, 0.07	0.28 0.36
USA TX 1995/6 *BJ-95R-03*	3EC 50WP	Spray. interval 4 days	1.12 1.12	189-192 181-187	3 3	7 7	Broccoli Broccoli	0.10, 0.10, 0.36 0.20, 0.44, 0.33	0.56 0.97
USA CA 1995/6 *BJ-95R-03*	3EC 50WP	Spray. interval 5/4d	1.12 1.12	331-337 323-324	3 3	7 7	Broccoli Broccoli	0.24, 0.31, 0.33 0.40, 0.41, 0.26	0.88 1.07
USA AZ 1995/6 *BJ-95R-03*	3EC 50WP	Spray. Spray Interval 5/ 4d	1.12 1.12	96.3-99.1 96.3-98.1	3 3	7 7	Broccoli Broccoli	0.93, 0.72, 0.39 0.76, 0.37, 0.18	2.04 1.31
USA CA 1995/6 *BJ-95R-03*	3EC 50WP	Spray. Spray interval 4 days	1.12 1.12		3 3	7 7	Broccoli Broccoli	1.16, 0.94, 0.30 1.0, 0.72, 0.14	2.40 1.86
USA OR1995/6 *BJ-95R-03*	3EC 50WP	Spray. interval 4/7 d	1.12 1.12	450-495 450-495	3 3	7 7	Broccoli Broccoli	0.10, 0.10, 0.06 0.27, 0.23, 0.07	0.26 0.57
USA 1960 *R-470*	2EC	Spray. Interval 24 d	1.12	701	2	0 6 13	Broccoli Broccoli Broccoli		3.1 0.22 0.16
Australia *2000* Stanthorpe *Babylon* *N° 1/10/594*	EC	spray	0.533	802	3	0 3 7 14	Broccoli florets	0.55, 0.27,0.011 0.39,0.25,0.060 0.08, 0.08, 0.012 < 0.005,< 0.005,< 0.005	0.83 0.70 0.17 < 0.005
Australia *2000* Stanthorpe *Babylon* *N° 1/10/594*	EC	spray	1.525	1156	3	0 3 7 14	Broccoli florets	1.25, 0.71, < 0.005 0.36, 0.27,0.077 0.11, 0.12, 0.055 0.08, 0.07, 0.010	1.96 0.71 0.29 0.16

BROCCOLI	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	Kg ai/ha/ applic'n	L/ha	No.				
Australia *2000* Cranbourne *greenbelt* *N° 1/10/594*	EC	spray	0.465+	700	3	0 3 7 14	Broccoli florets	1.70, 0.92,< 0.005 0.51, 0.36, 0.034 0.12, 0.14, 0.025 0.08, 0.006, 0.004	2.62 0.89 0.29 0.09
Australia *2000* Cranbourne *greenbelt* *N° 1/10/594*	EC	spray	0.924	700	3	0 3 7 14	Broccoli florets	1.91, 1.05, 0.009 0.70, 0.51, 0.047 0.27, 0.27, 0.064 0.016, 0.024, 0.020	2.97 1.26 0.60 0.06

Table 53. Endosulfan residues in Brussels sprouts from supervised trials in UK and USA.

BRUSSELS SPROUTS	Application					PHI (Days)	Sample analysed	Residues of alpha + beta endosulfan, endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
UK 1976 *Onward* *2-21-01-02*	35EC	Spray, 0.21%	0.3	600	1	0 7 14 21	Br. Sprts Br. Sprts Br. Sprts Br. Sprts		6.7 0.8 0.1 0.06
UK 1976 *Onward* *2-21-01-03A*	35EC	Spray, 0.29%	0.48	600	1	0 7 14 21	Br. Sprts Br. Sprts Br. Sprts Br. Sprts		4.2 0.3 0.4 0.08
USA 1965 Albion, NY *M-1575*	2EC	Spray	0.84		14	0 1 3 7 10	Br. Sprts Br. Sprts Br. Sprts Br. Sprts Br. Sprts	0.66, < 0.05 0.88, 0.11 0.93, 0.14 0.60, 0.08 0.35, 0.10	0.66 0.99 1.07 0.68 0.45
USA 1960 *R-470*	2EC	Spray. Spray Interval 24 d	0.84		4 4 4	3 7 14	Br. Sprts Br. Sprts Br. Sprts		2.41 0.88 0.94

Table 54. Endosulfan residues in cauliflower resulting from supervised trials in Australia, USA and Germany.

CAULIFLOWER	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/Ha	L/ha	No.				
Australia *2000* Medina *Galicia* *N° 1/10/550*	EC	spray	0.166	250	3	0 3 7 14	Florets	0.094, 0.066, 0.007 0.084, 0.046,0.011 0.050, 0.038,0.016 0.028,0.035,0.092	0.17 0.14 0.10 0.15
Australia *2000* Medina *Galicia* *N° 1/10/550*	EC	spray	0.435	330	3	0 3 7 14 7	Florets	0.54, 0.35,0.014 0.054, 0.040, 0.013 0.052, 0.038, 0.019 0.008,0.007, 0.010 0.028,0.008, < 0.005	0.90 0.11 0.11 0.03 0.04

CAULIFLOWER	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate,	Total
Country, Year of trial *Variety* Report	Form.	Method	g ai/Ha	L/ha	No.	days	analysed	mg/kg	Residues, mg/kg
Australia	EC	spray	0.315	474	3	0	Florets	0.042, 0.025, 0.020	0.09
2000						3		0.039, 0.029, 0.006	0.07
Werribee South						7		0.010, 0.006, < 0.005	0.02
chaser						14		< 0.005,< 0.005,< 0.005	< 0.005
N° 1/10/550									
Australia	EC	spray	0.625	474	3	0	Florets	0.23, 0.13, 0.005	0.37
2000						3		0.11, 0.074, 0.012	0.20
Werribee South						7		0.046, 0.040, 0.008	0.09
chaser						14		0.006, < 0.005, < 0.005	0.01
N° 1/10/550									
Germany	2.82%	Spread	0.705		3	0	Head	0.60, 0.40, 0.03	1.03
1983	Dust	Interval				5	Head	0.10, 0.20, 0.04	0.34
Erfurter Zwerg		11,7 d				10	Head	0.03, 0.07, 0.06	0.16
DEU83172711						14	Head	0.02, 0.02, 0.02	0.06
Germany	2.82%		0.705		3	0	Head	1.00, 0.80, 0.04	1.84
1983	Dust	Interval				5	Head	0.30, 0.20, 0.04	0.54
Erfurter Zwerg		13,11 d				10	Head	0.02, 0.03, 0.02	0.07
DEU83172721						14	Head	< 0.01, < 0.01, < 0.01	< 0.01
Germany	2.82%		0.705		3	0	Head	0.07, 0.03, < 0.01	0.10
1983	Dust	Interval				5	Head	< 0.01, < 0.01, < 0.01	< 0.01
Necker-Perle		14, 12 d				10	Head	< 0.01, < 0.01, < 0.01	< 0.01
DEU83172731						14	Head	< 0.01, < 0.01, < 0.01	< 0.01
Germany	2.82%		0.705		3	0	Head	0.50, 0.06, < 0.01	0.56
1983	Dust	Interval				5	Head	0.09, 0.04, 0.03	0.16
Celestar		11, 14 d				10	Head	0.02, 0.04, 0.02	0.08
DEU83172741						14	Head	< 0.01, < 0.01, < 0.01	< 0.01
								alpha+beta/sulfate	
USA	2EC	Spray	0.84	935	4	0	Heads+lvs	0.75, < 0.05	0.75
1964		Interval		(0.09		4	Hds+lvs	0.46, 0.05	0.51
Island Queen		8, 7, 12 d		% ai)		7	Hds+lvs	0.23, 0.07	0.30
A48549						11	Hds+lvs	0.15, 0.09	0.24
USA	2EC	Spray	0.84		11	0	Heads	< 0.05,< 0.05	< 0.05
1964		interval				1	Heads	0.41, 0.05	0.46
A48549		7 days				3	Heads	0.05, 0.05	0.10
						7	Heads	0.05, 0.05	0.10
						10	Heads	< 0.05, < 0.05	< 0.05
						0	Leaves	0.30, 0.08	0.38
						1	Leaves	2.58, 0.05	2.63
						3	Leaves	0.18, 0.05	0.23
						7	Leaves	0.24 , 0.07	0.31
						10	Leaves	0.34, 0.11	0.45
USA	2EC	Spray	0.75	100	8	0	Heads	< 0.05, < 0.05	< 0.05
1964				(0.09		3	Heads	< 0.05, < 0.05	< 0.05
Snowball "Y"				% ai)		7	Heads	< 0.05, < 0.05	≤ 0.05
A48549						10	Heads	< 0.05, < 0.05	< 0.05
						14	Heads	< 0.05, < 0.05	< 0.05
						0	Leaves	7.36, 0.95	8.31
						3	Leaves	2.30, 1.36	3.66
						7	Leaves	2.28, 1.05	3.33
						10	Leaves	2.38, 1.60	3.98
						14	Leaves	2.05, 1.74	3.79

Table 55. Endosulfan residues in cucumbers from supervised trials in Germany, USA and Australia.

CUCUMBER Country, Year of trial *Variety, report*	Application Form.	Method	kg ai/ha/ applic'n	L/ha	No.	PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Germany 1978 *Pepinex* *LEA 1/701/1-78*	24EC*	Spray indoor interval 3,3,4 days	0.576	1200 (0.048 % ai)	4	0 1 2 3	Fruit Fruit Fruit Fruit		1.20 0.60 0.30 0.30
Germany 1978 *Sandra* *LEA 2/701/1-78*	24EC*	Spray indoor interval 4,3,4 days	0.576	1200 (0.048% ai)	4	0 1 2 3	Fruit Fruit Fruit Fruit		0.02 0.01 0.01 0.005
Germany 1978 *Sandra* *LEA 2/701/1-78*	24EC*	Spray indoor interval 4,3,4 days	0.576	1200 (0.048 % ai)	4	0 1 2 3	Fruit Fruit Fruit Fruit		0.10 0.05 0.70 0.30
Germany 1978 *Uniflora* *LEA 2/701/1-78*	24EC*	Spray indoor interval 3,3,4 days	0.576	1200 (0.048 % ai)	4	0 1 2 3	Fruit Fruit Fruit Fruit		0.06 0.006 0.20 0.20
Germany 1976 *Hokus* *LEA 3/74/01/02-76*	24EC*	Spray Interval 18	0.216	600 (0.036% ai)	2	0 7 10 14	Fruit/peel Fruit/peel Fruit/peel Fruit/peel		0.04/0.1 0.02/0.1 ND/0.02 ND/0.04
Germany 1975 *Bambina* *LEA 3/85/01/02-75*	24EC*	Spray indoor	0.96	2000 (0.048% ai)	1	0 7 10 14 0 7 10 14	Fruit Fruit Fruit Fruit Peel Peel Peel Peel	0.01, ND, 0.01 ND, 0.009, 0.01 ND, ND, 0.01 ND, ND, 0.02 0.90, 0.90 ND ND, 0.03, 0.10 0.20 0.07, ND ND, ND, 0.06	0.02 0.02 0.01 0.02 1.80 0.13 0.27 0.06
Germany 1975 *Uniflora* *LEA 2/85/* *01/02-75A*	24EC*	Spray indoor	0.96	2000 (0.048% ai)	1	0 7 10 14	Fruit/peel Fruit/peel Fruit/peel Fruit/peel		< 0.06/0.7 0.04/0.7 0.01/0.2 < 0.06/0.09
Germany 1975 *Uniflora* *LEA 4/85/01/02-* *75B*	24EC*	Spray indoor	0.96	2000 (0.048 % ai)	1	0 7 10 14 0 7 10 14	Fruit Fruit Fruit Fruit Peel Peel Peel Peel	ND, ND, ND ND, ND, 0.06 ND, ND, 0.08 0.02, 0.02, 0.10 1.90 1.70.0.20 0.03, 0.04, 0.10 ND, ND, 0.06 ND, ND, 0.10	< 0.02 0.06 0.08 0.14 3.80 0.17 0.06 0.10
Germany 1975 *Pepinex* *LEA 1/85/* *01/02-75*	24EC*	Spray indoor	0.96	2000 (0.048 % ai)	1	0 7 10 14	Fruit/peel Fruit/peel Fruit/.peel Fruit/peel		0.01/3.0 0.10/0.9 0.09/0.5 0.10/0.4
USA1996 NC		Note: All spray intervals = 7 days							
Clypso	33EC*	Spray	1.12, 1.24, 1.12	96, 100, 92.5	3	2	Fruit	0.15, 0.15, 0.10	0.40
BJ-96R-01	50WP	Spray	1.12, 1.24, 1.12	98, 95.3,91.6			Fruit	0.08, 0.07, 0.07	0.22
USA1996 SC *Poinsett 76* *BJ-96R-01*	33EC 50WP	Spray Spray	1.12 1.12	192, 195, 195 193, 194, 194	3	2	Fruit Fruit	0.13, 0.11, 0.12 0.08, 0.11, 0.11	0.36 0.30

CUCUMBER Country, Year of trial *Variety, report*	Application Form.	Method	kg ai/ha/ applic'n	L/ha	No.	PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
USA 1996 FL	33EC	Spray	1.12, 1.34, 1.12	202, 237,199	3	2	Fruit	0.12, 0.09, 0.11	0.32
Poinsett *BJ-96R-01*	50WP	Spray	1.12, 1.34, 1.1	202, 237,199			Fruit	0.09, 0.05, 0.09	0.23
USA 1996 FL *Poinsett 76* *BJ-96R-01*	33EC 50WP	Spray Spray	1.12 1.12	274, 281,283 274, 276, 274	3	2	Fruit Fruit	0.13, 0.11, 0.07 0.07, 0.06, 0.06	0.31 0.19
USA 1996 FL *BJ-96R-01*	33EC 50WP	Spray Spray	1,1, 1.120 1.12	469, 464, 475 472, 473, 473	3	2	Fruit Fruit	0.22, 0.18, 0.13 0.12, 0.09, 0.07	0.53 0.28
USA 1996 MI *Marketmore 76* *BJ-96R-01*	33EC 50WP	Spray Spray	1.12 1.12	221, 211, 231 223, 217, 217	3	2	Fruit Fruit	0.17, 0.15, 0.10 0.06, 0.06, 0.06	0.42 0.18
USA 1996 OH *Thunder* *BJ-96R-01*	33EC 50WP	Spray Spray	1.12, 1.12,1 1.12	239, 236, 223 236, 236, 229	3	2	Fruit Fruit	0.13, 0.09, 0.10 0.14, 0.07, 0.10	0.32 0.31
USA 1996 WIS *Marketmore 76* *BJ-96R-01*	33EC 50WP	Spray Spray	1.12, 1.12,1 1.12	172, 183, 177.6 181, 183, 180	3	2	Fruit Fruit	0.27, 0.20, 0.11 0.11, 0.07, 0.06	0.58 0.24
USA 1996 OKL *Straight Eight* *BJ-96R-01*	33EC 50WP	Spray Spray	1.12 1.12	164, 179,188 166, 179,189	3	2	Fruit Fruit	0.28, 0.22, 0.14 0.14, 0.08, 0.08	0.64 0.30
USA 1996 TX *BJ-96R-01*	33EC 50WP	Spray Spray	1.12 1.12	317, 305, 272 317, 305, 272 (0.35% ai)_	3	2	Fruit Fruit	0.10, 0.09, 0.13 0.12, 0.13, 0.11	0.32 0.36
USA 1984 CA *Spacemaster* *1913(5)*	3EC	Spray. Interval: 7 d	1.12 UTC UTC	140 (0.8% ai)_	6	0 3 0 3	Fruit Fruit Fruit Fruit	0.165, 0.101, < 0.01 0.178, 0.122, 0.015 0.012, < 0.01, < 0.01 0.021, < 0.01, < 0.01	0.27 0.32 0.01 0.02
USA 1984 CA *1913(5)*	50WP	Spray. Interval: 7 days	1.12	140 (0.8% ai)	6	0	Fruit	0.513, 0.229, < 0.01	0.74
USA 1984 CA *Spacemaster* *1913(12)*	3EC	Spray. Interval: 7 days	1.12 UTC UTC	140 (0.8% ai)	6	0 3 0 3	Fruit Fruit Fruit Fruit	0.126, 0.059, < 0.01 0.029, 0.022, < 0.01 0.0195, 0.022, 0.0388 0.0276, 0.023, 0.0396	0.19 0.05 0.08 0.09
USA 1984 CA *Spacemaster* *1913(12)*	50WP	Spray. Interval: 7 days	1.12	140 (0.8% ai)	6	0 3	Fruit Fruit	0.412, 0.181, < 0.01 0.305, 0.183, < 0.01	0.59 0.49
USA 1984 NY *Victory* *1913 (7)*	3EC	Spray. Interval: 7/8 days	1.12 UTC UTC	327 (0.34% ai)	5	0 3 0 3	Fruit Fruit Fruit Fruit	0.197, 0.23, 0.139 0.035, 0.038, 0.046 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 001	0.57 0.12 0.03 < 0.03
USA 1984 NY *Victory* *1913 (7)*	50WP		1.12	327 (0.34% ai)	5	0 3	Fruit Fruit	0.118, 0.096, 0.109 0.088, 0.080, 0.069	0.32 0.23

CUCUMBER	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed		
Australia	EC	spray	0.168	253	4	0	Fruit	0.065, 0.056, 0.028	0.15
2000						3	Fruit	0.047,0.027, 0.035	0.11
Darlington						5	Fruit	0.030, 0.017,0.029	0.08
coolah						7	Fruit	0.051,0.031,0.035	0.11
N° 1/10/547									
Australia	EC	spray	0.555	421	4	0	Fruit	0.31, 0.20.0.054	0.56
2000						3	Fruit	0.12, 0.11,0.049	0.28
Darlington						5	Fruit	0.059, 0.037,0.034	0.13
coolah						7	Fruit	0.14,0.11, 0.082	0.33
N° 1/10/547									
Australia	EC	spray	0.15	226	4	0	Fruit	0.058, 0.037, 0.042	0.14
2000						3	Fruit	0.028, 0.017, 0.034	0.08
Lowood						5	Fruit	0.029, 0.017, 0.036	0.08
Warmer						7	Fruit	0.031, 0.021, 0.042	0.09
N° 1/10/547									
Australia	EC	spray	0.30	226	4	0	Fruit	0.071, 0.043, 0.050	0.17
2000						3	Fruit	0.041, 0.024, 0.054	0.12
Lowood						5	Fruit	0.039, 0.024, 0.050	0.11
Warmer						7	Fruit	0.044, 0.032, 0.056	0.13
N° 1/10/547						7	Fruit co	0.007 < 0.005, < 0.005	0.007

Table 56. Endosulfan residues in melons from supervised trials in Australia.

MELON	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai./hl	L/ha	No.	days	analysed		
Australia	EC	spray	66.5	1170	4	0	Fruit	0.39, 0.28, 0.032	0.70
2000						3		0.25,0.27, 0.034	0.55
Kialla West						5		0.12, 0.11,0.037	0.27
Hiline						7		0.089,0.097,0.045	0.23
N° 1/10/551									
Australia	EC	spray	132	1170	4	0	Fruit	0.89,0.90.0.04	1.83
2000						3		0.26, 0.32, 0.047	0.63
Kialla West						5		0.34, 0.40.0.059	0.80
Hiline						7		0.13, 0.16, 0.060	0.35
N° 1/10/551									
Australia	EC	spray	66.5	334	4	0	Fruit	0.30, 0.26, 0.13	0.69
2000						3		0.42, 0.35, 0.21	0.98
Fernvale						5		0.23,0.30, 070	1.23
planters jumbo						7		0.35, 0.36, 0.29	1.0
N° 1/10/556									
Australia	EC	spray	132	334	4	7	Fruit	0.10, 0.21, 0.74	1.05
2000								0.006, 0.005, 0.019	0.03
Fernvale								0.008, 0.005, 0.019	0.03
planters jumbo								0.008, 0.008, 0.019	0.04
N° 1/10/556									

Table 57. Endosulfan residues in melon from supervised trials in USA and Europe.

MELON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
USA 1995 CA *BJ-95R-05*	35EC	Spray Interval 7 d	1.12	191.6,184, 190	3	2	Cantaloupe	0.18, 0.27, < 0.05	0.45
USA 1995 CA *BJ-95R-05*	50WP	Spray Interval 7d	1.12	191.6,184, 190	3	2	Cantaloupe	0.24, 0.36, < 0.05	0.60
USA 1995 CA *BJ-95R-05*	35EC	Spray Interval 7 d	1.12	323.5, 329 326	3	2	Cantaloupe	< 0.05, < 0.05, 0.05	0.05
USA *1995 CA* *BJ-95R-05*	50WP	Spray Interval 7 d	1.12	325, 330 34.8	3	2	Cantaloupe	0.07, 0.11, 0.06	0.24
USA *1995 CA* *BJ-95R-05*	35EC	Spray Interval 7 d	1.12		3	2	Cantaloupe	0.16, 0.25, < 0.05	0.41
USA 1995 CA *BJ-95R-05*	50WP	Spray Interval 7 d	1.12		3	2	Cantaloupe	0.14, 0.21, < 0.05	0.35
USA 1995 FLA *BJ-95R-05*	35EC	Spray Interval 7 d	1.23,1.12 1.12	215,204.7 202	3	2	Cantaloupe	0.13, 0.15, 0.06	0.34
USA 1995 FLA *BJ-95R-05*	50WP	Spray Interval 7 d	1.23,1.12 1.12	215, 204.9 202	3	2	Cantaloupe	0.18, 0.17, 0.05	0.40
USA 1995 MI *BJ-95R-05*	50WP	Spray Interval 7 d	1.12	190.7,195.4 187	3	2	Cantaloupe	0.12, 0.12, 0.06	0.30
USA 1995 TX *BJ-95R-05*	35EC	Spray Interval 7 d	1, 1, 1	188,193.5 187	3	2	Cantaloupe	0.10, 0.15, 0.05	0.30
USA 1995 TX *BJ-95R-05*	50WP	Spray Interval 7 d	1, 1, 1	190,186 191.6	3	2	Cantaloupe	0.18, 0.26, 0.05	0.49
USA 1995 MI *BJ-95R-05*	35EC	Spray Interval 7 d	1.12	190.7,190.7 186	3	2	Cantaloupe	0.07, 0.09, 0.06	0.22
Spain 2000 *Extra Rica Miel* *DR 00 EUS 131*	CS*	Sprays at 28, 14,7 d PHI BBCH 67, 72 83	0.530	600 (0.088% ai)	3	0 7 7 7	Fruit Fruit Peel Pulp	0.04, 0.02, 0.04 0.05, 0.02, 0.05, 0.06, 0.03, < 0.02 < 0.02, < 0.02, 0.02	0.10 0.12 0.09 0.02
Italy 2000 *Calipso* *DR 00 EUS 131*	CS*	Sprays at 28, 14,7 d PHI BBCH 64, 76 81	0.530	800 (0.066% ai)	3	0 7 7 7	Fruit Fruit Peel Pulp	0.10, 0.07, < 0.02 0.04, 0.04, < 0.02 0.22, 0.19, < 0.02 < 0.02, < 0.02, < 0.02	0.17 0.08 0.41 < 0.02
Italy 2000 *Proteo* *DR 00 EUS 131*	CS*	Sprays at 28, 14,7 d PHI BBCH 71, 84 87	0.530	800 (0.066% ai)	3	0 7 7 7	Fruit Fruit Peel Pulp	0.26, 0.16, < 0.02 0.13, 0.07, < 0.02 0.19, 0.11, < 0.02 < 0.02, < 0.02, < 0.02	0.42 0.20 0.30 < 0.02
Spain 1999 *Piel sapo Ricamie* *ER 99 ECS 757*	CS*	Sprays at 28, 13,7 d PHI BBCH 73, 74 84	0.530	600 (0.088 % ai)	3	0 3 7	Fruit Fruit Fruit	0.10, 0.05,0.03 0.07, 0.04, 0.02 0.04, 0.02, 0.02	0.18 0.13 0.08

MELON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Italy	CS*	Sprays at 28,	0.530	800	3	0	Fruit	0.26, 0.15, < 0.02	0.41
1999		14,7 d PHI		(0.088% ai)		3	Fruit	0.13, 0.08, 0.04	0.25
Galia		BBCH 66, 68				7	Fruit	0.08, 0.07, 0.03	0.18
ER 99 ECS 757		75							
Spain	35EC	Sprays at 21,	0.530	300	3	0	Peel	0.13, 0.10 < 0.02	0.23
1997		14,7 d PHI		(0.177		0	Pulp	ND, ND, < 0.02	< 0.02
Panal		BBCH 73, 75		% ai)		3	Peel	0.02, 0.03, < 0.02	0.05
Musk melon		83				3	Pulp	ND, ND, < 0.02	< 0.02
ER 97 ECS 745						7	Peel	< 0.02, < 0.02, < 0.02	< 0.02
						7	Pulp	ND, ND, 0.02	0.02
						0	Fruit	0.06, 0.04, < 0.02	0.10
						3/7	Fruit	< 0.02, < 0.02, < 0.02	< 0.02
France (S)	35EC	Sprays at 21,	0.530	250	3	0	Peel	0.20, 0.13, 0.05	0.38
1997		14,7 d PHI		(0.212		0	Pulp	< 0.02, < 0.02,< 0.02	< 0.02
Manta		BBCH 71, 71		% ai)		3	Peel	0.05, 0.09, 0.08	0.22
Cantaloupe		72				3	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
ER 97 ECS 745						7	Peel	0.02, 0.04, 0.04	0.10
						7	Pulp	ND, < 0.02, < 0.02	< 0.02
						0	Fruit	0.08, 0.05, 0.02	0.15
						3	Fruit	0.02, 0.03, 0.03	0.08
						7	Fruit	< 0.02, 0.02, 0.02	0.04
Portugal	CS*	Sprays at 29,	0.530	600	3	0	Fruit	< 0.02, < 0.02, < 0.02	< 0.02
2000		14,7 d PHI		(0.088% ai)		7	Fruit	< 0.02, < 0.02, < 0.02	< 0.02
Pele de Sapo		BBCH 67, 72				7	Peel	0.05, 0.05, < 0.02	0.10
DR 00 EUS 131		83				7	Pulp	< 0.02, < 0.02, 0.02	0.02
Greece	CS*	Sprays at 29,	0.530	600	3	0	Fruit	0.16, 0.09, 0.04	0.29
1999		14,7 d PHI		(0.088% ai)		3	Fruit	0.06, 0.03, 0.04	0.13
Daniel		BBCH 73, 75				7	Fruit	0.05, 0.04, 0.04	0.13
ER 99 ECS 757		77							
Italy	35EC	Sprays at 20,	0.530	300	3	0	Peel	0.11, 0.07, < 0.02	0.18
1997		14,7 d PHI		(0.177% ai)		0	Pulp	< 0.02, < 0.02, 0.03	0.03
Pamir		BBCH 74, 79				3	Peel	< 0.02, 0.02, < 0.02	0.02
Musk melon		82				3	Pulp	< 0.02, ND, 0.02	0.02
ER 97 ECS 745						7	Peel/Pulp	ND, ND, < 0.02	< 0.02
						0	Fruit	0.05, 0.03, 0.02	0.10
						3	Fruit	< 0.02, 0.02, < 0.02	0.02
						7	Fruit	ND, ND, < 0.02	< 0.02
Italy	35EC	Sprays at 21,	0.530	600	3	0	Peel	0.66, 0.44, 0.02	1.12
1997		14,7 d PHI		(0.088% ai)		0	Pulp	< 0.02, < 0.02, < 0.02	< 0.02
Momo		BBCH 72, 81				3	Peel	0.24, 0.27, 0.02	0.53
Cantaloupe		84				3	Pulp	ND, ND, ND	< 0.02
ER 97 ECS 745						7	Peel	0.08, 0.14, < 0.02	0.22
						7	Pulp	ND, ND, < 0.02	< 0.02
						0	Fruit	0.21, 0.15, < 0.02	0.36
						3	Fruit	0.07, 0.08, < 0.02	0.15
						7	Fruit	0.03, 0.04, < 0.02	0.07
Spain	35EC	Sprays at 21,	1.0561	400	3	0	Peel	0.141, 0.12, 0.095	0.36
1994		14,7 d PHI		(0.264% ai)					
Daimiel		BBCH 69/70,							
ER 94 ECS 780		69/70, 69/70							
Spain	35EC	Sprays at 21,	1.0561	300,	3	0	Pulp	< 0.05, < 0.05, 0.074	0.07
1994		14,7 d PHI		400,		0	Peel	0.084, 0.07, 0.076	0.23
Rixan		BBCH 70, 70		400		0	Fruit		0.16
Musk melon		70		(0.352% ai)		3	Pulp	< 0.05, < 0.05, 0.074	0.07
ER 94 ECS 780						3	Peel	< 0.05, 0.053, 0.061	0.11
				(0.264% ai)		3	Fruit		0.10
						7	Pulp	< 0.05, < 0.05, 0.081	0.08
						7	Peel	< 0.05, < 0.05, 0.052	0.05
						7	Fruit		0.07
						14	Peel	< 0.05, < 0.05, < 0.05	< 0.05
						21	Peel	< 0.05, < 0.05, < 0.05	< 0.05
						29	Peel	< 0.05, < 0.05, < 0.05	< 0.05

MELON	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	beta endosulfan, Endosulfan sulfate, mg/kg	Residues, mg/kg
Spain	35EC	Sprays at 21,	0.528	400	3	0	Pulp	< 0.05, < 0.05, 0.076	0.08
1994		14,7 d PHI		(0.132% ai)		0	Peel	0.102, 0.104, 0.092	0.30
Daimiel		BBCH 69/70,				0	Fruit		0.19
Musk melon		69/70, 69/70				3	Pulp	< 0.05, < 0.05, 0.092	0.09
ER 94 ECS 780						3	Peel	< 0.05, < 0.05, 0.092	0.09
						3	Fruit		0.09
						7	Pulp	< 0.05, < 0.05, 0.091	0.09
						7	Peel	< 0.05, 0.061, 0.082	0.14
						7	Fruit		0.12
Spain	35EC	Sprays at 21,	0.528	300,	3	0	Pulp	< 0.05, < 0.05, 0.095	0.10
1994		14,7 d PHI		400,		0	Peel	< 0.05, < 0.05, 0.05	0.05
Rixan		BBCH 70, 70		400		0	Fruit		0.10
Musk melon		70		(0.177% ai)		3	Pulp	< 0.05, < 0.05, 0.096	0.10
ER 94 ECS 780				(0.132% ai)		3	Peel	< 0.05, < 0.05, 0.05	0.05
						3	Fruit		0.10
						7	Pulp	< 0.05, < 0.05, 0.095	0.10
						7	Peel	< 0.05, < 0.05, < 0.05	< 0.05
						7	Fruit		0.08
						14	Pulp	< 0.05, < 0.05, 0.115	0.12
						14	Peel	< 0.05, < 0.05, < 0.05	< 0.05
						14	Fruit		0.09
						21	Pulp	< 0.05, < 0.05, 0.09	0.09
						21	Peel	< 0.05, < 0.05, < 0.05	< 0.05
						21	Fruit		0.07
						29	Fruit		0.06
Spain	35EC	Sprays at 21,	0.528	400		0	Pulp	< 0.05, < 0.05, 0.069	0.07
1994		14,7 d PHI		(0.132% ai)		0	Peel	< 0.05, < 0.05,0.071	0.07
Daimiel		BBCH 69/70,				0	Fruit		0.07
Musk melon		69/70, 69/70				3	Pulp	0.084, 0.064,0.086	0.23
ER 94 ECS 780						3	Peel	< 0.05, < 0.05,0.059	0.06
						3	Fruit		0.15
						7	Pulp	< 0.05, < 0.05,0.09	0.09
						7	Peel	< 0.05, < 0.05,0.066	0.07
						7	Fruit		0.08
Italy	35EC	Sprays at 21,	0.528	1000	3	0	Pulp	< 0.05, < 0.05, < 0.05	< 0.05
1994		14,7 d PHI		(0.053% ai)		0	Peel	0.432, 0.294, < 0.05	0.73
Tamaris		BBCH 64/80,				0	Fruit		0.31
Musk melon		69/81, 70/82				3	Pulp	< 0.05, < 0.05, < 0.05	< 0.05
ER 94 ECS 780						3	Peel	0.11, 0.096, < 0.05	0.21
						3	Fruit		0.11
						7	Pulp	< 0.05, < 0.05, < 0.05	< 0.05
						7	Peel	0.112, 0.141, < 0.05	0.25
						7	Fruit		0.12
						14	Peel	< 0.05, < 0.05, < 0.05	< 0.05
						21	Peel	< 0.05, < 0.05, < 0.05	< 0.05
Spain	35EC	Sprays at 21,	1.0561	400	3	0	Peel	0.215, 0.145, 0.081	0.44
1994		14,7 d PHI		(0.264% ai)					
Daimiel		BBCH 69/70,							
ER 94 ECS 780		69/70, 69/70							
Portugal 1999	CS*	Sprays at 28,	0.530	600	3	0	Fruit	0.07, 0.04, 0.06	*0.17*
Branco do		14,7 d PHI		(0.088% ai)		3	Fruit	0.06, 0.04, 0.08	0.18
Ribatejo ER 99		BBCH 71, 74				7	Fruit	0.04, 0.03, 0.08	0.15
ECS 757		84,							
Italy	35EC	Sprays at 21,	0.528	1000	3	0	Pulp	< 0.05, < 0.05, < 0.05	< 0.05
1994		14,7 d PHI		(0.0528		0	Peel	0.469, 0.503, < 0.05	0.97
Calipso		BBCH 69/75,		% ai)		0	Fruit		0.47
Musk melon		69/80, 69/81				3	Pulp	< 0.05, < 0.05, < 0.05	< 0.05
ER 94 ECS 780						3	Peel	0.205, 0.261, < 0.05	0.47
						3	Fruit		0.22
						7	Pulp	< 0.05, < 0.05, < 0.05	< 0.05
						7	Peel	0.162, 0.282, 0.052	0.50
						7	Fruit		0.19

MELON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Italy 1994 *Calipso* *ER 94 ECS 780*	35EC	Sprays at 21, 14,7 d PHI BBCH 69/75, 69/80, 69/81	1.0561	1000 (0.1056 % ai)	3	0	Peel	0.779, 0.758, 0.079	1.62
Spain 1992 *Futuro* *PRS99/012*	35EC	Spray	0.82	780 (0.105% ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		0.81 0.28 0.23 0.11
Spain 1992 *Amarillo canario* *PRS99/012*	35EC	Spray	0.71	680 (0.105% ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		0.38 0.05 0.02 0.02
Spain 1992 *Galia* *PRS99/012*	35EC	Spray (0.105%)	0.76	720 (0.105% ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		0.97 0.63 0.50 0.22
Italy 1994 *Tamaris* Musk melon *ER 94 ECS 780*	35EC	Sprays at 21, 14,7 d PHI BBCH 64/80, 69/81, 70/82	1.0561	1000 (0.106 % ai)	3	0 0 0 3 3 3 7 7	Pulp Peel Fruit Pulp Peel Fruit Pulp Peel	< 0.05, < 0.05, < 0.05 0.76, 0.487, < 0.05 < 0.05, < 0.05, < 0.05 0.192, 0.20 < 0.05 < 0.05, < 0.05, < 0.05 < 0.05, 0.085, < 0.05	< 0.05 1.25 0.50 < 0.05 0.39 0.20 < 0.05 0.09
						7 14 21	Fruit Peel Peel	 < 0.05, < 0.05, < 0.05 < 0.05, < 0.05< 0.05	0.08 < 0.05 < 0.05
Spain 1992 *Futuro* *PRS99/012*	35EC	Spray (0.105%)	0.87	830 (0.105 % ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		0.09 < 0.01 < 0.01 0.04

Table 58. Endosulfan residues in summer squash from supervised trials in Spain and USA.

S. SQUASH	Application					PHI	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai//ha applic'n	L/ha	No.				
Spain 1992 *Elite* *PRS99/012*	35EC	Spray	1.09	1040 (0.105% ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		1.14 0.46 0.23 0.03
Spain 1992 *Senator* *PRS99/012*	35EC	Spray	1.21	1150 (0.105% ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		1.02 0.53 0.05 0.04
Spain 1992 *Senator* *PRS99/012*	35EC	Spray	1.37	1300 (0.105% ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		0.11 < 0.01 0.05 0.02
Spain 1992 *Diamante* *PRS99/012*	35EC	Spray	1.02	970 (0.105% ai)	1	0 3 7 15	Fruit Fruit Fruit Fruit		0.32 0.13 0.02 0.02
USA 1996 NI *Supersett* *BJ96R02*	3EC 50WP	Broadcast Interval 7d Broadcast Interval 7d	1.12,1.12 1.23 3x1.12	3x96.3 96.3,2x95.4	3 3	1 1	Fruit Fruit	0.08 < 0.05, 0.05 0.11, 0.06, 0.06	0.13 0.23

S. SQUASH	Application					PHI	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai//ha applic'n	L/ha	No.				
USA	3EC	Broadcast	3x1.12	2x95.4,96.3	3	2	Fruit	0.11, 0.05, < 0.05	0.16
1996 NC		Interval 7d							
Supersett	50WP	Broadcast	3x1.12	2x97.2, 95.4		2	Fruit	0.12, 0.05, < 0.05	0.17
BJ96R02		Interval 7d							
USA	3EC	Broadcast	1.12,2x1	3x92.5	3	2	Fruit	< 0.05, < 0.05, < 0.05	≤ 0.05
1996 FL		Interval 7d							
Early Summer	50WP	Broadcast	1.12	91.6,92.5, 91.6	3	2	Fruit	0.05, < 0.05, < 0.05	0.05
BJ96R02		Interval 7d							
USA	3EC	Broadcast	1.12	92.5,96,95	3	2	Fruit	0.09, < 0.05, < 0.05	0.09
1996 MI		Interval 7d							
Lemon Drop L	50WP	Broadcast	1.12	92.5,96,94.4	3	2	Fruit	0.07, < 0.05, < 0.05	0.07
BJ96R02		Interval 7d							
USA	3EC	Broadcast	2x1.12,1.	87,2x96.3	3	2	Fruit	0.08, < 0.05, < 0.05	0.08
1996 CA		Interval 7d							
BJ96R02	50WP	Broadcast	2x1.12,1	90.8,95.4,96	3	2	Fruit	0.08, 0.07, < 0.05	0.15
CA		Interval 7d							
USA	3EC	Spray	1	327	5	0	Fruit	0.142, 0.143, 0.065	0.35
1984 NY		Interval 7/8 d				3	Fruit	0.034, 0.021, 0.010	0.06
Goldbar									
1913 (6)						0 co	Fruit	< 0.01, < 0.01, 0.023	0.02
						3 co	Fruit	0.0269, 0.018, 0.022	0.07
	50WP	Spray	1	327	5	0	Fruit	0.129, 0.109, 0.057	0.29
		Interval 7/8 d				3	Fruit	0.064, 0.061, 0.013	0.14
USA	3EC	Spray	1	140	6	0	Fruit	0.504, 0.271, 0.068	0.84
1984 CA		Interval 7d				3	Fruit	0.098, 0.04, 0.028	0.17
Whittier, CA									
1913 (5)						0 co	Fruit	0.02, < 0.01, < 0.01	0.02
						3 co	Fruit	0.03, < 0.01, 0.0153	0.05
	50WP	Spray	1	140	6	0	Fruit	1.363, 0.684, 0.068	2.12
		Interval 7 d				3	Fruit	0.86, 0.101, 0.018	0.98
USA	3EC	Broadcast	3x1.12	94,95,90	3	2	Fruit	0.09, 0.07, < 0.05	0.16
1996 CA		Interval 7d							
Black Beauty	50WP	Broadcast	3x1.12	94.4,2x93.5	3	2	Fruit	0.08, 0.06, < 0.05	0.14
BJ96R02		Interval 7d							

Table 59. Endosulfan residues in zucchini from supervised trials in Australia.

ZUCCHINI	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.				
Australia	EC	spray	66.5	224	4	0	zucchini	0.078, 0.036, 0.046	0.16
2000						3	zucchini	0.030.0.021, 0.039	0.09
Koraleigh						5	zucchini	0.023, 0.012,0.032	0.07
Regal black						7	zucchini	0.042,0.014,0.032	0.09
N° 1/10/556									
Australia	EC	spray	132	224	4	0	zucchini	0.069,0.038,0.019	0.13
2000						3	zucchini	0.026, 0.011, 0.025	0.07
Koraleigh						5	zucchini	0.018, 0.009,0.023	0.05
Regal black						7	zucchini	0.026, 0.005, 0.033	0.06
N° 1/10/556						7	co	0.007, < 0.005,< 0.005	0.007
Australia	EC	spray	66.5	310	4	0	zucchini	0.028, 0.013, 0.038	0.08
2000						3	zucchini	0.011, 0.005, 0.039	0.06
Walkamin						5	zucchini	0.011, < 0.005, 0.034	0.05
Regal black						7	zucchini	0.005, < 0.005, 0.032	0.04
N° 1/10/556						0	co	0.12	

ZUCCHINI	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.	days	analysed		
Australia	EC	spray	132	488	4	0	zucchini	0.11, 0.083, 0.046	0.24
2000						3	zucchini	0.006, 0.005, 0.019	0.03
Walkamin						5	zucchini	0.008, 0.005, 0.019	0.03
Regal black						7	zucchini	0.008, 0.008, 0.019	0.04
N° 1/10/556						7	co	0.018,, 0.005,0.095	0.12
Australia	EC	spray	66.5	266	4	0	zucchini	0.085, 0.035, 0.12	0.24
2000						3	zucchini	0.021,0.007, 0.059	0.09
Malanda						5	zucchini	0.013, < 0.005, 0.046	0.06
Gold finger						7	zucchini	0.012,< 0.005, 0.068	0.09
N° 1/10/556									
Australia	EC	spray	132	518	4				
2000									
Malanda						7	zucchini	0.016, < 0.005, 0.058	0.08
Gold finger						7	co	< 0.005, < 0.005, 0.069	0.07c
N° 1/10/556									
Australia	EC	spray	66.5	260	4	0	zucchini	0.17, 0.10, 0.015	0.28
2000						3	zucchini	0.028,0.009, 0.012	0.05
Wattleup						5	zucchini	0.021, 0.005,0.012	0.04
Regal black						7	zucchini	0.015,< 0.005, 0.01	0.03
N° 1/10/556						7	co	< 0.005,< 0.005,< 0.005	< 0.005
Australia	EC	spray	132	260	4	7	zucchini	0.019, < 0.005, 0.011	0.03
2000						7	co	< 0.005,< 0.005,< 0.005	< 0.005
Wattleup									
Regal black									
N° 1/10/556									

Table 60. Endosulfan residues in peppers from supervised trials in Spain and USA.

PEPPERS	Application					PHI	Sample	Residues of alpha, +Beta endosulfan,/ Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* report	Form	Method	kg ai/ha /applic'n	L/ha	No.	(Days)	analysed		
Spain	35EC	Spray indoor	1.058,	1002	3	14	Red Pepper	0.15,0.02	0.17
2000		Interval 7 d	1.109,	1050		21	Red Pepper	0.05,0.02	0.07
Dallas		BBCH 71, 73, 74	1.069	1012					
R-11726				(0.11% ai)					
Spain	35EC	Spray indoor	1.003,	950	3	14	Green Pepper	0.37,0.03	0.40
2000		Interval 7 d	1.062,	1006		21	Green Pepper	0.31,0.05	0.36
Genil		BBCH 71, 71	1.064	1008					
R-11726		, 73		(0.11% ai)					
Spain	35EC	Spray indoor)	1.035,	980	3	0	Green Pepper		1.82
2000		Interval 8, 6 d	1.073,	1016		3	Green Pepper		1.83
Turia		BBCH 71, 72, 82	1.075	1018		7	Green Pepper		1.25
R-11726				(0.11% ai)		14	Green Pepper		1.15
						21	Green Pepper		0.51
Spain	35EC	Spray indoor	1.014,	960	3	0	Green Pepper	0.56,0.10	0.66
2000		Spray interval	1.060,	1004		3	Green Pepper	0.34,0.09	0.43
Italic		7 days	1.024	970		7	Green Pepper	0.26,0.24	0.50
R-11726		BBCH 71, 73, 81		(0.11% ai)		14	Green Pepper	0.12,0.14	0.26
						21	Green Pepper	0.03,0.09	0.12

PEPPERS	Application					PHI	Sample	Residues of alpha, +Beta endosulfan,/ Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* report	Form	Method	kg ai/ha /applic'n	L/ha	No.	(Days)	analysed		
Spain	35EC	Spray	1.086,	1012	3	14	G Pepper	0.01,0.01	0.02
1999		Interval 7d	1.096,	1038		21	G Pepper		< 0.02
Turia		BBCH 71, 73, 74	1.109	1050					
R-11724				(0.11% ai)					
Spain	35EC	Spray	1.030,	976	3	14	Pepper	< 0.01,< 0.01	< 0.01
1999		Interval 7d	1.050,	995		21	Pepper	< 0.01,< 0.01	< 0.01
Blanco		BBCH 72, 72, 73	1.065	1009					
R-11724				(0.11% ai)					
Spain	35EC	Spray	1.087,	1029	3	0	Green Pepper	0.23,0.02	0.25
1999		Interval 7d	1.090,	1033		4	Green Pepper	0.09,0.03	0.12
Estilo		BBCH 71,	1.107	1048		7	Green Pepper	0.04,0.04	0.08
R-11724		69/72, 69/ 73		(0.11% ai)		14	Green Pepper	< 0.01,0.02	0.02
						21	Green Pepper	< 0.01,0.02	0.02
Spain	35EC	Spray	1.048,	992	3	0	Green Pepper	1.66,0.07	1.73
1999		Interval 7d	1.113,	1054		4	Green Pepper	0.14,0.05	0.19
La Canal		73	1.082	1025		7	Green Pepper	0.07,0.05	0.12
R-11724				(0.11% ai)		14	Green Pepper	0.02,0.04	0.06
						21	Green Pepper	0.01, < 0.01	0.01
Spain	35EC	Spray indoor	1.039,	984	3	14	Red Pepper	0.41,0.08	0.49
2000		Interval 7d	1.035,	980		21	Red Pepper	0.14,0.06	0.20
Barbadillo		BBCH 71, 71, 72	1.056	1000					
R-11725				(0.11% ai)					
Spain	35EC	Spray indoor	1.068,	1012	3	0	Pepper	0.72,0.06	0.78
2000		Interval 8,6 d	1.044,	988		3	Pepper	0.12,0.06	0.18
Turia		BBCH 71,	1.118	1059		7	Pepper	0.04,0.05	0.09
R-11725		71, 72		(0.11% ai)		14	Pepper	0.02,0.03	0.05
						21	Pepper	< 0.01,0.03	0.03
Spain	35EC	Spray indoor	1.076,	1019	3	14	Red Pepper	0.20.0.07	0.27
2000		Interval 7d	1.043,	988		21	Red Pepper	0.12,0.05	0.17
Mariner		BBCH 72, 73,	1.066	1010					
R-11725		81		(0.11% ai)					
Spain	35EC	Spray indoor	0.850,	805	3	0	Green Pepper	0.88,0.06	0.94
2000		Interval 7d	0.830,	786		3	Green Pepper	0.57,0.18	0.75
Teide		BBCH 71, 72,	0.850	805		7	Green Pepper	0.20.0.07	0.27
R-11725		82		(0.11% ai)		14	Green Pepper	0.10.0.09	0.19
						21	Green Pepper	0.02,0.04	0.06
USA	2EC	Interval 7 d	1.12	567	3	0	Bell Pepper		0.47*
1966				(0.2% ai)		2	Bell Pepper		0.05
Great Northern						7	Bell Pepper		0.02
A48560	50WP	Interval 7 d	1.12	567	3	0	Bell Pepper		0.97
				(0.2% ai)		2	Bell Pepper		0.22
						7	Bell Pepper		0.02
	3% Dust	Interval 7 d	1.68		3	0	Bell Pepper		0.88
						2	Bell Pepper		0.44
						7	Bell Pepper		0.02
	2EC	Interval 7d	1.12	567	3	0	Green Pepper		3.15
				(0.2% ai)		2	Green Pepper		3.30
						7	Green Pepper		0.65

Table 61. Endosulfan residues in peppers from supervised trials in Australia.

PEPPERS	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	Kg ai/ha	L/ha	No.				
Australia	EC	spray	0.735	500	3	0		0.076, 0.098, 0.012	0.19
2000						3		0.056, 0.087, 0.012	0.16
Emerald Creek						7		0.058, 0.091,0.018	0.17
Merlin						14		0.066,0.11,0.18	0.36
N° 1/10/559									
Australia	EC	spray	1.47	500	3	0		0.21,0.29,0.018	0.52
2000						3		0.065, 0.10, 0.013	0.18
Emerald Creek						7		0.18, 0.27,0.048	0.50
Merlin						14		0.065, 0.14, 0.032	0.24
N° 1/10/559									
Australia	EC	spray	0.735	5084	3				
2000									
Gumlu						7		0.02, 0.053, 0.016	0.09
Airies						14		0.019, 0.039, 0.016	0.07
N° 1/10/559									
Australia	EC	spray	0.735	452	3	7		0.009, 0.018, 0.010	0.04
2000						14		0.006, 0.014, 0.007	0.03
Shepparton									
Target									
N° 1/10/559									
Australia	EC	spray	0.735	500	3	0		0.36, 0.39,0.13	0.88
2000						3		0.054, 0.13, 0.22	0.40
Virginia						7		0.013, 0.023, 0.039	0.08
Yaspo						14		< 0.005, < 0.005, 0.006	0.02
N° 1/10/559									
Australia	EC	spray	1.47	500	3	0		0.32, 0.30, 0.061	0.68
2000						3		0.037, 0.10, 0.13	0.27
Virginia						7		< 0.005, 0.013, 0.050	0.07
Yaspo						14		0.005, 0.014, 0.015	0.03
N° 1/10/559									

Table 62. Endosulfan residues in tomatoes from supervised field trials in Europe, USA and Australia.

TOMATO	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany	35EC	Spray	0.21	600	4	0	Fruit	0.40, 0.19, < 0.01	0.59
1989			0.28	800		7	Fruit	0.01, 0.02, < 0.01	0.03
Rheinglut			0.42	1200		7	Washings	< 0.01, < 0.01, < 0.01	< 0.01
PSR99/012			0.42	1200		7	Cooking water	< 0.01, < 0.01, < 0.01	< 0.01
				(0.035		7	Cooked Fruit	0.01, 0.02, < 0.01	0.03
				% ai)		7	Puree	< 0.01, < 0.01, < 0.01	< 0.01
						7	Juice	< 0.01, < 0.01, < 0.01	< 0.01
Germany	35EC	Spray	0.21	600	4	0	Fruit	0.48, 0.23, < 0.01	0.71
1989			0.235	675		7	Fruit	0.04, 0.05, < 0.01	0.09
Hellfrucht			0.308	880		7	Washings	< 0.01, < 0.01, < 0.01	< 0.01
PSR99/012			0.42	1200		7	Cooking water	< 0.01, < 0.01, < 0.01	< 0.01
				(0.035		7	Cooked Fruit	0.05, 0.04, < 0.01	0.09
				% ai)		7	Puree	< 0.01, < 0.01, < 0.01	< 0.01
						7	Juice	< 0.01, < 0.01, < 0.01	< 0.01

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
Germany	2.82%	Spread	0.705	25	3	0	Fruit	0.20, 0.20, 0.01	0.41
1983	Dust	interval		Kg		5	Fruit	0.10, 0.10, 0.01	0.21
Moneymaker		14 d		product		10	Fruit	0.06, 0.06, < 0.01	0.12
DEU8317 2911						14	Fruit	0.03, 0.04, < 0.01	0.07
Germany	2.82%	Spread	0.705	25	3	0	Fruit	0.20, 0.10, < 0.01	0.30
1983	Dust	interval		Kg		5	Fruit	0.10, 0.10, < 0.01	0.20
Hoffmans Rentita		19, 11 days		product		10	Fruit	0.04, 0.06, < 0.01	0.10
DEU83172921						14	Fruit	0.03, 0.06, 0.01	0.10
Germany	2.82%	Spread	0.705	25	3	0	Fruit	0.40, 0.30, < 0.01	0.70
1983	Dust	interval		Kg		5	Fruit	0.10, 0.10, < 0.01	0.20
Hoffmans Rentita		14 days		product		10	Fruit	0.06, 0.06, < 0.01	0.12
DEU83172941						14	Fruit	0.06, 0.06, < 0.01	0.12
Germany	24EC*	Spray, 0.15%	0.216	600	2	0	Fruit		1.1
1976		Spray interval		(0.036% ai)		7	Fruit		0.02
Rheinlands Ruhm		18 days				10	Fruit		0.02
LEA 3/67/01/02-76						14	Fruit		0.03
Greece2002	CS*	Spray.	1.0603	500	2	3	Fruit	0.71, 0.35, ND,	1.06
Titane		Interval 13d		(0.212% ai)				< 0.02(endosulfan diol)	
MR-510/02		BBCH 87, 88							
C030836									
Italy2002	CS*	Spray.	1.0603	500	2	3	Fruit	0.06, 0.04, ND,	0.10
Locale di Molfetta		Interval 14d		(0.212% ai)				< 0.02(endosulfan diol)	
MR-510/02		BBCH 84, 88							
C030836									
Greece	35EC	Spray.	0.5298	500	2	0	Fruit	0.66, 0.34, < 0.02	1.00
2002		Interval 11 d		(0.1065%		2	Fruit	0.59, 0.40, < 0.02	0.99
Titano		BBCH 87, 88		ai)		3	Fruit	0.35, 0.32, < 0.02	0.67
02 R 171						7	Fruit	0.39, 0.35, 0.045	0.79
Italy	35EC	Spray.	0.5298	500	2	0	Fruit	0.095, 0.093, < 0.02	0.19
2002		Interval 12d		(0.1065%		2	Fruit	0.017, 0.031, < 0.02	0.05
		BBCH 84, 88		ai)		3	Fruit	< 0.02, 0.03, < 0.02	0.03
02 R 171						7	Fruit	< 0.02, 0.021, < 0.02	0.02
Italy	35EC	Spray	0.5298	500	2	0	Fruit	0.087, 0.15, < 0.02	0.24
2002		Interval 12 d		(0.1065%		2	Fruit	0.089, 0.088, < 0.02	0.18
PS 1296		BBCH 83, 88		ai)		3	Fruit	0.048, 0.081, < 0.02	0.13
02 R 171						7	Fruit	< 0.02, 0.055, < 0.02	0.06
Spain2001	CS*	Spray.	0.800	1500	2	3	Single Fruit**	0.06, 0.06, 0.01	0.13
Optima		Interval 14d		(0.0535% ai)					
02F002		BBCH 76, 86							
France2001	CS*	Spray.	0.900,	1688,	2	3	Single Fruit	0.19, 0.12, 0.01	0.32
Felicia		Interval 14 d	0.800	1500					
02F002		BBCH 81, 81		(0.0535% ai)					
Greece2001	CS*	Spray.	0.800	1500	2	3	Single Fruit	0.07, 0.05, 0.01	0.13
Alma		Interval 14d		(0.0535% ai)					
02F002		BBCH 81, 87							

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
Italy2001 *Naxos* *02F002*	CS*	Spray. Interval 14 d BBCH 77, 82	0.800	1500 (0.0535% ai)	2	3	Single Fruit	0.17, 0.12, 0.01	0.30
Spain1999 *Inca* *ER 99* ECS *752*	CS*	Spray. Interval 13d BBCH 87, 89	0.530	300 (0.177% ai)	2	0 3	Fruit Fruit	0.34, 0.20, ND 0.26, 0.17, ND	0.54 0.43
Greece1999 *Rio Grande* *ER 99* ECS *752*	CS*	Spray. Interval 13d BBCH 73, 88	0.530	500 (0.106% ai)	2	0 3	Fruit Fruit	0.13, 0.09, ND 0.13, 0.08, ND	0.22 0.21
Greece1999 *Titan* *ER 99* ECS *752*	CS*	Spray. Interval 14d BBCH 86, 89	0.530	500 (0.106% ai)	2	0 3	Fruit Fruit	0.16, 0.11, ND 0.09, 0.06, ND	0.27 0.15
Italy1999 *PS 1296* *ER 99* ECS *752*	CS*	Spray. Interval 15d BBCH 79, 88	0.530	500 (0.106% ai)	2	0 3	Fruit Fruit	0.19, 0.11, ND 0.18, 0.10, ND	0.30 0.28
Portugal1999 *H9280 F1* *ER 99* ECS *752*	CS*	Spray Interval 18d BBCH 79, 83	0.530	400 (0.133% ai)	2	0 3	Fruit Fruit	0.11, 0.07, ND 0.08, 0.05, ND	0.18 0.13
Spain 1998 *Inca* *ER 98 ECS 752*	CS*	Spray. Interval 14d BBCH 81, 88	0.530	300 (0.177% ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.22, 0.13, ND 0.17, 0.11, ND 0.12, 0.07, ND 0.10, 0.07, ND	0.35 0.28 0.19 0.17
Greece 1998 *Rio Grande* *ER 98 ECS 752*	CS*	Spray. Interval 14d BBCH 86, 88	0.530	500 (0.177% ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.08, 0.06, ND 0.06, 0.04, ND 0.13, 0.09, < 0.02 0.07, 0.05, ND	0.14 0.10 0.22 0.12
Greece 1998 *Rio Grande* *ER 98 ECS 752*	CS*	Spray. Interval 14d BBCH 86, 88	0.530	500 (0.177% ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.12, 0.07, ND 0.07, 0.06, < 0.02 0.14, 0.10, < 0.02 0.04, 0.04, ND	0.19 0.13 0.24 0.08
Italy 1998 *Hypeel-244* *ER 98 ECS 752*	CS*	Spray Interval 14 d BBCH 72, 85	0.530	500 (0.177% ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.12, 0.07, ND 0.08, 0.05, ND 0.08, 0.05, ND 0.05, 0.02, ND	0.19 0.13 0.13 0.07
Portugal 1998 *Stromboli F1* *ER 98 ECS 752*	CS*	Spray. Interval 14d BBCH 81, 86	0.530	400 (0.133% ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.36, 0.18, ND 0.12, 0.08, ND 0.09, 0.06, ND 0.06, 0.04, ND	0.54 0.20 0.15 0.10
Spain 1994 *Red Zetor* *ER 94 ECS 700b*	35EC	Spray. Interval 14d GS 17, 19	0.264	350 (0.075% ai)	2	0 3 7 14 20 27	Fruit Fruit Fruit Fruit Fruit Fruit	0.05, 0.04, < 0.01 0.03, 0.03, < 0.01 0.03, 0.04, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01	0.09 0.06 0.07 < 0.01 < 0.01 < 0.01

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
Spain	35EC	Spray	0.528	350	2	0	Fruit	0.14, 0.13, < 0.01	0.27
1994		Interval 14d		(0.15%		3	Fruit	0.06, 0.05, < 0.01	0.11
Red Zetor		GS 17, 19		ai)		6	Cann. Liq.	< 0.01, < 0.01, < 0.01	< 0.01
ER 94 ECS 700b						6	Frt unwshd	0.04, 0.04, < 0.01	0.08
						6	Frt washed	0.04, 0.04, < 0.01	0.08
						6	Frt proc'd	0.04, 0.04, < 0.01	0.08
						6	juice	< 0.01, < 0.01, < 0.01	< 0.01
						6	Frt presv'd	0.34, 0.24, 0.03	0.61
						6	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
						7	Fruit	0.04, 0.04, < 0.01	0.08
						14	Fruit	0.02, 0.02, < 0.01	0.04
						20	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						27	Fruit	< 0.01< 0.01, < 0.01	< 0.01
Spain	35EC	Spray	0.264	350	2	0	Fruit	0.04, 0.04, < 0.01	0.08
1994		Interval 14d		(0.075		3	Fruit	< 0.01, 0.01, < 0.01	0.01
Pluton		GS 17/19, 21		% ai)		7	Fruit	0.01, 0.01, < 0.01	0.02
ER 94 ECS 700b						14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray	0.264	350	2	0	Fruit	0.07, 0.06, < 0.01	0.13
1994		Interval 14d		(0.075		3	Fruit	0.01, 0.02, < 0.01	0.03
Petto 95		GS 17/19, 19		% ai)		8	Fruit	< 0.01, 0.01, < 0.01	< 0.01
ER 94 ECS 700b						14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	< 0.01, < 0.01,< 0.01	< 0.01
						28	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray	0.528	350	2	0	Fruit	0.11, 0.06, < 0.01	0.17
1994		Interval 14		(0.15		3	Fruit	0.03, 0.04, < 0.01	0.07
Petto 95		days		% ai)		8	Fruit	0.01, 0.02, < 0.01	0.03
ER 94 ECS 700b		GS 17/19, 19				14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						28	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray.	0.264	1000	2	0	Fruit	0.01, 0.02, < 0.01	0.03
1994		Interval 14 d		(0.0264		3	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Loni		GS17/19,		% ai)		7	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
ER 94 ECS 700		17/19				14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						29	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray. Spray	0.264	1200	2	0	Fruit	0.03, 0.03, < 0.01	0.06
1994		Interval 14d		(0.022		3	Fruit	0.027, 0.03, < 0.01	0.06
U.C. 82		GS 15/17,		% ai)		7	Fruit	0.025, 0.025, < 0.01	0.05
ER 94 ECS700b		15/19				14	Fruit	0.01, 0.02, 0.02	0.05
						21	Fruit	< 0.01, 0.01, < 0.01	< 0.01
						28	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray.	0.528	350	2	0	Fruit	0.21, 0.15, < 0.01	0.36
1994		Interval 14d		(0.15		3	Fruit	0.02, 0.03, < 0.01	0.05
Pluton		GS 17/19, 21		% ai)		7	Fruit	0.01, 0.03, < 0.01	0.04
ER 94 ECS 700b						14	Fruit	0.01, 0.02, < 0.01	0.03

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
Italy	35EC	Spray. Spray	0.528	1200	2	0	Fruit	0.17, 0.12, < 0.01	0.29
1994		Interval 14		(0.044		3	Fruit	0.04, 0.05, 0.01	0.10
Emiglia		days		% ai)		7	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
Romagna		GS 15/17,				7	Frt unwshd	0.03, 0.03, < 0.01	0.06
U.C. 82		15/19				7	Frt washed	0.03, 0.03, < 0.01	0.06
ER 94 ECS700b						7	Frt presv'd	0.033, 0.033, < 0.01	0.07
						7	juice	< 0.01, < 0.01, < 0.01	< 0.01
						7	pomace	0.15, 0.12, 0.02	0.29
						7	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
						7	Fruit	0.03, 0.04, 0.01	0.08
						14	Fruit	0.03, 0.03, 0.02	0.08
						20	Fruit	0.02, 0.02, < 0.01	0.04
						28	Fruit	0.01, 0.02, < 0.01	0.03
Spain	35EC	Spray,	0.2642	500	2	0	Fruit	0.10, 0.08, < 0.01	0.18
1993		(sprayer)		(0.053% ai)		3	Fruit	0.03, 0.04, < 0.01	0.07
Ipanema		hand held				7	Fruit	0.02, 0.02, < 0.01	0.04
ER 93 ECS700		Interval 14d				14	Fruit	0.01, < 0.01< 0.01	0.01
		GS 17, 19				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
						14	Frt unwshd	< 0.01, 0.01, < 0.01	< 0.01
						14	Frt washed	< 0.01, < 0.01, < 0.01	< 0.01
						14	Frt presv'd	< 0.01, 0.01, < 0.01	0.01
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, 0.05, < 0.01	0.05
						14	Pomace	0.04, < 0.01, 0.01	0.04
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray	0.528	500	2	0	Fruit	0.15, 0.10, < 0.01	0.25
1993		(sprayer,		(0.1056		3	Fruit	0.10, 0.09, < 0.01	0.19
Ipanema		Hand held)		% ai)		7	Fruit	0.02, 0.025, < 0.01	0.05
ER 93 ECS700		Interval 14d				14	Fruit	0.02, 0.02, < 0.01	0.04
		GS 17, 19				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
						14	Frt unwshd	0.03, 0.03, < 0.01	0.06
						14	Frt washed	0.01, 0.02, < 0.01	0.03
						14	Frt presv'd	0.01, 0.01, < 0.01	0.02
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, 0.01, < 0.01	0.01
						14	Pomace	0.08, 0.09, 0.03	0.20
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray	0.2642	500	2	0	Fruit	0.09, 0.09, < 0.01	0.18
1993		(sprayer,		(0.0528% ai)		3	Fruit	0.03, 0.03, < 0.01	0.06
Justar		hand held)				7	Fruit	0.03, 0.03, < 0.01	0.06
ER 93 ECS700		Interval 14d				14	Fruit	0.015, 0.015, < 0.01	0.03
		GS 21, 21				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
						14	Frt unwshd	0.02, 0.03, < 0.01	0.05
						14	Frt washed	0.035, 0.04, < 0.01	0.08
						14	Frt presv'd	0.01, 0.01, < 0.01	0.02
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, < 0.01, < 0.01	< 0.01
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
						14	Pomace	0.07, 0.1, 0.02	0.19

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety* *report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
Spain	35EC	Spray	0.528	500	2	0	Fruit	0.24, 0.18, < 0.01	0.42
1993		(sprayer,		(0.1056% ai)		3	Fruit	0.09, 0.10, < 0.01	0.19
Justar		hand held)				7	Fruit	0.04, 0.05, < 0.01	0.09
ER 93 ECS700		Interval 14d				14	Fruit	0.03, 0.04, < 0.01	0.07
		GS 21, 21				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
						14	Frt unwshd	0.03, 0.03, < 0.01	0.06
						14	Frt washed	0.02,0.03, < 0.01	0.05
						14	Frt presv'd	0.01, 0.02, < 0.01	0.03
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, 0.02, < 0.01	0.02
						14	Pomace	0.14, 0.19, 0.015	0.35
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray	0.2642	700	2	0	Fruit	0.04, 0.05, 0.03	0.12
1993		(sprayer,		(0.037% ai)		3	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Foggia		hand held)				7	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Marcoro		Interval 14d				14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
ER 93 ECS700		GS 11/17,				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
		17/19				14	Frt unwshd	< 0.01, < 0.01, < 0.01	< 0.01
						14	Frt washed	< 0.01, < 0.01, < 0.01	< 0.01
						14	Frt presv'd	< 0.01, < 0.01, < 0.01	< 0.01
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, < 0.01, < 0.01	< 0.01
						14	Pomace	0.03, 0.03, 0.01	0.07
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray	0.528	700	2	0	Fruit	0.12, 0.08, < 0.01	0.20
1993		(sprayer,		(0.0754% ai)		3	Fruit	0.01, 0.02, < 0.01	0.03
Foggia		hand held)				7	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Marcoro		Interval 14d				14	Fruit	< 0.01, < 0.01< 0.01	< 0.01
ER 93 ECS700		GS 11/17,				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
		17/19				14	Frt unwshd	< 0.01, 0.01, < 0.01	0.01
						14	Frt washed	< 0.01, 0.01, < 0.01	0.01
						14	Frt presv'd	< 0.01, < 0.01, < 0.01	< 0.01
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, < 0.01, < 0.01	< 0.01
						14	Pomace	0.05, 0.06, 0.04	0.15
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray	0.2642	1000	2	0	Fruit	0.11, 0.1, < 0.01	0.21
1993		(sprayer,		(0.0264% ai)		3	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Emilia		hand held)				7	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Romagna		Interval 14d				14	Fruit	< 0.01, < 0.01< 0.01	< 0.01
V.C. 82 B		GS 17/19,				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
ER 93 ECS700		19/21				14	Frt unwshd	< 0.01, 0.01, < 0.01	0.01
						14	Frt washed	< 0.01,< 0.01, < 0.01	< 0.01
						14	Frt proc'c	< 0.01, 0.01, < 0.01	0.01
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, < 0.01, < 0.01	< 0.01
						14	Pomace	0.03, 0.03, < 0.01	0.06
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
Italy	35EC	Spray.	0.528	1000	2	0	Fruit	0.06, 0.06, < 0.01	0.12
1994		Interval 14 d		(0.0528		3	Fruit	0.015, 0.025, < 0.01	0.04
Loni		GS		% ai)		7	Fruit	< 0.01, 0.01, < 0.01	0.01
ER 94 ECS		17/19,17/19				14	Fruit	< 0.01, 0.015, < 0.01	0.02
700b						21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						29	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray	0.528	1000	2	0	Fruit	0.13, 0.1, < 0.01	0.23
1993		(sprayer,		(0.0528		3	Fruit	< 0.01, 0.02, < 0.01	0.02
Emilia		Hand held)		% ai)		7	Fruit	0.0125, 0.015, < 0.01	0.03
Romagna		Interval 14d				14	Fruit	0.01, 0.01< 0.01	0.01
V.C. 82 B		GS 17/19,				14	Cann liq	< 0.01, < 0.01, < 0.01	< 0.01
ER 93 ECS700		19/21				14	Frt unwshd	< 0.01, 0.01, < 0.01	0.01
						14	Frt washed	0.01, 0.01, < 0.01	0.02
						14	Frt presv'd	0.01, 0.01, < 0.01	0.02
						14	Juice	< 0.01, < 0.01, < 0.01	< 0.01
						14	Paste	< 0.01, < 0.01, < 0.01	< 0.01
						14	Pomace	0.06, 0.06, 0.015	0.14
						14	Wash water	< 0.01, < 0.01, < 0.01	< 0.01
USA	3EC*	Broadcast	5.6	259	3	2	Fld frt**	1.09, 1.04, < 0.05	2.13
1995 CA	33.7%	Spray,	(5x)	258			Proc frt	1.09, 1.19, < 0.05	2.28
Apex 1000		Interval 5d		262			Puree	0.65, 0.71, < 0.05	1.36
BJ-95R-09				(2.14% ai)			Paste	1.26, 1.46, 0.06	2.78
USA 1995 CA	3EC	Broadcast	1.12	2x258-262	3	2	Fruit	0.16, 0.18, < 0.05	0.34
Apex 1000		Spray,							
BJ-95R-06	50WP	Interval 5d	1.12	2x258-262	3	2	Fruit	0.14, 0.24, < 0.05	0.38
USA1995 CA	3EC	Broadcast	1.23,1.12	197,189,186	3	2	Fruit	0.12, 0.13, < 0.05	0.25
Roma		Spray,							
BJ-95R-06	50WP	Interval 4d	1.12	189,184,187	3	2	Fruit	0.08, 0.08, < 0.05	0.16
USA1995 CA	3EC	Broadcast	1.12	476,476,465	3	2	Fruit	0.20, 0.13, < 0.05	0.33
Rio Grande		Spray,							
BJ-95R-06	50WP	Interval 4d	1.12	471,468,463	3	2	Fruit	0.20, 0.25, < 0.05	0.45
USA1995 PA	3EC	Broadcast	1.12	286,315, 305	3	2	Fruit	0.10, 0.14, < 0.05	0.24
Better Boy		Spray,							
BJ-95R-06	50WP	Interval 4d	1.12	292, 312, 307	3	2	Fruit	0.13, 0.14, < 0.05	0.27
USA1995 FL	3EC	Broadcast	1.12	181, 178, 184	3	2	Fruit	0.10, 0.15, < 0.05	0.25
Heatwave		Spray,							
BJ-95R-06	50WP	Interval 4	1,12, 1,1	181, 153, 158	3	2	Fruit	0.11, 0.16, < 0.05	0.27
USA1995 OH	3EC	Broadcast	1.12	178, 175,182	3	2	Fruit	0.39, 0.46, < 0.05	0.85
Heinz 8813		Spray,							
BJ-95R-06	50WP	Interval 5d	1.12	178, 175, 182	3	2	Fruit	0.33, 0.33, < 0.05	0.66
USA1995 CA	3EC	Broadcast	1.12	321, 327, 325	3	2	Fruit	0.20, 0.22, < 0.05	0.42
Sureset		Spray,							
BJ-95R-06	50WP	Interval 4d	1.12	322, 322,326	3	2	Fruit	0.22, 0.23, < 0.05	0.45

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
USA1995 CA	3EC	Broadcast	1.12	186, 187, 186	3	2	Fruit	0.11, 0.16, < 0.05	0.27
512		Spray,							
BJ-95R-06	50WP	Interval 5d	1.12	186, 188, 187	3	2	Fruit	0.22, 0.25, < 0.05	0.47
USA1995CA	3EC	Broadcast	1.12	188,189, 185	3	2	Fruit	0.15, 0.20, < 0.05	0.35
512		Spray,							
BJ-95R-06	50WP	Interval 5d	1.12	188, 186, 185	3	2	Fruit	0.10, 0.17, < 0.05	0.27
USA1995 CA	3EC	Broadcast	1.12,1.12	375, 374, 302	3	2	Fruit	0.33, 0.40, < 0.05	0.73
Sunny		Spray,	0.88						
BJ-95R-06	50WP	Interva4d	1.12,1.12 0.88	375, 376, 287	3	2	Fruit	0.37, 0.46, < 0.05	0.83
USA1995 FL	3EC	Broadcast	1.12	785,785,785	3	2	Fruit	< 0.05, < 0.05, < 0.05	≤ 0.05
Agroset		Spray,							
BJ-95R-06	50WP	Interval 4d	1.12	785,785,785	3	2	Fruit	< 0.05, < 0.05, < 0.05	≤ 0.05
USA1995 FL	3EC	Broadcast	1.12	235.6,234, 235.6	3	2	Fruit	< 0.05, < 0.05, < 0.05	≤ 0.05
Apex 1000		Spray,							
BJ-95R-06	50WP	Interval 4d	1.12	236, 234, 234.6	3	2	Fruit	< 0.05, < 0.05, < 0.05	≤ 0.05
USA	3EC	Spray	1.12	587	5	1 hr	Fruit	0.049, 0.033, < 0.01	0.08
1984		at 0, 7, 14,				3	Fruit	0.020, 0.024, < 0.01	0.04
Sunny		47, 54 days				7	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
PSR99/012		Pre-harvest				14	Fruit	0.011, 0.017, < 0.01	0.03
PSR99/012		before harvest				21	Fruit	0.014, 0.023, < 0.01	0.04
USA	3EC	Spray	1.12	587	5	1 hr	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
1984 FL		at 0, 7, 14,				3	Fruit	0.010, 0.016, < 0.010	0.03
Sunny		47, 54 days				7	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
PSR99/012		Pre-harvest				14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	< 0.01, 0.023, < 0.01	0.02
USA	50WP	Spray	1.12	587	5	1 hr	Fruit	0.061, 0.024, < 0.01	0.09
1984 FL		at 0, 7, 14,				3	Fruit	0.034, 0.039, < 0.01	0.07
Sunny		47, 54 days				7	Fruit	0.015, 0.027, < 0.01	0.04
PSR99/012		Pre-harvest				14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
USA	3EC	Spray	1.12	587	5	0.5 hr	Fruit*	0.049, 0.058, < 0.01	0.11
1984 FL		at 0, 7, 15,				0.5 hr	Fruit*	0.047, 0.081, < 0.01	0.13
Sunny		52, 59 d					Ch fr	0.082, 0.081, < 0.01	0.16
PSR99/012		Pre-harvest					Sds, pl	0.571, 0.546, 0.047	1.16
							Puree	0.018, 0.019, < 0.01	0.04
							P slds	< 0.01, 0.025, < 0.01	0.03
							P slds	< 0.01, 0.033, < 0.01	0.03
							Fruit co	< 0.01, < 0.01, < 0.01	< 0.01
							Ch fr co	< 0.01, < 0.01, < 0.01	< 0.01
		Seeds and					Sds, pl co	0.0172, 0.01, < 0.01	0.03
		peel					Puree co	< 0.01, < 0.01, < 0.01	< 0.01
		Puree	solids				P slds co	< 0.01, < 0.01, < 0.01	< 0.01
		10/11%							
		Puree 16%					P slds co	< 0.01, < 0.01, < 0.01	< 0.01

TOMATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
USA	50WP	Spray	1.12	587	5	1 hr	Fruit	0.074, 0.036, < 0.01	0.11
1984 FL		Sprays at 0, 7,				3	Fruit	0.015, 0.014, < 0.01	0.03
Sunny		14, 47, 54 days				7	Fruit	< 0.01, 0.02, < 0.01	0.02
PSR99/012		Pre-harvest				14	Fruit	< 0.01, 0.015, < 0.01	0.02
						21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
USA	3EC	Spray	1.12	587	5	0	Fruit*	0.049, 0.058, < 0.01	0.11
1984FL		at 0, 7, 15,				0	Fruit*	0.047, 0.081, < 0.01	0.13
Sunny		52, 59 d					Dry P	1.354, 1.245, 0.111	2.71
PSR99/012		Pre-harvest					Fruit co	< 0.01, < 0.01, < 0.01	< 0.01
							Dry P co	0.084, 0.053, 0.031	0.17
USA	50WP	Spray	1.12	374	5	0	Fruit	0.304, 0.249, < 0.01	0.55
1984 CA		at 0, 7, 13,				3	Fruit	0.117, 0.176, < 0.01	0.29
na		52, 59 d				7	Fruit	0.039, 0.092, < 0.01	0.13
PSR99/012		Pre-harvest				14	Fruit	0.017, 0.076, < 0.01	0.09
						21	Fruit	0.011, 0.097, 0.013	0.12
	3EC	Spray	1.12	374	5	0	Fruit	0.201, 0.222, < 0.01	0.42
		at 0, 7, 13,				3	Fruit	0.111, 0.161, 0.011	0.28
		52, 59 d				7	Fruit	0.016, 0.049, < 0.01	0.07
		Pre-harvest				14	Fruit	0.018, 0.049, 0.008	0.08
						21	Fruit	0.011, 0.032, < 0.01	0.04
USA	3EC	Spray	1.12	374	5	0	Fruit	0.045, 0.052, < 0.01	0.10
1984 CA		at 0, 7, 14		(0.3%		0	Fruit	0.073, 0.076, < 0.01	0.15
na		, 66, 73 d		ai)			Fruit co	< 0.01, < 0.01, < 0.01	< 0.01
PSR99/012		Pre-harvest					Fruit co	< 0.01, < 0.01, < 0.01	< 0.01
USA	3EC	Spray	1.12	374	5	0	Fruit	0.045, 0.052, < 0.01	0.10
1984 CA		at 0, 7, 14,				0	Fruit	0.073, 0.076, < 0.01	0.15
na		66, 73 d					Wh Pk	< 0.01, < 0.01, < 0.01	< 0.01
PSR99/012		Pre-harvest					Juice	0.023, 0.021, < 0.01	0.04
							Paste	0.026, 0.036, 0.026	0.09
							Ckd S,P	1.830, 1.975, 0.138	3.94
							Dry SP	1.492, 2.827, 0.244	4.56
							Fruit co	< 0.01, < 0.01, < 0.01	< 0.01
							Fruit co	< 0.01, < 0.01, < 0.01	< 0.01
USA	3EC	Spray	1.12	140	5	0	Fruit	0.133 0.146, 0.037	0.32
1984 CA		Interval				3	Fruit	0.065, 0.112, 0.032	0.21
Better Boy		7 days		(0.8% ai)		7	Fruit	0.011, 0.037, 0.019	0.07
03R/1919 (4)						14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
USA	50WP	Spray	1.12	140	5	0	Fruit	0.115, 0.105, 0.017	0.24
1984 CA		Interval		(0.8% ai)		3	Fruit	0.021, 0.060, 0.023	0.10
Better Boy		7 days				7	Fruit	0.019, 0.050, 0.019	0.09
03R/1919 (4)						14	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
USA	3EC	Spray	1.12	776	5	0	Fruit	0.149, 0.077, < 0.01	0.23
1984NU		Interval 7d		(0.145% ai)		3	Fruit	0.016, 0.022, < 0.01	0.04
XP27P2						7	Fruit	0.01, 0.017, 0.014	0.04
E184-USA-						14	Fruit	0.010, 0.016, 0.021	0.05
03R/1913 (1)						21	Fruit	< 0.01, 0.21, 0.011	0.22
USA	50WP	Spray	1.12	776	5	0	Fruit	0.091, 0.033, < 0.01	0.12
1984 NI		Interval 7d		(0.145% ai)		3	Fruit	0.040, 0.033, < 0.01	0.07
XP27P2						7	Fruit	0.091, 0.083, 0.079	0.25
E184-USA-						14	Fruit	0.028, 0.035, 0.020	0.08
03R/1913 (1)						21	Fruit	0.010, 0.016, 0.012	0.04

TOMATO	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, endosulfan sulfate mg/kg	Total Residues mg/kg
Country, Year of trial *Variety report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
USA	3EC	Spray	1.12	580	4	0	Fruit	0.159, 0.247, 0.016	0.42
1984 MI		Interval		(0.193% ai)		3	Fruit	0.143, 0.16, 0.026	0.33
Pik Red		20, 11, 9 days				7	Fruit	0.045, 0.063, 0.024	0.13
E184-USA-03R/1913 (2)						14	Fruit	0.046, 0.086, 0.048	0.18
						21	Fruit	0.033, 0.055, 0.03	0.12
USA	50WP	Spray	??	62	4	0	Fruit	0.153, 0.215, 0.017	0.38
1984 MI		Interval				3	Fruit	0.135, 0.188, 0.05	0.37
Pik Red		20, 11, 9 days				7	Fruit	0.067, 0.093, 0.027	0.19
E184-USA-03R/1913 (2)						14	Fruit	0.039, 0.069, 0.06	0.17
						21	Fruit	0.03, 0.045, 0.028	0.10
Australia	EC	spray	0.735	493	3	0		0.037, 0.045, 0.007	0.09
2000						3		0.013,0.037, 0.006	0.06
Walkamin						7		0.005, 0.021,0.009	0.04
Zola						14		< 0.005,0.008,0.007	0.02
N° 1/10/552									
Australia	EC	spray	1.47	552	3	0		0.054, 0.064, 0.006	0.12
2000						3		0.025, 0.074, 0.010	0.11
Walkamin						7		0.007, 0.028,0.010	0.05
Zola						14		0.006, 0.033, 0.014	0.05
N° 1/10/552									
Australia*2000*	EC	spray	0.735	673	3	0		0.044, 0.032, 0.007	0.08
Caffey						3		< 0.005, < 0.005, < 0.005	≤ 0.005
Thunder						7		< 0.005, < 0.005, < 0.005	< 0.005
N° 1/10/552						14		< 0.005, < 0.005, < 0.005	< 0.005
Australia	EC	spray	0.735	452	3	0		0.027, 0.026, 0.006	0.06
2000						3		0.025,0.035, 0.009	0.07
Goulburn Valley						7		0.007, 0.013,0.007	0.03
Granades						14		0.009,0.016,0.013	0.04
N° 1/10/552									
Australia	EC	spray	1.47	452	3	0		0.072, 0.061, 0.012	0.15
2000						3		0.020, 0.033, 0.009	0.06
Goulburn Valley						7		0.016, 0.032,0.018	0.07
Granades						14		0.014, 0.025, 0.018	0.06
N° 1/10/552									
Australia	EC	spray	0.735	421	3	0		0.037, 0.044, < 0.005	0.08
2000						3		0.032,0.053, 0.009	0.09
Mancini						7		0.030, 0.052,0.008	0.09
Early nema						14		0.009,0.011, < 0.005	0.02
N° 1/10/552									

** endosulfan diol

Table 63. Endosulfan residues in tomatoes from supervised trials indoor in Europe.

TOMATO (Indoor)	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate mg/kg	Total Residue, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany	24EC*	Spray, 0.2%	0.72	1500	1	0	Fruit	0.60, 0.40, ND	1.00
1975				(0.048% ai)		7	Fruit	0.09, 0.09, ND	0.18
Hellfrucht						10	Fruit	0.10, 0.10, ND	0.20
LEA 4/84/01/02-75B						14	Fruit	0.02, 0.03, ND	0.05

TOMATO (Indoor)	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate mg/kg	Total Residue, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Germany 1975 *Hildaris* *LEA3/84/01/02-75*	24EC*	Spray, 0.2%	0.72	1500 (0.048 % ai)	1	0 7 10 14	Fruit Fruit Fruit Fruit	0.09, 0.08, ND 0.02, 0.07, ND 0.02, 0.05, ND 0.01, 0.03, ND	0.17 0.09 0.07 0.04
Germany 1975 *Hellfrucht* *LEA 2/84/01/02-75A*	24EC*	Spray, 0.2%	0.96	2000 (0.048% ai)	1	0 7 10 14	Fruit Fruit Fruit Fruit		0.30 0.05 < 0.05 < 0.05
Germany 1975 *Refa* *LEA1/84/01/02-75*	24EC*	Spray, 0.2%	0.96	2000 (0.048 % ai)	1	0 7 10 14	Fruit Fruit Fruit Fruit		0.80 0.10 0.10 0.10
Spain 2001 *Optima* 01 R 642	35EC	Spray interval 14 d BBCH 76, 86	0.800	1500 (0.053% ai)	2	0 3	Fruit Fruit	0.03, 0.03, < 0.02 0.04, 0.03, < 0.02	0.06 0.07
France2001 *Felicia* 01 R 642	35EC	Spray interval 14 d BBCH 81, 81	0.885, 0.800	1660 1500 (0.053% ai)	2	0 3	Fruit Fruit	0.06, 0.05, < 0.02 0.09, 0.07, < 0.02	0.11 0.16
Greece 2001 *Alma* 01 R 642	35EC	Spray indoor interval 14 d BBCH 81, 87	0.800	1500 (0.053 % ai)	2	0 3	Fruit Fruit	0.13, 0.08, < 0.02 0.13, 0.08, < 0.02	0.21 0.21
Italy 2001 *Naxos* 01 R 642	35EC	Spray indoor interval 14 d BBCH 77, 82	0.800	1500 (0.053 % ai)	2	0 3	Fruit Fruit	0.18, 0.12, < 0.02 0.08, 0.09, < 0.02	0.30 0.17
Spain 2001 *Optima* 01 R 641	CS*	Spray indoor interval 14 d BBCH 76, 86	0.800	1500 (0.053% ai)	2	0 3 7	Fruit Fruit Fruit	0.08, 0.05, < 0.02 < 0.02, 0.03, < 0.02 0.07, 0.04, < 0.02	0.13 0.03 0.11
France 2001 *Felicia* 01 R 641	CS*	Spray indoor interval 14 d BBCH 81, 81	0.900 0.800	1688, 1500 (0.053% ai)	2	0 3 7	Fruit Fruit Fruit	0.14, 0.08, < 0.02 0.22, 0.13, < 0.02 0.17, 0.10, < 0.02	0.22 0.35 0.27
Greece 2001 *Alma* 01 R 641	CS*	Spray indoor interval 14 d BBCH 81, 87	0.800	1500 (0.053% ai)	2	0 3 7	Fruit Fruit Fruit	0.12, 0.07, < 0.02 0.14, 0.07, < 0.02 0.12, 0.06, < 0.02	0.19 0.21 0.18
Italy 2001 *Naxos* 01 R 641	CS*	Spray indoor interval 14 d BBCH 77, 82	0.800	1500 (0.053% ai)	2	0 3 7	Fruit Fruit Fruit	0.15, 0.09, < 0.02 0.27, 0.14, < 0.02 0.22, 0.12, < 0.02	0.24 0.41 0.34
Spain 1998 *Genaro* *ER 98 ECS 753*	CS*	Spray indoor interval 14 d BBCH 72, 74	0.7986 0.8865	1500 1665 (0.053% ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.20, 0.10, ND 0.18, 0.09, ND 0.15, 0.08, ND 0.14, 0.09, ND	0.30 0.27 0.23 0.23
Greece 1998 *Arleta* *ER 98 ECS 753*	CS*	Spray indoor interval 14 d BBCH 81, 85	0.7986	1500 (0.053% ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.19, 0.11, ND 0.12, 0.07, ND 0.11, 0.06, ND 0.13, 0.07, ND	0.30 0.19 0.17 0.20
Greece 1998 *Arleta* *ER 98 ECS 753*	CS*	Spray indoor interval 14 d BBCH 87, 87	0.7986	1500 (0.053 % ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.15, 0.09, ND 0.19, 0.12, ND 0.15, 0.09, ND 0.06, 0.04, ND	0.24 0.31 0.24 0.10
Italy 1998 *Vermone* *ER 98 ECS 753*	CS*	Spray indoor interval 14 d BBCH 75, 77	0.7986	1500 (0.053 % ai)	2	0 1 3 7	Fruit Fruit Fruit Fruit	0.32, 0.17, ND 0.45, 0.24, ND 0.44, 0.21, ND 0.27, 0.14, < 0.02	0.49 0.69 0.65 0.41

TOMATO (Indoor)	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate mg/kg	Total Residue, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Portugal	CS*	Spray indoor	0.7986	1500	2	0	Fruit	0.19, 0.11, ND	0.30
1998		interval 14 d		(0.053		1	Fruit	0.16, 0.10, ND	0.26
Zapata		BBCH 73, 79		% ai)		3	Fruit	0.17, 0.11, ND	0.28
ER 98 ECS 753						7	Fruit	0.07, 0.04, ND	0.11
Spain	35EC	Spray indoor	1.074,	2033	2	0	Fruit	0.12, 0.09, < 0.01	0.21
1994		(motorised	0.809	1533		3	Fruit	0.04, 0.06, < 0.01	0.10
Andalucia		knapsack)		(0.053		7	Fruit	0.04, 0.04, 0.02	0.10
Presto		interval 14d		% ai)		14	Fruit	0.01, 0.02, 0.02	0.05
ER 94 ECS 701		GS 22, 23				21	Fruit	< 0.01, < 0.01, 0.01	< 0.01
						29	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray indoor	1.919,	1817	2	0	Fruit	0.17, 0.14, < 0.01	0.31
1994		(motorised	1.655	1567		3	Fruit	0.11, 0.15, 0.03	0.29
Andalucia		knapsack)		(0.1056		7	Fruit	0.09, 0.10.0.04	0.23
Presto		interval 14d		% ai)		14	Fruit	0.04, 0.07, 0.04	0.15
ER 94 ECS 701		GS 22, 23				21	Fruit	0.04, 0.06, 0.03	0.13
						29	Fruit	< 0.01, 0.02, 0.02	0.04
Spain	35EC	Spray indoor	0.616,	1167	2	0	Fruit	0.06, 0.07, < 0.01	0.13
1994		(motorised	0.720	1364		3	Fruit	0.02, 0.03, < 0.01	0.05
Caruso		knapsack)		(0.053% ai)		7	Fruit	0.01, 0.02, < 0.01	0.03
ER 94 ECS 701		interval 14d				14	Fruit	< 0.01, 0.02, 0.01	0.03
		GS 22, 23				21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
						29	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray indoor	1.168,	1106	2	0	Fruit	0.08, 0.08, < 0.01	0.16
1994		(motorised	1.121	1061		3	Fruit	0.07, 0.10, 0.04	0.21
Caruso		knapsack)		0.1056% ai)		7	Fruit	0.03, 0.06, 0.04	0.13
ER 94 ECS 701		interval 14d				14	Fruit	0.02, 0.03, 0.02	0.07
		GS 22, 23				21	Fruit	< 0.01, 0.02, 0.01	0.03
						29	Fruit	< 0.01, < 0.01, 0.01	0.01
Italy	35EC	Spray indoor	0.898,	1700	2	0	Fruit	0.19, 0.18, < 0.01	0.37
1994		(motorised	0.898	1700		3	Fruit	0.14, 0.12, 0.01	0.27
Vemone		knapsack)		(0.053% ai)		7	Fruit	0.05, 0.07, 0.02	0.14
ER 94 ECS 701		interval 14d				14	Fruit	0.01, 0.03, 0.01	0.05
		GS 11/17,				21	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
A		11/21				28	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray indoor	1.795,	1700	2	0	Fruit	0.45, 0.4, < 0.01	0.85
1994		(motorised	1.795	1700		3	Fruit	0.35, 0.35, 0.02	0.72
Vemone		knapsack)		0.1056% ai)		7	Fruit	0.15, 0.31, 0.02	0.48
ER 94 ECS 701		interval 14d				14	Fruit	0.06, 0.11, 0.04	0.21
		GS 11/17,				21	Fruit	0.01, 0.04, 0.02	0.07
		11/21				28	Fruit	0.01, 0.02, 0.02	0.05
Italy	35EC	Spray indoor	1.056,	2000	2	0	Fruit	0.2, 0.1, < 0.01	0.30
1994		(knapsack)	1.056	2000		3	Fruit	0.06, 0.05, < 0.01	0.11
San Marzano		interval 14d		(0.053% ai)		7	Fruit	0.03, 0.043, 0.01	0.08
(Italdor)		GS 15/17,				14	Fruit	0.033, 0.057, 0.033	0.12
ER 94 ECS 701		15/21				21	Fruit	0.01, 0.03, 0.02	0.06
						27	Fruit	< 0.01, < 0.01, 0.01	< 0.01
Italy	35EC	Spray indoor	2.112,	2000	2	0	Fruit	0.45, 0.25, 0.02	0.72
1994		knapsack)	2.112	2000		3	Fruit	0.35, 0.23, 0.02	0.60
San Marzano		interval 14d		0.1056% ai)		7	Fruit	0.053, 0.06, 0.02	0.13
(Italdor)		GS 15/17,				14	Fruit	0.1, 0.113, 0.04	0.25
ER 94 ECS 701		15/21				21	Fruit	0.03, 0.04, 0.04	0.11
						27	Fruit	0.02, 0.02, 0.02	0.06
Spain	35EC	Spray indoor	0.5376	1018	2	0	Fruit	0.13, 0.06, < 0.01	0.19
1993		(motorised		(0.053		3	Fruit	0.04, 0.05, < 0.01	0.09
Andalucia		knapsack)		% ai)		7	Fruit	0.01, 0.03, < 0.01	0.04
Prieto		interval 14d				14	Fruit	< 0.01, 0.02, < 0.01	0.02
ER 93 ECS 701									

TOMATO (Indoor)	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate mg/kg	Total Residue, mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Spain 1993 Andalucia *Prieto* *ER 93 ECS 701*	35EC	Spray indoor (motorised knapsack) interval 14d	1.0752	1018 (0.1056 % ai)	2	0 3 7 14	Fruit Fruit Fruit Fruit	0.25, 0.12, < 0.01 0.06, 0.13, < 0.01 0.03, 0.08, 0.02 0.02, 0.05, 0.02	0.37 0.19 0.13 0.09
Italy 1993 Ampulia *Majorca* *ER 93 ECS 701*	35EC	Spray indoor (motorised knapsack) interval 14d GS 11/19,	0.8975	1700 (0.053 % ai)	2	0 3 7 14	Fruit Fruit Fruit Fruit	0.18, 0.12, < 0.01 0.03, 0.04, < 0.01 0.11, 0.175, 0.03 0.02, 0.03, 0.015	0.30 0.07 0.32 0.07
Italy 1993 Ampulia *Majorca* *ER 93 ECS 701*	35EC	Spray indoor (motorised knapsack) interval 14d GS 11/19,	1.7954	1700 (0.1056 % ai)	2	0 3 7 14	Fruit Fruit Fruit Fruit	0.48, 0.31, < 0.01 0.13, 0.22, 0.023 0.025, 0.035, 0.01 0.025, 0.045, 0.02	0.79 0.37 0.07 0.09

Table 64. Endosulfan residues in eggplant from supervised trials in Australia.

EGGPLANT	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia *2001* Koraleigh *Grace* *1/10/540&*	EC	Spray	0.73	224	3	0 3 7 14	Fruit	0.034,0.030,< 0.005 < 0.005,0.007< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005	0.07 0.01 ≤ 0.005 < 0.005
Australia *2001* Glasshouse Mtns *Venus* *1/10/540&*	EC	Spray	1.46	334	3	0 3 7 14	Fruit	0.058, 0.081, 0.016	0.15
Australia *2001* Glasshouse Mtns *Venus* *1/10/540&*	EC	Spray	0.73	334	3	0 3 7 14	Fruit	0.33, 0.21, 0.26 0.043, 0.062, 0.031 0.014, 0.029, 0.012	0.57 0.14 0.06
Australia *2001* Shepparton *Black pearl* *1/10/540&*	EC	Spray	0.73	452	3	0 3 7 14	Fruit	0.015,0.011, 0.006 < 0.005,< 0.005< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005	0.03 < 0.005 ≤ 0.005 < 0.005
Australia *2001* Gumlu *Black pearl* *1/10/540&*	EC	Spray	0.73	352	3	0 3 6 14	Fruit	0.014,0.014,< 0.005 < 0.005<,0.005< 0.005 < 0.005,< 0.005,< 0.005 0.006, < 0.005,< 0.005	0.03 < 0.005 < 0.005 0.006

Table 65. Endosulfan residues in sweet corn from supervised trials in Australia.

SWEET CORN	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia *2000* Mulgowie *Golden sweet* *1/10/560*	EC	Spray	0.73	226	3	0 3 7 14	Fruit	< 0.005<,0.005< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005	< 0.005 < 0.005 < 0.005 < 0.005
Australia *2000* Mulgowie *Golden sweet* *1/10/560*	EC	Spray	1.46	226	3	0 3 7	Fruit	< 0.005<,0.005< 0.005	< 0.005
Australia *2000* Warragal *Honey sweet* *1/10/560*	EC	Spray	0.73	347	3	0 3 7 14	Fruit	< 0.005<,0.005< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005	< 0.005 < 0.005 < 0.005 < 0.005
Australia *2000* Warragal *Honey sweet* *1/10/560*	EC	Spray	1.46	347	3	7	Fruit	< 0.005,< 0.005,< 0.005	< 0.005
Australia *2000* Koraleigh *Golden sweet* *1/10/560*	EC	Spray	0.73	205	3	0 3 7 14	Fruit	< 0.005<,0.005< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005	< 0.005 < 0.005 < 0.005 < 0.005
Australia *2000* Koraleigh *Golden sweet* *1/10/560*	EC	Spray	0.73	224	3	7	Fruit	< 0.005,< 0.005,< 0.005	< 0.005

Table 66. Endosulfan residues in beans from supervised trials in Germany, USA and Australia.

PHASEOLUS BEANS	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai /ha/ applic'n	L/ha	No.				
Germany 1983 *Filetty* *DEU83172811*	2.82% Dust	Spread Interval 14, 21 d	0.705		3	0 5 11 14	Bean Bean Bean Bean	0.10, 0.07, ND 0.02, 0.04, 0.01 ND, 0.02, 0.02 ND, 0.01, 0.01	0.17 0.06 0.04 0.02
Germany 1983 *Marona* *DEU83172821*	2.82 % Dust	Spread Interval 15d	0.705		3	0 5 11	Bean Bean Bean	0.20 0.10 0.03 0.05, 0.05, 0.09 0.02, 0.01, 0.09	0.33 0.19 0.12
Germany 1983 *Sotexa* *DEU83172831*	2.82 % Dust	Spread interval 14, 12, d	0.705		3	0 5 10 14	Bean Bean Bean Bean	0.10 0.07, 0.02 ND, ND, 0.05 ND, ND, 0.02 ND, ND, 0.03	0.19 0.05 0.02 0.03

PHASEOLUS BEANS	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai /ha/ applic'n	L/ha	No.				
Germany 1983 *Dublette* *DEU83172841*	2.82% Dust	Spread Interval 14 d	0.705		3	0 5 10 14	Bean Bean Bean Bean	0.70, 0.40, 0.02 0.06, 0.10, 0.03 0.01, 0.03, 0.03 ND, 0.02, 0.03	1.12 0.19 0.07 0.07
Germany 1974 *Bravo* *1/74/01/02*	3% Dust	Spread	0.9		1	0 7 14 21 28 35	Bean Bean Bean Bean Bean Bean		46.6 0.64 0.59 0.22 0.08 < 0.05
Germany 1974 *Favorit* *2/74/01/02*	3% Dust	Spread	0.9		1	0 7 14 21 28	Bean Bean Bean Bean Bean		21.8 2.3 0.2 0.1 0.04
Germany 1974 Hattersheim *Favorit* *4/74/01/02*	3% Dust	Spread	0.9		1	0 7 14 21 28	Bean Bean Bean Bean Bean	2.90, 0.2 0.04, 0.05 0.02, 0.02 0.03, 0.04 ND, 0.02	3.10 0.09 0.04 0.07 0.02
Germany 1974 Hattersheim *Sotexa* *4/74/02/02*	3% Dust	Spread	0.9		1	0 7 14 21 28	Bean Bean Bean Bean Bean	6.20 1.0 0.04, 0.06 0.02, 0.02 0.01, 0.02 ND, 0.02	7.20 0.10 0.04 0.03 0.02
Germany 1974 *Kaskade* *3/74/02/02*	3% Dust	Spread	0.9		1	0 7 14 21 28	Bean Bean Bean Bean Bean	0.05, 0.04, 0.02 ND, ND, 0.02 ND, ND, 0.08 ND, ND, 0.009 ND, ND, 0.002	0.11 0.02 0.08 0.01 0.01
Germany 1974 *Kaskade* *3/74/01/02*	3% Dust	Spread	0.9		1	0 7 14 21 28	Bean Bean Bean Bean Bean	0.05, 0.01, 0.01 0.02, ND, 0.01 ND, ND, 0.004 ND, ND, 0.002 ND, ND, ND	0.07 0.03 0.01 0.01 < 0.01
USA 1965 NY Lima beans M-1610	50WP	Spray Interval 37, 7 d	0.56		3	0 1 4 7 11 20 32 11 20 32 11 20 32	Beans, pods Beans, pods Beans, pods Beans, pods Beans, pods Beans, pods Beans, pods Shelled beans Shelled beans Shelled beans Pods Pods Pods	1.48, 0.38 0.68, 0.14 0.35, 0.13 0.15, 0.08 0.48, 0.35 0.22, 0.14 0.09, 0.10 < 0.05, < 0.05 < 0.05, 0.05 < 0.05, < 0.05 0.38, 0.20 0.18, 0.12 0.23, 0.20	1.86 0.82 0.48 0.23 0.83 0.36 0.19 < 0.05 0.05 < 0.05 0.58 0.30 0.43

PHASEOLUS BEANS	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai /ha/ applic'n	L/ha	No.				
USA 1965 NY Lima beans M-1610	50WP	Spray Interval 37, 7 d	0.56		3	0 1 4 7 11 20 32 11 20 32 11 20 32	Beans, pods Beans, pods Beans, pods Beans, pods Beans, pods Beans, pods Beans, pods Shelled beans Shelled beans Shelled beans	0.77, 0.10 0.18, 0.10 0.19, 0.12 0.11, 0.06 0.20, 0.14 0.06, 0.08 < 0.05, 0.05 < 0.05, < 0.05 < 0.05, 0.05 < 0.05, < 0.05 0.21, 0.15 0.09, 0.12 0.06, 0.07	0.87 0.28 <u>0.31</u> 0.17 0.34 0.14 0.05 < 0.05 0.05 < 0.05 0.36 0.21 0.13
USA 1965 NY Snap beans M-1592	50WP	Spray Interval 2, 8 d	0.56		3	0 3 5 7 10 20 28 35 40	Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans	2.30 ND 0.25, ND 0.07, 0.05 0.10, 0.05 0.09, 0.06 < 0.05, 0.09 < 0.05, 0.05 < 0.05, 0.12 < 0.05, 0.06	2.30 <u>0.25</u> 0.12 0.15 0.15 0.09 0.05 0.12 0.06
USA 1965 NY M-1592	50WP	Spray Interval 2, 8 days	<u>1.12</u>		3	0 3 5 7 10 20 28 35 40	Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans Snap beans	2.88, ND 0.59, 0.05 0.18, 0.11 0.18, 0.12 0.20, 0.18 0.06, 0.14 < 0.05, 0.09 0.05, 0.20 < 0.05, 0.11	2.88 <u>0.64</u> 0.29 0.30 0.38 0.20 0.09 0.25 0.11
Australia *2000* Glen Allyn *festina* *1/10/538*	EC	SPRAY	0.73	426	3	7 10 14	Beans	0.032, 0.006, 0.11 0.015, 0.005,0.062 0.014,0.008, 0.028	0.148 0.082 0.050
Australia *2000* Glen Allyn *festina* *1/10/538*	EC	SPRAY	1.46	500	3	7 10 14 7c	Beans	0.18, 0.12, 0.58 0.035, 0.019,019 0.034,0.022, 0.11 0.11, 0.01, 0.007	0.88 0.24 0.167 0.127
Australia *2000* Don *montano* *1/10/538*	EC	SPRAY	0.73	533	3	0 3 7 14	Beans	0.30, 0.23, 0.055 0.081, 0.066, 0.09 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005	0.58 0.237 < 0.005 < 0.005
Australia *2000* Don *montano* *1/10/538*	EC	SPRAY	1.46	533	3	7	Beans	0.050, 0.033, 0.11	0.193
Australia *2000* Goulburn Valley *dwarf* *1/10/538*	EC	SPRAY	0.73	452	3	0 3 7 14	Beans	0.15, 0.10, 0.039 0.055,0.048,0.035 0.022, 0.021,0.049 0.006,0.006,0.025	0.29 0.143 0.092 0.037

Table 67. Endosulfan residues in peas from supervised trials in Australia.

PEAS	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia *2000* Lockyer Valley *epic* *1/10/557*	EC	SPRAY	0.73	500	3	0 3 7 14	Peas in pod	0.42, 0.48, 0.095 0.062, 0.15,0.10 0.009,0.026, 0.047 0.005, 0.010, 0.022	0.995 0.312 0.082 0.037
Australia *2000* Lockyer Valley *epic* *1/10/557*	EC	SPRAY	1.46	500	3	0 3 7 14	Peas in pod	1.50,1.40, 0.20 0.21, 0.45,0.28 0.06,0.11, 0.24 0.013, 0.037, 0.089	3.10 0.94 0.41 0.139
Australia *2000* Don *Small sieve freezer* *1/10/557*	EC	SPRAY	0.73	533	3	0 3 7 14	Peas in pod	0.46, 0.55, 0.05 0.068, 0.12, 0.17 0.015, 0.022, 0.087 0.006, 0.006, 0.018	1.06 0.358 0.124 0.03
AUSTRALIA *2000* Don *Small sieve freezer* *1/10/557*	EC	SPRAY	1.46	533	3	7	Peas in pod	0.033, 0.10, 0.20	0.333
AUSTRALIA *2000* Werribee *melbourne market* *1/10/557*	EC	SPRAY	0.73	500	3	0 3 7 28	Peas in pod	1.00, 0.81, 0.15 0.17,0.20.0.33 0.067, 0.099, 0.20 < 0.005, 0.005, 0.008	1.96 0.70 0.366 0.018

Table 68. Endosulfan residues in soybeans from supervised trials in Australia and Brazil.

SOYBEAN	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia 1981 *Forrest* *PSR99/010*	35EC	Spray (3.675% ai)	0.74	20	1	21 28	Seeds Seeds	< 0.02, < 0.02, < 0.02 < 0.02, < 0.02, 0.02	< 0.02 0.02
Australia 1981 *Forrest* A30088	35EC	Spray (3.675% ai)	1.47	40	1	21 28	Seeds Seeds	< 0.02, < 0.02, < 0.02 0.02, < 0.02, 0.13	< 0.02 0.15
Australia 1981 *Forrest*	250ULV	Spray (24.0% ai)	0.72	3	1	21 28	Seeds Seeds		0.015 0.02
Australia 1981 *Forrest*	250ULV	Spray (24.0% ai)	1.44	6	1	21 28	Seeds Seeds		0.02 0.02
Brazil 1974 *Santa Rosa*	35EC	Spray (0.105% ai)	0.42	400	3	62	Seeds	ND, ND, 0.20	0.20
Brazil 1974 *Santa Rosa* (A01812)	35EC	Spray (0.105% ai)	0.42	400	4	13	Seeds	0.03, 0.04, 0.10	0.17
Brazil 1975 *Davies* A07560)	35EC	Spray (0.131% ai)	0.53	400	1	13	Seeds	ND, 0.20, 0.01	0.21
Brazil 1977 *IAC-3* (A13732)	35EC	Spray (0.131% ai)	0.53	700	1	103	Seeds	0.05, 0.04	0.09

SOYBEAN	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Brazil 1977 *IAC-3* (A13733)	35EC	Spray (0.075% ai)	0.53	700	2	66	Seeds	0.08, 0.25	0.33
Brazil 1977 *IAC-3* (A13735)	35EC	Spray (0.075% ai)	0.53	700	3	36	Seeds	0.12, 0.33	0.45
Brazil 1977 *IAC-3* (A13734)	35EC	Spray (0.075% ai)	0.53	700	1	66	Seeds	0.08, 0.25	0.33
Brazil 1977 *IAC-3* (A13730)	35EC	Spray (0.075% ai)	0.53	700	1	36	Seeds	0.11, 0.04	0.15
Brazil 1977 *IAC-3* (A13731)	35EC	Spray (0.075% ai)	0.53	700	2	36	Seeds	0.13, 0.29	0.42
Brazil 1977 *Santa Rosa* (A13738)	35EC	Spray (0.075% ai)	0.53	700	1	22	Seeds	0.05, 0.04	0.09
Brazil 1977 *Santa Rosa* (A13736)	35EC	Spray (0.075% ai)	0.53	700	2	22	Seeds	0.10, 0.15	0.25
Brazil 1977 *Santa Rosa* (A13737)	35EC	Spray (0.075% ai)	0.53	700	3	22	Seeds	0.12, 0.19	0.31
Brazil 1978 *Santa Rosa* (A16115)	35EC	Spray (0.075% ai)	0.53	700	1	90	Seeds	ND, ND, ND	< 0.01
Brazil 1978 *Santa Rosa* (A16114)	35EC	Spray (0.075% ai)	0.53	700	2	62	Seeds		0.50
Brazil 1978 *Santa Rosa* (A16111)	35EC	Spray (0.075% ai)	0.53	700	3	31	Seeds		0.40
Brazil 1978 *Santa Rosa* (A16113)	35EC	Spray (0.075% ai)	0.53	700	2	31	Seeds		0.10
Brazil 1978 *Santa Rosa* (A16116)	35EC	Spray (0.075% ai)	0.53	700	1	62	Seeds		0.20
Brazil 1978 *Santa Rosa* (A16112)	35EC	Spray (0.075% ai)	0.53	700	2	31	Seeds		0.30
Brazil 1978 *Santa Rosa* (A16124)	35EC	Spray (0.075% ai)	0.53	700	1	90	Seeds		0.05
Brazil 1978 *Santa Rosa* (A16121)	35EC	Spray (0.075% ai)	0.53	700	2	61	Seeds		0.20
Brazil 1978 *Santa Rosa* (A16118)	35EC	Spray (0.075% ai)	0.53	700	3	29	Seeds		0.30
Brazil 1978 *Santa Rosa* (A16120)	35EC	Spray (0.075% ai)	0.53	700	2	29	Seeds		0.20
Brazil 1978 *Santa Rosa 16117*	35EC	Spray (0.075% ai)	0.53	700	1	31	Seeds		0.10
Brazil 1978 *Santa Rosa* (A16123)	35EC	Spray (0.075% ai)	0.53	700	1	61	Seeds		0.20

SOYBEAN	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Brazil 1978 *Santa Rosa* (A16119)	35EC	Spray (0.075% ai)	0.53	700	2	29	Seeds		0.20
Brazil 1978 *Santa Rosa* (A16122)	35EC	Spray (0.075% ai)	0.53	700	1	29	Seeds		0.08
Brazil 1979 *Santa Rosa* (A17983)	35EC	Spray (0.075% ai)	0.53	700	1	101	Seeds	ND, 0.02, 0.08	0.10
Brazil 1979 *Santa Rosa* (A17982)	35EC	Spray (0.075% ai)	0.53	700	2	71	Seeds	ND, 0.04, 0.3	0.34
Brazil 1979 *Santa Rosa* (A17979, 17978)	35EC	Spray (0.075% ai)	0.53	700	3	41 41 41	Seeds Crude oil Press cake	0.02, 0.02, 0.3 0.1, 0.7, 0.6 ND, ND, ND	0.34 1.40 < 0.02
Brazil 1979 *Santa Rosa* (A17981)	35EC	Spray (0.075% ai)	0.53	700	2	41	Seeds	0.02, 0.06, 0.20	0.28
Brazil 1979 *Santa Rosa* (A17984)	35EC	Spray (0.075% ai)	0.53	700	1	71	Seeds	ND, ND, 0.30	0.34
Brazil 1979 *Santa Rosa* (A17980)	35EC	Spray (0.075% ai)	0.53	700	2	41	Seeds	0.01, 0.05, 0.50	0.56
Brazil 1979 *Santa Rosa* (A17985)	35EC	Spray (0.075% ai)	0.53	700	1	41	Seeds	0.02, 0.05, 0.20	0.27
Brazil 1979 *Santa Rosa* (A17993)	35EC	Spray (0.075% ai)	0.53	700	1	91	Seeds	ND, ND, ND	< 0.02
Brazil 1979 *Santa Rosa* (A17990)	35EC	Spray (0.075% ai)	0.53	700	2	62	Seeds	ND, 0.05, 0.20	0.25
Brazil 1979 *Santa Rosa* (A17986)	35EC	Spray (0.075% ai)	0.53	700	3	30	Seeds	0.10, 0.10, 0.40	0.60
Brazil 1979 *Santa Rosa* (A17987)	35EC	Spray (0.075% ai)	0.53	700	3	30 30	Crude oil Press cake	0.10, 0.30, 0.30 ND, ND, ND	0.70 < 0.02
Brazil 1979 *Santa Rosa* (A17989)	35EC	Spray (0.075% ai)	0.53	700	2	30	Seeds	ND, ND, ND	≤ 0.02
Brazil 1979 *Santa Rosa* (A17992)	35EC	Spray (0.075% ai)	0.53	700	1	62	Seeds	ND, ND, 0.10	0.10
Brazil 1979 *Santa Rosa* (A17988)	35EC	Spray (0.075% ai)	0.53	700	2	30	Seeds	ND, ND, 0.20	0.20
Brazil 1979 *Santa Rosa* (A17991)	35EC	Spray (0.075% ai)	0.53	700	1	30	Seeds	ND, ND, 0.05	0.05
Brazil 1978 *Parana* (A16110)	250 ULV	Spray	0.50 (25.% ai	2	2	32	Seeds Crude oil Press cake		0.30 1.30 0.03

Table 69. Endosulfan residues in beetroot resulting from supervised trials in Australia.

BEETROOT	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.	days	analysed		
Australia *2000* Lockyer Valley *Detroit short top* *N° 1/8/534*	EC	spray	0.735	1000	4	0 7 14 21	Root	0.18,0.11,0.10 0.10, 0.11,011 0.062, 0.063, 0.075 0.080, 0.080, 0.090	0.39 0.32 0.20 0.25
Australia *2000* Lockyer Valley *Detroit short top* *N° 1/8/534*	EC	spray	1.47	1000	5	0 7 14 21	Root	0.38, 0.27, 0.13 0.25, 0.22, 0.16 0.20, 0.20, 0.20 0.16, 0.15, 0.15	0.78 0.63 0.60 0.46

Table 70. Endosulfan residues in carrot resulting from supervised trials in Australia.

CARROT	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.	days	analysed		
Australia *2000* Virginia *Ricardo* *N° 1/10/565*	EC	spray	0.735	400	3	0 7 14 21	Root	0.016, 0.030, 0.028 0.017, 0.034, 0.025 0.020, 0.021, 0.019 0.034, 0.054, 0.046	0.07 0.08 0.06 <u>0.13</u>
Australia *2000* Virginia *Ricardo* *N° 1/10/565*	EC	spray	1.47	400	3	0 7 14 21 *14co*	Root *co*	0.040, 0.066, 0.046 0.066, 0.12, 0.062 0.044, 0.080, 0.062 0.066, 0.13, 0.082 *0.011, < 0.005, 0.007*	0.15 0.25 0.19 0.28 *0.02*
Australia *2000* Virginia *ricarto* *N° 1/10/565*	EC	spray	0.735	400	3	 14 21 *14co*	Root *co*	 0.019, 0.043, 0.033 0.018, 0.023, 0.019 *0.013, < 0.005, 0.005*	 <u>0.10</u> 0.06 *0.02*
Australia *2000* SILVAN VIC *flakie* *N° 1/10/565*	EC	spray	0.735	387	3	0 7 14 21	Root	< 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005 < 0.005,< 0.005,< 0.005	< 0.005 < 0.005 <u>< 0.005</u> < 0.005
Australia *2000* Silvan *flakie* *N° 1/10/565*	EC	spray	1.47	387	3	0 7 14 21	Root	< 0.005,< 0.005,< 0.005 < 0.005,< 0.005,0.005 < 0.005,< 0.005,< 0.005 0.005,< 0.005,0.006	< 0.005 0.01 < 0.005 0.01
Australia *2000* Medina *ivar* *N° 1/10/565*	EC	spray	0.735	250	3	14 21	Root	0.013, 0.012, 0.012 0.019, 0.019, 0.016	<u>0.04</u> 0.05

Table 71. Endosulfan residues in potato from supervised trials in Europe, USA and Australia.

POTATO	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.				
Germany 1983 *Nicola* *PSR96/058*	28DP 2.82% ai.	Spread interval 14d	0.705	25 kg formulation by ha	2	0 5 10 14	Tuber Tuber Tuber Tuber		0.015 0.015 0.015 0.015
Germany 1983 *Grata* *PSR96/058*	28DP 2.82% ai.	Spread interval 12, 14 d	0.705	25 kg formulation by ha	3	0 6 10 14	Tuber Tuber Tuber Tuber		0.015 0.015 0.015 0.015
Germany 1983 *Grata* *PSR96/058*	28DP 2.82% ai.	Spread interval 14d	0.705	25 kg formulation by ha	2	0 5 11 14	Tuber Tuber Tuber Tuber		0.015 0.015 0.015 0.015
Germany 1976 *Frigga* *PSR96/058*	35WP	Spread interval 20d 20 days	0.210	600 (0.035 % ai)	2	13 19 23 28	Tuber Tuber Tuber Tuber		0.015 0.015 0.015 0.015
Germany 1976 *Erstling* *PSR96/058*	35WP	Spread interval 13d	0.210	600 (0.035 % ai)	2	0 13 20 28	Tuber Tuber Tuber Tuber		0.015 0.015 0.015 0.015
Germany 1976 *Marion* *PSR96/058*	35WP	Spread interval 8d	0.210	600 (0.035 % ai)	2	20 24 28 20 24 28	Peel Peel Peel Tuber (w/o Peel) Tuber		0.015 0.015 0.015 0.015 0.015 0.015
Germany 1977 *Saskia* *2/713/01/02-77A*	24EC*	Spray interval 20 d	0.216	600 (0.036 % ai)	2	0 7 14 21	Tuber Tuber Tuber Tuber		0.01 ND ND ND
Germany 1977 *Holl. Erstlinge* *4/713/01/02-77A*	24EC*	Spray interval 21d	0.216	600 (0.036 % ai)	2	0 7 14 21	Tuber Tuber Tuber Tuber		ND ND ND ND
Germany 1977 *Holl. Erstlinge* *1/713/01/02-77*	24EC*	Spray interval 21d	0.216	600 (0.036 % ai)	2	0 7 14 21	Tuber Tuber Tuber Tuber		ND ND ND ND
Germany 1977 *Marion* *3/713/01/02-77A*	24EC*	Spray interval 21 d	0.216	600 (0.036 % ai)	2	0 7 14 21	Tuber Tuber Tuber Tuber		ND ND ND ND
Spain 1994 *Quebec* *ER 94 ECS 770*	35EC	Spray interval 14 d BBCH 59/61, 65/71	0.528	300 (0.176% ai)	2	0 7 13 21 27	Tuber Tuber Tuber Tuber Tuber	< 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01	< 0.01 < 0.01 < 0.01 < 0.01 < 0.01
Spain 1994 *Spunta* *ER 94 ECS 770*	35EC	Spray interval 14 d BBCH 35, 395	0.528	300 (0.176% ai)	2	0 7 14 21 28	Tuber Tuber Tuber Tuber Tuber	< 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01	< 0.01 < 0.01 < 0.01 < 0.01 < 0.01
France (S) 1994 *Spunta* *ER 94 ECS 770*	35EC	Spray interval 14 d BBCH 31/35, 39/41	0.528	200 (0.264% ai)	2	0 7 15 21 29	Tuber Tuber Tuber Tuber Tuber	< 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01 < 0.01, < 0.01, < 0.01	< 0.01 < 0.01 < 0.01 < 0.01 < 0.01

POTATO	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.	days	analysed		
Germany	35WP	Spread	0.210	600	2	0	Tuber		0.015
1976		interval 28d		(0.035		13	Tuber		0.015
Hollers				% ai)		20	Tuber		0.015
PSR96/058						28	Tuber		0.015
Italy	35EC	Spray	0.528	900,	2	0	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
1994		interval 14 d		1000		7	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Sigunde		BBCH		(0.0528% ai)		14	Tube	< 0.01, < 0.01, < 0.01	< 0.01
ER 94 ECS 770		41/51, 69/75				21	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray	0.528	300	2	0	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
1994		interval 14 d		(0.176% ai)		7	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Liseta		BBCH				14	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
ER 94 ECS 770		59/61, 61/71				21	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
						28	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray	0.528	300	2	0	Tuber	< 0.01, < 0.01,< 0.01	< 0.01
1994		interval 14 d		(0.176% ai)		7	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Quebec						13	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
ER94ECS770						21	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
						27	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Spain	35EC	Spray	0.528	300	2	0	Tuber	< 0.01, < 0.01,< 0.01	< 0.01
1994		interval 14 d		(0.176% ai)		7	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Spunta						14	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
ER94ECS770						21	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
						27	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
France	35EC	Spray	0.528	200	2	0	Tuber	< 0.01, < 0.01,< 0.01	< 0.01
1994		interval 14 d		(0.264% ai)		7	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Nicola						15	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
ER94ECS770						22	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
						29	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray	0.528	900,	2	0	Tuber	< 0.01, < 0.01,< 0.01	< 0.01
1994		interval 14 d		1000		7	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Sigunde				(0.0528% ai)		14	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
ER94ECS770						21	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Italy	35EC	Spray	0.528	300	2	0	Tuber	< 0.01, < 0.01,< 0.01	< 0.01
1994		interval 14 d		(0.176% ai)		7	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Liseta						14	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
Maggiore						21	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
ER94ECS770						28	Tuber	< 0.01, < 0.01, < 0.01	< 0.01
USA (WA)	3EC*	Broadcast	5;6**	190	3	1	Potato	< 0.05, < 0.05, < 0.05	< 0.05
1995	33.7%	spray					Potato	< 0.05, < 0.05, < 0.05	< 0.05
R1612B/U022		Interval 4d					Flakes	< 0.05, < 0.05, < 0.05	< 0.05
							Chips	< 0.05, < 0.05, < 0.05	< 0.05
							Wet peel	< 0.05, < 0.05, < 0.05	< 0.05
Australia	EC	spray	0.735	350	3	0	Tuber	0.005, 0.005, < 0.005	0.01
2000						7	Tuber	< 0.005,< 0.005, < 0.005	< 0.005
Torquay						14	Tuber	< 0.005,< 0.005, < 0.005	< 0.005
Sequoia						21	Tuber	< 0.005,< 0.005, 0.005	0.005
N° 1/10/562									
Australia	EC	spray	1.47	350	3	0	Tuber	< 0.005,< 0.005, < 0.005	< 0.005
2000						7	Tuber	< 0.005,< 0.005, < 0.005	< 0.005
Torquay						14	Tuber	< 0.005,< 0.005, < 0.005	< 0.005
Sequoia						21	Tuber	< 0.005,< 0.005, < 0.005	< 0.005
N° 1/10/562									

POTATO	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha	L/ha	No.				
Australia	EC	spray	0.735	500	3	0	Tuber	< 0.005,< 0.005,0.008	0.008
2000						7	Tuber	< 0.005,< 0.005,0.007	0.007
Lockyer Valley						14	Tuber	< 0.005,< 0.005, 0.007	0.007
Sebago						21	Tuber	< 0.005,< 0.005,0.006	0.006
N° 1/10/562									
Australia	EC	spray	1.47	500	3	0	Tuber	< 0.005,< 0.005,0.007	0.007
2000						7	Tuber	< 0.005,< 0.005,0.006	0.006
Lockyer Valley						14	Tuber	< 0.005,< 0.005,0.008	0.008
Sebago						21	Tuber	< 0.005,< 0.005, 0.008	0.008
N° 1/10/562									
Australia	EC	spray	0.735	250	3	0	Tuber	0.26, 0.15,< 0.005	0.41
2000						7	Tuber	< 0.005,< 0.005,< 0.005	< 0.005
Medina						14	Tuber	< 0.005,< 0.005,< 0.005	≤ 0.005
Delaware						21	Tuber	< 0.005,< 0.005,< 0.005	< 0.005
N° 1/10/565									
Australia	EC	spray	1.47	300	3	14	Tuber	< 0.005,< 0.005,< 0.005	< 0.005
2000									
Virginia									
Collabeen									
N° 1/10/565									

Table 72. Endosulfan residues in sweet potato from supervised trials in USA and Australia.

SWEET POTATO	Application					PHI Days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
USA	3EC*	Foliar spray	1, 34	10.1, 96.3	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 NC	50WP		1, 34	91.6,90.8	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
BJ-96R-05	3EC	1 soil incorp,	3x1.12	93.5, 91.6,94.4	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
	50WP	+ 2 fol. spray	3x1.12	96, 95, 95	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
USA	3EC	Foliar spray	1, 34	92.5,94.	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 NC	50WP		1, 34	90.8,93.5	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
BJ-96R-05	3EC	1 soil incorp,	3x1.12	93.5,92.5,94.4	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
	50WP	+ 2 fol. spray	3x1.12	94.4,91.6,93.5	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
USA	3EC	Foliar spray	1, 34	98, 102.9	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 SC	50WP		1, .34	100, 103.8	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
BJ-96R-05	3EC	1 soil incorp,	3x1.12	99,99,102	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
	50WP	+ 2 fol. spray	3x1.12	97, 99, 102	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
USA	3EC	Foliar spray	1, 34	98,98	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
Escambia Co.,	50WP		1, .34	.93.5,98	2	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 FL	3EC	1 soil incorp,	3x1.12	115,96.3, 98	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
BJ-96R-05	50WP	+ 2 fol. spray	3x1.12	80.4, 95, 97	3	1	Sw.Potato	< 0.05, < 0.05, < 0.05	< 0.05
USA	3EC	Foliar spray	1, 34	91.6,96.3	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
Seminole Co., FL	50WP		1, .34	95.4,93.5	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 FL	3EC	1 soil incorp,	3x1.12	84, 95,88	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
BJ-96R-05	50WP	+ 2 fol. spray	3x1.12	88, 98, 94.4	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05

SWEET POTATO	Application					PHI Days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
USA	3EC	Foliar spray	1, 34	93.5,92.5	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
Greenville Co.,	50WP		1, .34	93.5, 92.5	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
MS	3EC	1 soil incorp,	3x1.12	100,93.5,92.5	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 MS	50WP	+ 2 fol. spray	3x1.12	100,93.5,92.5	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
BJ-96R-05									
USA	3EC	Foliar spray	1, 34	91.6,93.5	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
Pattison Co., TX	50WP		1, .34	93.5, 94.4	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 TX	3EC	1 soil incorp,	3x1.12	94.4, 93.5,93.5	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
BJ-96R-05	50WP	+ 2 fol. spray	3x1.12	94.4,94.4, 94.4	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
USA	3EC	Foliar spray	1, 34	94.4, 94.4	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
Fresno Co., CA	50WP		1, .34	94.4, 95.4	2	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
1996 CA	3EC	1 soil incorp,	3x1.12	3x93.5	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
	50WP	+ 2 fol. spray	3x1.12	2x93.5,95.4	3	1	Sw potato	< 0.05, < 0.05, < 0.05	< 0.05
Australia	EC	spray	0.735	300	3	0	Sw potato	< 0.005,0.005,< 0.005	0.005
2000						7	Sw potato	< 0.005,< 0.005, < 0.005	< 0.005
Southedge						14	Sw potato	< 0.005,< 0.005, < 0.005	< 0.005
sentinal						21	Sw potato	< 0.005,< 0.005, < 0.005	< 0.005
N° 1/8/503									
Australia	EC	spray	1.47	500	3	0	Sw potato	0.005,< 0.005,< 0.005	0.005
2000						7	Sw potato	0.007,0.008,< 0.005	0.015
Southedge						14	Sw potato	0.007, 0.006,< 0.005	0.013
sentinal						21	Sw potato	< 0.005,< 0.005,0.0065	0.007
N° 1/8/503									

Table 73. Endosulfan residues in sugar beet from supervised trials in Italy.

SUGARBEET	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Italy 1998	35EC	Spray	0.630	600	2	0	Root	< 0.02, < 0.02, < 0.02	< 0.02
Dorotea		Interval 30 d		(0.105% ai)		27	Root	ND, ND, < 0.02	< 0.02
ER 98 ECS746		BBCH39							
Italy 1998	35EC	Spray	0.630	600	2	0	Root	0.05, 0.03, < 0.02	0.08
Adige		Interval 33d		(0.105% ai)		26	Root	ND, < 0.02, 0.03	0.03
ER 98 ECS 746		BBCH39							
Italy 1998	35EC	Spray	0.630	300,	2	0	Root	0.02, < 0.02, < 0.02	0.02
Alesia		Interval 32d		600		28	Root	ND, < 0.02, 0.03	0.03
ER 98 ECS 746		BBCH38/39		(0.105% ai)					
Italy 1998	35EC	Spray	0.630	300,	2	0	Root	< 0.02, < 0.02, < 0.02	< 0.02
Monodoro		Interval 32 d		600		28	Root	ND, < 0.02, < 0.02	< 0.02
ER 98 ECS 746		BBCH 38/39		(0.10% ai)5					
Italy1997	35EC	Spray	0.630	600		0	Root	0.02 ,< 0.02, < 0.02	0.02
Bianca		Interval 20 d		(0.105		14	Root	ND, ND, < 0.02,	< 0.02
ER 97 ECS 746		BBCH 39		% ai)		28	Root	ND, ND, < 0.02	< 0.02
Italy1997	35EC	Spray	0.630	600	2	0	Root	0.02, < 0.02, 0.03	0.05
Adige		Interval 20 d		(0.105		14	Root	< 0.02, < 0.02, 0.03	0.03
ER 97 ECS 746		BBCH 39		% ai)		28	Root	ND, ND, < 0.02	< 0.02
Italy1997	35EC	Spray	0.630	600	2	0	Root	< 0.02, < 0.02, < 0.02	< 0.02
Monodoro		Interval 20 d		(0.105		14	Root	ND, < 0.02, < 0.02	< 0.02
ER 97 ECS 746		BBCH 39		% ai)		28	Root	ND, ND, 0.02	0.02
Italy1997	35EC	Spray	0.630	600	2	0	Root	< 0.02, < 0.02, 0.02	0.02
Formula		Interval 20 d		(0.105		14	Root	ND, < 0.02, 0.04	0.04
ER 97 ECS 746		BBCH 39,49		% ai)		28	Root	ND, ND, 0.03	0.03

SUGARBEET	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
Italy1997	35EC	Spray	0.630	600	2	0	Root	< 0.02, ND, < 0.02	< 0.02
Rizor		Interval 20 d		(0.105		14	Root	ND, ND, 0.02	0.02
ER 97 ECS 746		BBCH 39,49		% ai)		28	Root	ND, ND, < 0.02	< 0.02

Table 74. Endosulfan residues in celery from supervised trials in USA and Australia.

CELERY	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form	Method	Rate kg ai/ha/ applic'n	Water volume L/ha	No.	Days	analysed		
USA	3EC*	(backpack).	1.12	271,280.5	1	14	Celery	0.83, 0.37, 0.26	1.46
1997/8 MI	50WP	(backpack).	1.12	(0.414% ai)	1	14	Celery	0.83, 0.31, 0.27	1.41
BJ-97R-02									
USA1997/8 CA	3EC*	Spray	1	19	1	14	Celery	1.09, 0.79, 0.46,	2.34
Pacifica	50WP	(backpack).	1	20	1	14	Celery	1.28, 1.44, 1.00	3.72
BJ-97R-02				(0.6% ai)					
USA	3EC*	Spray	1	30	1	14	Celery	0.35, 0.24, 0.15	0.74
1997/8 CA	50WP	(backpack).	1	30	1	14	Celery	0.17, 0.29, 0.09	0.55
TA Special #1				(0.414% ai)					
BJ-97R-02									
USA1997/8 CA	3EC*	Spray	1	31	1	14	Celery	0.32, 0.26, 0.14	0.72
Conquistador	50WP	(backpack).	1	30	1	14	Celery	0.38, 0.73, 0.17	1.28
BJ-97R-02				(0.414% ai)					
USA	3EC*	Spray .	1.12	271	1	14	Celery	1.20, 0.83, 0.40	2.43
1997/8 CA	50WP	(backpack).	1.12	290	1	14	Celery	1.56, 1.52, 0.39	3.47
Conquistador				(0.414% ai)					
BJ-97R-02									
USA 1995 CA	3EC*	Spray	1.12	649	1	4	Celery	1.19, 1.15, 0.13	2.47
Matador	50WP	(directed)	1.12	648	1	4	Celery	1.41, 1.37, 0.15	2.93
U022/R141C				(0.17% ai)					
USA 1995 CA	3EC*	Spray	1.12	635	1	4	Celery	1.61, 1.19, 0.34	3.14
T&A Special #1	50WP	(directed)	1.12	646	1	4	Celery	1.36, 1.47, 0.24	3.07
U022/R141C				(0.174% ai)					
USA 1995 CA	3EC*	Spray	1.12	650	1	4	Celery	0.87, 1.49, 0.24	2.60
TA Special #1	50WP	(directed)	1.12	663	1	4	Celery	1.61, 2.0, 0.14	3.75
U022/R141C				(0.17% ai)					
USA 1995 MI	3EC*	Spray	1.12	220.7	1	4	Celery	0.77, 0.75, 0.23	1.75
Florida 683K	50WP	broadcast	1.12	220.7	1	4	Celery	1.24, 1.14, 0.23	2.61
U022/R141C				(0.51% ai)					
USA 1995 FL	3EC*	Spray	1.12	416	1	4	Celery	0.46, 0.29, 0.25	1.00
1622	50WP	broadcast	1.12	416	1	4	Celery	0.63, 0.47, 0.26	1.36
U022/R141C				(0.27% ai)					
USA 1995 CA	3EC*	Spray	1.12	909	1	4	Celery	1.89, 1.77, 0.39	4.05
Conquistador	50WP	broadcast	1.12	942	1	4	Celery	2.32, 2.14, 0.55	5.01
U022/R141C				(0.12% ai)					
USA 1965 CA	2EC	Spray	1.12		3	0	Celery		17.8-17.9
F-M 96						7	Celery		2.0-2.6
R-90						14	Celery		0.83-1.09
						21	Celery		0.53-0.58
						28	Celery		0.37-0.39
USA 1965 CA	2EC	Spray	1.12		3	0	Celery		11.2-13.9
F-M 96		(2 qt/40 gal)				7	Celery		1.72-1.77
R-908						14	Celery		1.08-1.27
						21	Celery		0.79-0.96
USA 1965 CA	2EC	Spray	1.12		3	0	Celery		13.5-17.7
F-M 96		(2 qt/40 gal)				7	Celery		3.3-3.5
R-908						14	Celery		0.85-1.17
						21	Celery		0.60-0.72
						28	Celery		0.47-0.51

CELERY	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form	Method	Rate kg ai/ha/ applic'n	Water volume L/ha	No.	Days	analysed		
Australia	EC	spray	0.232	350	3	0	Celery	2.5, 1.5, 0.22	4.20
2000 Toowoomba						3	Celery	0.58, 0.39,0.25	1.20
American stringless						7	Celery	0.31, 0.16, 0.12	0.59
N° 1/10/535						10	Celery	0.56, 0.29,0.26	1.10
Australia	EC	spray	0.707	575	3	7	Celery	1.1, 0.63, 0.48	2.20
2000 Toowoomba						10	Celery	1.6, 0.85,0.58	3.0
American stringless						7	Celery co	0.054,0.024,0.045	0.12
N° 1/10/535						10	Celery co	0.064,0.029,.058	0.15
Australia	EC	spray	0.465	700		0	Celery	0.18, 0.12, 0.053	0.36
2000 Cranbourne						3	Celery	0.16, 0.13,0.068	0.36
Summit						7	Celery	0.12, 0.076, 0.062	0.26
N° 1/10/535						10	Celery	0.14, 0.09, 0.062	0.29
Australia	EC	spray	0.865	700		7	Celery	0.71, 0.43, 0.15	1.30
2000						10	Celery	0.34, 0.20.0.081	0.62
Cranbourne						7	Celery co	< 0.005,< 0.005,< 0.005	0.015
Summit									
N° 1/10/535						10	Celery co	0.006,0.013,< 0.005	0.019

Table 75. Endosulfan residues in rhubarb from supervised trials in Australia.

RHUBARB	Application					PHI	Sample	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	Rate g ai/hL/	Water volume L/ha	No.	days	analysed		
Australia	EC	spray	70	185	2	0	rhubarb	0.015,0.29,0.26	0.57
2000						3	rhubarb	0.016,0.0612,0.013	0.09
Hamton						7	rhubarb	0.012,0.036,0.011	0.059
Sydney crimson						10	rhubarb	0.017,0.042,0.02	0.079
N° 1/10/558									
Australia	EC	spray	140	185	2	7	rhubarb	0.026,0.10.0.039	0.16
2000						10	rhubarb	0.015, 0.06,0.028	0.10
Hamton						7	rhubarb co	< 0.005,< 0.005,< 0.005	<.0.005
Sydney crimson						10	rhubarb co	< 0.005,< 0.005,< 0.005	< 0.015
N° 1/10/558									
Australia	EC	spray	70	334	2	0	rhubarb	2.10,1.50.0.094	3.70
2000						3	rhubarb	0.41,0.33,0.065	0.80
Mt Tambourine						7	rhubarb	0.098,0.17,0.072	0.34
Big red						10	rhubarb	0.056,0.087,0.053	0.20
N° 1/10/558									
Australia	EC	spray	140	334	2				
2000						7	rhubarb	0.19,0.034,0.20	0.73
Mt Tambourine						10	rhubarb	0.063, 0.12,0.063	0.25
Big red						7	rhubarb co	< 0.005,< 0.005,< 0.005	< 0.005
N° 1/10/558						10	rhubarb co	< 0.005,< 0.005,< 0.005	< 0.005

Table 76. Endosulfan residues in hazelnuts from supervised trials in Italy.

HAZELNUT	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial *Variety*	Form.	Method	Rate kg ai/ha/ applic'n	Water volume L/ha	No.	days	analysed	beta endosulfan, Endosulfan sulfate, mg/kg	Residues, mg/kg
Italy	33EC	Spray	0.796	992	2	0	Nutmeat	ND, ND, ND	< 0.02
1999		(backpack)		(0.08		7	Nutmeat	ND, ND, ND	< 0.02
Gentile Tonda		Interval 14d		% ai)		14	Nutmeat	ND, ND, ND	< 0.02
Romana		BBCH				21	Nutmeat	ND, ND, ND	≤ 0.02
99335/l1- FPHN		81, 81				28	Nutmeat	ND, ND, ND	≤ 0.02
Italy	33EC	Spray	0.796	991	2	0	Nutmeat	ND, ND, ND	< 0.02
1999		(backpack)		(0.08		7	Nutmeat	ND, ND, ND	< 0.02
Gentile Tonda				% ai)		14	Nutmeat	ND, ND, ND	< 0.02
Romana						21	Nutmeat	ND, ND, ND	≤ 0.02
99335/l1- FPHN						28	Nutmeat	ND, ND, ND	≤ 0.02
Italy	33EC		0.288	1000	2	0	Nutmeat	ND, ND, ND	< 0.02
1998				(0.028		7	Nutmeat	ND, ND, ND	< 0.02
Gentile Tonda				% ai)		14	Nutmeat	ND, ND, ND	≤ 0.02
Romana						21	Nutmeat	ND, ND, ND-	< 0.02
98059/l1- FPHN						28	Nutmeat	ND, ND, ND	< 0.02
Italy	33EC		0.2688	1000	2	0	Nutmeat	ND, ND, ND	< 0.02
1998				(0.028		7	Nutmeat	ND, ND, ND	< 0.02
Gentile Tonda				% ai)		14	Nutmeat	ND, ND, ND	≤ 0.02
Romana						21	Nutmeat	ND, ND, ND	< 0.02
98059/l1- FPHN						28	Nutmeat	ND, ND, ND	< 0.02

Table 77. Endosulfan residues in macadamia from supervised trials in Australia.

MACADAMIA	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial *Variety* Report	Form.	Method	g ai/hL	L/ha	No.	days	analysed	beta endosulfan, Endosulfan sulfate, mg/kg	Residues, mg/kg
Australia	EC	spray	52.5	1400	3	0		< 0.005,< 0.005,< 0.005	< 0.005
2001						1		< 0.005,< 0.005,< 0.005	< 0.005
Dorroughby						2		< 0.005,< 0.005,< 0.005	≤ 0.005
334						4		< 0.005,< 0.005,< 0.005	< 0.005
N° 1/10/532									
Australia	EC	spray	105	1400	3	0		< 0.005,< 0.005,< 0.005	< 0.005
2001						1		< 0.005,< 0.005,< 0.005	< 0.005
Dorroughby						2		< 0.005,< 0.005,< 0.005	< 0.005
334						4		< 0.005,< 0.005,< 0.005	< 0.005
N° 1/10/532									
Australia	EC	spray	52.5	1250	3	0		< 0.005,< 0.005,< 0.005	< 0.005
2001 Tolga						1		< 0.005,< 0.005,< 0.005	< 0.005
344						2		< 0.005,< 0.005,< 0.005	≤ 0.005
N° 1/10/532						4		< 0.005,< 0.005,< 0.005	< 0.005
Australia	EC	spray	52.5	1400	3	0		< 0.005,< 0.005,< 0.005	< 0.005
2001						1		< 0.005,< 0.005,< 0.005	< 0.005
Glasshouse Mtns						2		< 0.005,< 0.005,< 0.005	≤ 0.005
344/711						4		< 0.005,< 0.005,< 0.005	< 0.005
N° 1/10/532									

Table 78. Endosulfan residues in cotton from supervised trials in Spain and Greece.

COTTON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety,* report	Form.	Method	kg ai/ha / applic'n	L/ha	No.				
Spain 2002 tabladilla 02 R 172	CS	spray	0.840	550 0.15%	3	0 20	Bolls seeds	0.65, 0.56, 0.02 0.07, 0.09, 0.08	1.23 0.24
Spain 2002 *Roca* 02 R 172	CS	spray	0.840	550 0.15%	3	0 20	Bolls seeds	0.53, 0.46, < 0.02 < 0.02, < 0.02, < 0.02	0.99 < 0.02
Greece 2002 *Sig 125* 02 R 172	CS	spray	0.840	600 0.14%	3	0 28	Bolls seeds	0.93, 0.77, 0.09 < 0.02, 0.03, < 0.02	1.79 0.03
Greece 2002 *Sig 125* 02 R 172	CS	spray	0.840	600 0.14%	3	0 28	Bolls seeds	0.34, 0.35, 0.13 < 0.02, < 0.02, < 0.02	0.82 < 0.02
Spain 2002 *tabladilla* 02 R 170	33 EC	spray	0.84	550 0.15%	3	0 20	Bolls seeds	0.17, 0.29, 0.04 < 0.02, 0.02, 0.04	0.50 0.06
Spain 2002 *Roca* 02 R 170	33 EC	spray	0.84	550 0.15%	3	0 20	Bolls seeds	0.50, 0.52, 0.04 < 0.02, < 0.02, < 0.02	1.06 < 0.02
Greece 2002 *Sig 125* 02 R 170	33 EC	spray	0.84	600 0.14%	3	0 28	Bolls seeds	0.94, 1.30, 0.28 < 0.02, < 0.02, 0.04	2.52 0.04
Greece 2002 *Sig 125* 02 R 170	33 EC	spray	0.84	600 0.14%	3	0 28	Bolls seeds	0.12, 0.19, 0.11 < 0.02, < 0.02, < 0.02	0.42 < 0.02
Greece 2002 *Midas* 02 R 170	33 EC	spray	0.84	600 0.14%	3	0 28	Bolls seeds	1.40, 1.80, 0.21 < 0.02, < 0.02, < 0.02	3.41 < 0.02
Spain 2001 *Sonia* 02 R 170	CS	spray	0.84	1000 0.084%	3	0 7 14 21	Bolls Bolls Bolls Seeds	0.46, 0.36, 0.15 0.10, 0.08, 0.04 0.05, 0.04, 0.03 < 0.02, < 0.02, < 0.02	0.97 0.22 0.12 < 0.02
Spain 2001 *Sonia* 01 R 170	33 EC	spray	0.84	1000 0.084%	3	0 7 14 14	Bolls Bolls Bolls Seeds	0.18, 0.15, < 0.02 < 0.02, 0.03, 0.06 < 0.02, < 0.02, < 0.02 < 0.02, < 0.02, < 0.02	0.33 0.11 < 0.02 < 0.02
Spain 2001 *Sonia* 01 R 170	CS	spray	0.84	1000 0.084%	3	0 7 14 14	Bolls Bolls Bolls Seeds	0.67, 0.40, 0.02 0.34, 0.16, 0.07 0.09, 0.07, 0.03 < 0.02, < 0.02, < 0.02	1.09 0.57 0.19 < 0.02
Spain 2001 01 R 170	33 EC	spray	0.84	1000 0.084%	3	0 7 14 14	Bolls Bolls Bolls Seeds	1.10, 0.69, 0.16 0.05, 0.03, 0.17 0.04, 0.12, 0.27 < 0.02, < 0.02, < 0.02	1.95 0.25 0.43 < 0.02
Spain 2001 *bravada* 01 R 170	CS	spray	0.84	1000 0.084%	3	0 7 14 14	Bolls Bolls Bolls Seeds	0.89, 0.52, 0.40 0.33, 0.36, 0.17 0.25, 0.26, 0.17 < 0.02, < 0.02, < 0.02	1.81 0.86 0.68 < 0.02

COTTON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety,* report	Form.	Method	kg ai/ha / applic'n	L/ha	No.				
Spain 2001	CS	spray	0.49	1000	3	0	Bolls	0.54, 0.28, 0.04	0.86
				0.05%		7	Bolls	0.08, 0.07, 0.04	0.19
01 R 170						14	Bolls	0.10, 0.10, 0.06	0.26
						14	Seeds	< 0.02, < 0.02, < 0.02	< 0.02
Greece 2001	33 EC	spray	0.84	600	3	0	Bolls	0.14, 0.10, < 0.02	0.26
				0.14%		7	Bolls	< 0.02, 0.06, 0.05	0.13
01 R 170						14	Bolls	< 0.02, 0.02, < 0.02	0.02
						14	Seeds	< 0.02, < 0.02, < 0.02	< 0.02
Greece 2001	CS	spray	0.84	600	3	0	Bolls	< 0.02, < 0.02, < 0.02	< 0.02
SG 125				0.14%		7	Bolls	0.15, 0.18, 0.06	0.39
01 R 170						14	Bolls	0.10, 0.11, 0.02	0.23
						14	Seeds	0.04, 0.04, 0.03	0.11
Greece 2001	CS	spray	0.49	600	3	0	Bolls	0.05, 0.03, < 0.02	0.08
SG 125				0.08%		7	Bolls	1.40, 0.75,< 0.02	2.15
01 R 170						14	Bolls	1.00, 0.49, < 0.02	1.49
						14	Seeds	0.07, 0.06, < 0.02	0.13
Greece 2001	CS	spray	0.84	600	3	0	Bolls	0.12, 0.11, < 0.02	0.23
SG 125				0.14%		7	Bolls	2.20, 1.20, < 0.02	3.40
01 R 170						14	Bolls	2.3, 1.10, 0.04	3.44
						14	Seeds	0.29, 0.20, < 0.02	0.49
Australia 1974*Delta pine* PSR 99/011	35 EC	spray	0.74	10-20 3.7-7.4%	13	44	Seeds		≤ 0.02
Australia 1974*Delta pine* PSR 99/011	35 EC	spray	0.74	11 6.73%	15	25	Seeds		0.035
Spain 1992	35EC	spray	0.63	600	1	0	Seeds		2.99
Crema 111				0.105%		3	Seeds		0.78
PSR 99/011						7	Seeds		0.27
						15	Seeds		0.05
Spain 1992	35EC	spray	0.63	600	1	0	Seeds		2.96
Stoneville 506				0.105%		3	Seeds		0.35
PSR 99/011						7	Seeds		0.30
						15	Seeds		0.05
Spain 1992	35EC	spray	1.00	956	1	0	Seeds		0.91
Crema 111				0.105%		3	Seeds		0.20
PSR 99/011						7	Seeds		0.17
						15	Seeds		0.02
Spain 1992	35EC	spray	1.00	956	1	0	Seeds		0.86
Cocker 310				0.105%		3	Seeds		0.22
PSR 99/011						7	Seeds		0.22
						14	Seeds		0.25
Spain 1992	35EC	spray	1.00	950	1	0	Seeds		0.79
Stoneville				0.105%		3	Seeds		0.62
PSR 99/011						7	Seeds		0.25
						14	Seeds		0.03
Spain 1992	35EC	spray	1.00	950	1	0	Seeds		0.68
Crema 111				0.105%		3	Seeds		0.10
PSR 99/011						7	Seeds		0.10
						14	Seeds		0.12
Spain 1992	35EC	spray	1.11	1058	1	0	Seeds		1.39
Max 9				0.105%		3	Seeds		0.24
PSR 99/011						7	Seeds		0.11
						14	Seeds		0.07
Spain 1992	35EC	spray	111	1058	1	0	Seeds		1.83
Cocker 310				0.105%		3	Seeds		0.40
PSR 99/011						7	Seeds		0.11
						14	Seeds		0.10

Table 79. Endosulfan residues in cocoa from supervised trials in Brazil, Ghana and Ivory Coast.

COCOA	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial *Variety*	Form	Method	kg ai/ha / applic'n	L/ha	No.	days	analysed	beta endosulfan, Endosulfan sulfate, mg/kg	Residues mg/kg
Brazil1982	35EC	Foliar Spray	0.35	120	2	30	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Forasteiro		Interval 21 d		(0.292%)		45	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
(A25749)									
Brazil1982	35EC	Foliar Spray	0.70	120	2	30	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Forasteiro		Interval 21 d		(0.583%)		45	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Brazil1982	35EC	Foliar Spray	0.70	120	2	30	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Forasteiro		Interval 21 d		(0.583%)		45	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
(A25748)									
Brazil1982	35EC	Foliar Spray	0.35	120	2	30	Fruit	< 0.01, < 0.01, < 0.01	< 0.01
Forasteiro		Interval 21 d		(0.292%)		45	Fruit	< 0.01, < 0.01, --	< 0.01
(A25747)									
Ghana	CS*	Spray,	0.243,	58, 66	2	0	Beans	0.01, < 0.01, ND	0.01
Ahensan		BBCH 67-81	0.273	(1.25, 1.24		7	Beans	< 0.01, < 0.01, ND	≤ 0.01
2002		and 66-84		% v/v)		13/20	Beans	ND, ND, ND	< 0.01
Several hybrids		(Spray #1: 42				13	Ferm.beans	< 0.01, ND, ND	< 0.01
AF1-FPCC		Days before				13	Dry beans	ND, ND, ND	< 0.01
20013056/		harvest				20	Ferm.beans	< 0.01, < 0.01, ND	< 0.01
C032568		Spray #2: 13				27	Beans	ND, ND, ND	≤ 0.01
		day PHI)				27	Ferm.beans	< 0.01, < 0.01, ND	< 0.01
						27	Dry beans	< 0.01, ND, ND	< 0.01
Ghana	500EC	Spray,	0.256,	62, 63	2	0/7/13	Beans	ND, ND, ND	≤ 0.01
Ahensan		BBCH 67-81	0.263	58, 66		13/20	Ferm.beans	ND, ND, ND	< 0.01
2002		and 66-85		(0.78,		13	Dry beans	ND, ND, ND	< 0.01
Several hybrids		(42 d and		0.79%)		20/27	Beans	ND, ND, ND	< 0.01
20013056/		13 d before				20/27	Dry beans	ND, ND, < 0.01	< 0.01
AF1-FPCC		harvest				27	Ferm.beans	ND, ND, < 0.01	< 0.01
Ghana	CS*	Spray,	0.26,	62, 62	2	0	Beans	< 0.01, ND, ND	< 0.01
			0.26						
Fumso		BBCH 67-77		(1.25% v/v)		7	Beans	0.02, 0.01, ND	0.03
2002		and 84				14	Beans	0.01, < 0.01, ND	0.01
Amazon		(Spray 1: 41				14	Ferm.beans	< 0.01, < 0.01, ND	< 0.01
20013056/		Days before				14	Dry beans	0.01,< 0.01, ND	0.01
AF1-FPCC		harvest				20/27	Beans	ND, ND, ND	< 0.01
		Spray 2: 14				20	Ferm.beans	< 0.01, ND, ND	< 0.01
		day PHI)				20	Dry beans	ND, ND, < 0.01	< 0.01
						27	Ferm.beans	< 0.01, < 0.01, ND	< 0.01
						27	Dry beans	< 0.01, ND, < 0.01	< 0.01
Ghana	500EC	Spray	0.259,	62, 60	2	0	Beans	ND, ND, ND	< 0.01
Fumso		BBCH 67-77	0.25	(0.79% v/v)		7/14	Beans	ND, ND, ND	≤ 0.01
2002		and 84				14/20:	Ferm.beans	ND, ND, ND	< 0.01
Amazon		(41 d and 14				14	Dry beans	ND, ND, ND	< 0.01
20013056/		d before				20/27	Beans	ND, ND, ND	< 0.01
AF1-FPCC		harvest)				20/27	Dry beans	ND, ND, < 0.01	< 0.01
						27	Ferm.beans	ND, ND, ND	< 0.01
Ghana	CS*	Spray	0.246,	59, 61	2	0	Beans	0.02, < 0.01, ND	0.02
Tafo		BBCH 67-84	0. 256	(1.24,		6	Beans	< 0.01, < 0.01, ND	≤ 0.01
				1.25%					
2002		and 66-82		v/v)		13/27	Beans	ND, ND, ND	< 0.01
Hybrids		(40 d and 13				13	Ferm.beans	ND, ND, < 0.01	< 0.01
20013056/		d before				13	Dry beans	ND, ND, < 0.01	< 0.01
AF1-FPCC		harvest)				20	Beans	< 0.01, ND, ND	< 0.01
						20/27	Ferm.beans	< 0.01, ND, < 0.01	< 0.01
						20/27	Dry beans	ND, ND, < 0.01	< 0.01

COCOA	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial *Variety*	Form	Method	kg ai/ha / applic'n	L/ha	No.	days	analysed	beta endosulfan, Endosulfan sulfate, mg/kg	Residues mg/kg
Ghana	500EC	Spray	0. 254	61, 61		0	Beans	< 0.01, < 0.01, ND	< 0.01
Tafo		BBCH 67-84	0.255,	(0.79,		6/13	Beans	ND, ND, ND	≤ 0.01
				0.78%					
2002		and 66-86				13	Ferm.beans	ND, ND, ND	< 0.01
Hybrids		(40 d and 13				13/20	Dry beans	ND, ND, < 0.01	< 0.01
20013056/		d before				20/27	Beans	ND, ND, ND	≤ 0.01
AF1-FPCC		harvest)				20/27	Ferm.beans	ND, ND, < 0.01	< 0.01
						27	Dry beans	ND, ND, 0.02	0.02
Ghana	CS*	Spray	0.250,	60, 58	2	0	Beans	< 0.01, < 0.01, ND	< 0.01
Bososo		BBCH 67-76	0. 243	(1.24,		7	Beans	< 0.01, ND, ND	≤ 0.01
				1.25%					
2002		and 66-85		v/v)		14/21	Beans	ND, ND, ND	< 0.01
Several hybrids		(42 d and				14/21	Ferm.beans	< 0.01, ND, < 0.01	< 0.01
		14d							
20013056/		before				14/21	Dry beans	ND, ND, < 0.01	< 0.01
AF1-FPCC		harvest)				27	Beans	ND, ND, ND	< 0.01
						27	Ferm.beans	< 0.01, ND, < 0.01	< 0.01
						27	Dry beans	ND, ND, < 0.01	< 0.01
Ghana	500EC	Spray	0.247,	59, 65	2	0/7/14	Beans	ND, ND, ND	≤ 0.01
Bososo		BBCH 67-76	0. 272	(0.79%,		14/21	Ferm.beans	ND, ND, < 0.01	< 0.01
				v/v)					
2002		and 66-85				14/21	Dry beans	ND, ND, < 0.01	< 0.01
Several hybrids		(42 d and				21/27	Beans	ND, ND, ND	≤ 0.01
		14d							
20013056/		before				27	Ferm.beans	ND, ND, 0.01	0.01
AF1-FPCC		harvest)				27	Dry beans	ND, ND, 0.01	0.01
Ivory Coast	CS*	Spray	0.256,	60, 62	2	0	Beans	< 0.01, < 0.01, ND	< 0.01
Yakassé Mé		BBCH 59-73	0.262	(1.24,		0	Ferm.bean	ND, ND, < 0.01	< 0.01
				1.25%					
2001		and 73-89		v/v)		2	Beans	0.02, < 0.01, ND	0.02
Criollo		(41 d and				7	Beans	0.02, 0.01, ND	0.03
		14d							
Forasteiro		before				14	Beans	< 0.01, ND, < 0.01	< 0.01
20013056/		harvest)				14	Ferm.bean	< 0.01, < 0.01, < 0.01	< 0.01
IC1-FPCC						14	Dry beans	ND, ND, < 0.01	< 0.01
Ivory Coast	500EC	Spray	0.279,	63, 63	2	0	Beans	< 0.01, < 0.01, < 0.01	< 0.01
Yakassé Mé		BBCH 59-73	0.27	(0.84,		0	Ferm.bean	ND, ND, ND	< 0.01
				0.83%					
2001		and 73-89		v/v)		2	Beans	ND, < 0.01, ND	≤ 0.01
Criollo /		(41 d and				7/14	Beans	ND, ND, ND	< 0.01
		14d							
Forasteiro		before				14	Ferm.bean	ND, ND, < 0.01	< 0.01
20013056/		harvest)				14	Dry beans	ND, ND, < 0.01	< 0.01
IC1-FPCC									
Ivory Coast	CS*	Spray	0.25,	58, 64	2	0/14	Beans	ND, ND, ND	< 0.01
			0.25						
Akoupe		BBCH 61-73		(1.26% v/v)		0	Ferm.bean	ND, ND, ND	< 0.01
2001		and 76-89				3	Beans	0.03, 0.02, ND	0.05
Frances		(39 d and				7	Beans	0.03, 0.03, ND	0.06
		14d							
20013056/		before				14	Ferm.bean	< 0.01, < 0.01, ND	< 0.01
IC1-FPCC		harvest)				14	Dry beans	ND, < 0.01, < 0.01	< 0.01
Ivory Coast	500EC	Spray	0.26,	58, 61	2	0	Beans	< 0.01, < 0.01, ND	< 0.01
			0.26						
Akoupe		BBCH 61-73		(0.83% v/v)		0	Ferm.bean	ND, < 0.01, < 0.01	< 0.01
2001		and 76-89				3/14	Beans	ND, ND, ND	≤ 0.01
Frances		(39 d and				7	Beans	< 0.01, < 0.01, ND	< 0.01
		14d							
20013056/		before				14	Ferm.bean	ND, ND, < 0.01	< 0.01
IC1-FPCC		harvest)				14	Dry beans	ND, ND, < 0.01	< 0.01

COCOA	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial *Variety*	Form	Method	kg ai/ha / applic'n	L/ha	No.	days	analysed	beta endosulfan, Endosulfan sulfate, mg/kg	Residues mg/kg
Ivory Coast	CS*	Spray,	0.24,	56, 61	2	0	Beans	0.01, 0.01, ND	0.02
Monteso		BBCH 61-74	0.26	(1.27% v/v)		0	Ferm.bean	ND, ND, ND	< 0.01
2001		and 73-89				3	Beans	0.02, 0.01, ND	0.03
Ghana		(40 d and				7	Beans	< 0.01, < 0.01, ND	< 0.01
		14d							
20013056/		before				14	Beans	ND, ND, ND	< 0.01
IC1-FPCC		harvest)				14	Ferm.bean	< 0.01, < 0.01, < 0.01	< 0.01
						14	Dry beans	ND, ND, ND	< 0.01
Ivory Coast	500EC	Spray	0.25,	57, 63	2	0	Beans	ND, < 0.01, ND	< 0.01
Monteso		BBCH 61-74	0.28	(0.83% v/v)		0/14	Ferm.bean	ND, ND, ND	< 0.01
2001		and 73-89				3	Beans	ND, < 0.01, ND	≤ 0.01
Ghana		(40 d and				7/14	Beans	ND, ND, ND	< 0.01
		14d							
20013056/		before				14	Dry beans	ND, ND, ND	< 0.01
IC1-FPCC		harvest)							
Ivory Coast	CS*	Spray,	0.24,	57, 58	2	0	Beans	ND, ND, < 0.01	< 0.01
			0.25						
Akoupe		BBCH 61-74		(1.26% v/v)		0	Ferm.bean	ND, ND, < 0.01	< 0.01
2001		and 76-89				3/14	Beans	ND, ND, ND	< 0.01
Ghana		(40 d and				7	Beans	0.01, < 0.01, ND	0.01
		14d							
20013056/		before				14	Ferm.bean	ND, ND, ND	< 0.01
IC1-FPCC		harvest)				14	Dry beans	ND, ND, ND	< 0.01
Ivory Coast	500EC	Spray	0.25,	57, 59	2	0	Beans	ND, < 0.01, ND	< 0.01
			0.26						
Akoupe		BBCH 61-74		(0.83% v/v)		0/14	Ferm.bean	ND, ND, ND	< 0.01
2001		and 76-89				3/14	Beans	ND, ND, ND	≤ 0.01
Ghana		(40 d and				7	Beans	ND, < 0.01, ND	<.0.01
		14d							
20013056/		before				14	Dry beans	ND, ND, ND	< 0.01
IC1-FPCC		harvest)							
Ivory Coast	50EC	Foliar Spray	0.25	40	2	28	Seed	< 0.01, < 0.01, < 0.01	< 0.01
1983		Interval 21 d		(0.625%)					
PSR94/034									
(A28024)									
Ivory Coast	50EC	Foliar Spray	0.25	40	2	10	Seed	< 0.01, < 0.01,0.01	0.01
1983		Interval 21 d		(0.625%)					
Bingerville									
A28025)									
Ivory Coast	50EC	Foliar Spray	0.25	40	2	2	Seed	< 0.01,0.05,0.03	0.08
1983				(0.625%)					
Bingerville		(A28026)							

Table 80. Endosulfan residues in coffee from supervised trials in Brazil, Columbia, Guatemala and Mexico.

COFFEE	Application					PHI	Sample	Residues of alpha,	Total
Country, Year of trial *Variety, report*	Form	Method	kg ai/ha/ applic'n	L/ha	No.	days	analysed	beta endosulfan, Endosulfan sulfate, mg/kg	Residues mg/kg
Brazil	35EC	Spray,	0.70	500	3	32	Green bean	< 0.01,< 0.01,0.01	0.01
1994		~ 90, 60, 30		(0.14% ai)					
Catuai		days before							
AA930040		harvest.							
Brazil	35EC		0.70	(0.14%	3	33	Green bean	< 001,0.02,0.02	0.04
1994 *Catuai*				ai)				0.02,0.04,0.05	0.11
AA930040								mean	0.08
Brazil	35EC		0.70	(0.14%	3	33	Green bean	0.02,0.04,0.03	0.09
1994 *Catuai*				ai)				0.01,0.02,0.01	0.04
AA930040								mean	0.06

COFFEE	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Brazil 1994 *Catuai* *AA930040*	35EC	Spray Interval 30 d	2.10	(0.42% ai)	3	33	Green bean Ground roast coffee Instant coffee	0.04, 0.08, 0.04 < 0.01, < 0.01, < 0.01	0.16 < 0.01 < 0.01
Colombia1994 *Colombia* *AA930040*	35EC		0.70	(0.14% ai)	3	30	Green bean	< 0.01,< 0.01,< 0.01	≤ 0.01
Colombia1994 *Colombia* *AA930040*	35EC		0.70	(0.14% ai)	3	30	Green bean	< 0.01,< 0.01,< 0.01	≤ 0.01
Colombia1994 *Colombia* *AA930040*	35EC		0.70	(0.14% ai)	3	30	Green bean	< 0.01,< 0.01,< 0.01	≤ 0.01
Colombia1994 *AA930040*	35EC	Spray Interval 30 d	2.10	(0.42% ai)	3	33	Green bean roast coffee Inst. coffee	< 0.01,< 0.01,< 0.01 < 0.01,< 0.01,< 0.01 < 0.01,< 0.01,< 0.01	< 0.01 < 0.01 < 0.01
Guatemala1994 *Catimor* *AA930040*	35EC		0.70	(0.14% ai)	3	32	Green bean	0.02,0.01,0.04 0.04,0.02,0.04 mean	0.07 0.10 0.09
Guatemala 1994 *Caturra* *AA930040*	35EC		0.70	(0.14% ai)	3	32	Green bean	< 0.01,< 0.01,0.02 < 0.01,< 0.01,0.03 mean	0.02 0.03 0.03
Mexico 1994 Veracruz *Catimor* *AA930040*	35EC		0.70	(0.14% ai)	3	31	Green bean	< 0.01,< 0.01,0.02 < 0.01,< 0.01,0.02 mean	0.02 0.02 0.02
Mexico 1994 Veracruz *Tipica* *AA930040*	35EC		0.70	(0.14% ai)	3	31	Green bean	< 0.01,< 0.01,0.02 < 0.01,< 0.01,0.02 mean	0.02 0.02 0.02

Table 81. Endosulfan residues in tea from supervised trials in India.

TEA	Application					PHI days	Sample analysed	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha / applic'n	L/ha	No.			
India 1971 Cinchona (elev. 3000ft Above MSL) *(A31719)* *PSR94/028*	35EC	Spray	0.88	350 (0.250 % ai)	3	1 7 15 1 7 15 1 7 15 1	Dried green tea Dried green tea Dried green tea Proc. Black tea Proc. Black tea Proc. Black tea Tea infusion from green tea Tea infusion from green tea Tea infusion from green tea Tea infusion from black tea	6.0-18.2 2.1-4.8 0.7-1.2 8.4-29.6 16.3-35.0 2.4-11.4 0.013 0.016 0.006-007 0.014
India 1971 Akkamalai (elev. 5000ft Above MSL) *(A31719)* *PSR94/028*	35EC	Spray	0.44	350 (0.125 % ai)	3	1 7 15 1 7 15 1 1 1	Dried green tea Dried green tea Dried green tea Proc. Black tea Proc. Black tea Proc. Black tea Tea infusion from green tea Tea infusion from green tea Tea infusion from black tea	6.2-37.5 16.2-24.1 2.5-4.0 15.0-36.4 4.0-12.7 2.7-3.3 0.027 0.041 0.086

TEA	Application					PHI days	Sample analysed	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha / applic'n	L/ha	No.			
India	35EC	Spray	0.88	350	3	1	Dried green tea	14.4-49.7
1971				(0.250		7	Dried green tea	3.9-13.6
Akkamalai				% ai)		15	Dried green tea	1.9-5.3
(elev. 5000ft								
Above MSL)						1	Proc. Black tea	31.1-84.0
(A31719)						7		6.8-14.8
PSR94/028						15		3.2-9.9
						1	Tea infusion from green tea	0.101
						1	Tea infusion from green tea	0.062
						1	Tea infusion from black tea	0.107
India	35EC	Spray	0.88	100	3	1	Dry tea	19.7-25.6
1970				(0.875		2	Dry tea	15.4-18.1
Tocklai Exptl				% ai)		4	Dry tea	4.9-8.4
Sta						7	Dry tea	2.3-4.2
(A31718)								
PSR94/028						1	Tea infusion	0.028-0.030
						2	Tea infusion	0.014-0.017
						4	Tea infusion	0.003-0.007
						7	Tea infusion	0.001-0.002
India	35EC	Spray	1.75	100	3	1	Dry tea	93-108
1970				(1.750		2	Dry tea	22.9-42.7
Tocklai Exptl				% ai)		4	Dry tea	6.3-9.0
Sta						7	Dry tea	2.1-2.3
(A31718)								
PSR94/028						1	Tea infusion	0.097-0.158
						2	Tea infusion	0.026-0.032
						4	Tea infusion	0.008-0.016
						7	Tea infusion	0.001-0.002
India	35EC	Spray	0.44	350	3	1	Dried green tea	2.2-4.2
1971				(0.125% ai)		7	Dried green tea	1.1-5.0
Cinchona						15	Dried green tea	0.7-1.2
(elev. 3000ft						1	Proc. Black tea	7.8-15.6
Above MSL)						7	Proc. Black tea	4.5-16.1
(A31719)						15	Proc. Black tea	0.8-1.6
PSR94/028						1	Tea infusion from green tea	0.016
						7	Tea infusion from green tea	0.006
						15	Tea infusion from green tea	0.003
						1	Tea infusion from black tea	0.043

Table 82. Endosulfan residues in sugar beet leaves and head from supervised trials in Italy.

SUGARBEET	Application					PHI (Days)	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Italy		Spray	0.630	600	2	0	Lves+ hd	3.40, 2.50, 0.29	6.19
1998		sprayer, hand)		(0.105% ai)		27	Lves+ hd	0.02, 0.04, 0.30	0.36
Dorotea		Interval 30 d							
ER 98 ECS746		BBCH39							
Italy		Spray	0.630	600	2	0	Lves+ hd	4.10, 2.70, 0.25	7.05
1998		sprayer, hand)		(0.105% ai)		26	Lves+ hd	0.11, 0.14, 0.57	0.82
Adige		Interval 33d							
ER 98 ECS 746		BBCH39							
Italy		Spray	0.630	300,	2	0	Lves+ hd	3.60, 2.00, 0.32	5.92
1998		sprayer, hand)		600		28	Lves+ hd	< 0.02, < 0.02, 0.31	0.31
Alesia		Interval 32d		(0.105% ai)					
ER 98 ECS 746		BBCH38/39							

Italy 1998 *Monodoro* *ER 98 ECS 746*		Spray sprayer, hand) Interval 32 d BBCH 38/39	0.630	300, 600 (0.10% ai)5	2	0 28	Lves+ hd Lves+ hd	2.90 1.70 0.41 < 0.02, < 0.02, 0.28	5.01 0.28
Italy 1997 *Adige* *ER 97 ECS 746*	35EC	Spray sprayer, hand) Interval 20 d BBCH 39	0.630	600 (0.105 % ai)	2	0 14 28	Leaves+ hd Leaves+ hd Leaves+ hd	4.40 2.80 1.00 0.13, 0.19, 0.49 0.04, 0.09, 0.49	8.20 0.81 0.62
Italy 1997 *Monodoro* *ER 97 ECS 746*	35EC	Spray sprayer, hand) Interval 20 d BBCH 39	0.630	600 (0.105 % ai)	2	0 14 28	Leaves+ hd Leaves+ hd Leaves+ hd	4.40 2.80 0.54 0.04, 0.08, 0.57 0.02, 0.05, 0.35	7.74 0.69 0.42
Italy 1997 *Formula* Romagna *ER 97 ECS 746*	35EC	Spray sprayer, hand) Interval 20 d BBCH 39,49	0.630	600 (0.105 % ai)	2	0 14 28	Leaves+ hd Leaves+ hd Leaves+ hd	2.60 1.70 0.20 0.05, 0.11, 0.59 < 0.02, 0.03, 0.11	4.50 0.75 0.14
Italy 1997 *Rizor* *ER 97 ECS 746*	35EC	Spray sprayer, hand) Interval 20 d BBCH 39,49	0.630	600 (0.105 % ai)	2	0 14 28	Leaves+ hd Leaves+ hd Leaves+ hd	4.60 2.90 0.44 0.07, 0.14, 0.78 0.02, 0.04, 0.17	7.94 0.99 0.23
Italy 1997 *Bianca* *ER 97 ECS 746*	35EC	Spray sprayer, hand) Interval 20 d BBCH 39	0.630	600 (0.105 % ai)	2	0 14 28	Leaves+hd Leaves+hd Leaves+hd	3.40 2.30 0.39 0.13, 0.21, 0.53 0.03, 0.03, 0.40	6.09 0.87 0.46

Table 83. Endosulfan residues in forage and vines beans from supervised trials in USA.

VINE BEANS	Application					PHI	Sample	Residues of alpha + beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety*	Form.	Method	kg ai/ha/ applic'n	L/ha	No.	(Days)	analysed		
USA1965 NY Lima beans M-1610	50W	Interval 37, 7 d	0.56		3	11 20 32	Bean forage Bean forage Bean forage	2.11, 2.09 0.97, 1.75 1.56, 3.86	4.20 2.72 5.42
USA 1965 NY Snap beans M-1592	50WP	Spray Interval 2, 8 d	0.56		3	0 10 20 28 35 40	Vines Vines Vines Vines Vines Vines	50, 2.3 2.27, 1.65 0.96, 3.15 0.35, 0.81 0.95, 0.76 0.29, 0.41	52.3 3.92 4.11 1.16 1.71 0.70
USA 1965 NY M-1592	50WP	Spray Interval 2, 8 days	1.12		3	0 10 20 23 35 40	Vines Vines Vines Vines Vines Vines	87.5, ND 5.4, 4.31 1.08, 3.95 0.68, 2.31 0.63, 1.54 0.61, 1.53	87.5 9.71 5.03 2.99 2.17 2.14
USA 1965 NY Lima beans M-1610	50WP	Spray Interval 37, 7 d	0.56		3	0 11 20 32	Bean forage Bean forage Bean forage Bean forage	40.3, 1.62 5.80, 4.22 3.99, 3.70 4.72, 9.16	41.92 10.02 7.69 13.88

Table 84. Endosulfan residues in pea hay from supervised trials in Australia.

PEA HAY	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues, mg/kg
Country, Year of trial *Variety* Report	Form.	Method	kg ai/ha/ applic'n	L/ha	No.				
Australia *2000* Lockyer Valley *epic* *1/10/557*	EC	SPRAY	0.73	500	3	 7 14		 0.42, 1.60, 1.105 0.30, 0.81, 1.10	 3.12 2.21
Australia *2000* Lockyer Valley *epic* *1/10/557*	EC	SPRAY	1.46	500	3	7 14 7c		0.81,350, 3.80 0.33, 1.10, 2.40 0.006,0.005, < 0.005	8.11 3.83 0.011
Australia *2000* Werribee *melbourne market*	EC	SPRAY	0.73	500	3	28		0.015, 0.041, 0.066	0.122

Table 85. Endosulfan residues in cocoa shell from supervised trials in Ghana and Ivory Coast.

COCOA	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha / applic'n	L/ha	No.				
Ghana2002 Ahensan *Several hybrids* *20013056/* C032568	CS*	Spray, BBCH 67-81 and 66-84	0.243, 0.273	58, 66 (1.25, 1.24 % v/v)	2	0 7 13 20 27	Shell Shell Shell Shell Shell	0.13, 0.07, < 0.01 0.09, 0.04, ND 0.15, 0.08, < 0.01 0.12, 0.06, < 0.01 0.07, 0.03, ND	0.20 0.13 0.23 0.18 0.10
Ghana2002 Ahensan *Several hybrids* *20013056/*	500EC	Spray, BBCH 67-81 and 66-85	0.256, 0.263	62, 63 58, 66 (0.78, 0.79%)	2	0 7 13 20	Shell Shell Shell Shell	0.06, 0.06, < 0.01 ND, ND, < 0.01 < 0.01, ND, < 0.01 < 0.01, ND, < 0.01	0.12 < 0.01 < 0.01 < 0.01
Ghana2002 Fumso *Amazon* *20013056/*	CS*	Spray, BBCH 67-77 and 84	0.26, 0.26	62, 62 (1.25% v/v)	2	0 7 14 20 27	Shell Shell Shell Shell Shell	0.09, 0.05, < 0.01 0.24, 0.13, < 0.01 0.11, 0.08, < 0.01 0.07, 0.03, < 0.01 0.10, 0.06, < 0.01	0.14 0.37 0.19 0.10 0.16
Ghana2002 Fumso *Amazon* *20013056/*	500EC	Spray , BBCH 67-77 and 84	0.259, 0.25	62, 60 (0.79% v/v)	2	0 7 14 20	Shell Shell Shell Shell	0.04, 0.05, < 0.01 ND, ND, ND ND, < 0.01, ND ND, < 0.01, ND	0.09 < 0.01 < 0.01 < 0.01
Ghana2002 Tafo *Hybrids* *20013056/*	CS*	Spray, BBCH 67-84 and 66-82	0.246, 0. 256	59, 61 (1.24, 1.25% v/v)	2	0 6 13 20	Shell Shell Shell Shell	0.26, 0.15, < 0.01 0.19, 0.10, < 0.01 0.25, 0.12, 0.01 0.09, 0.04, < 0.01	0.41 0.29 0.38 0.13
Ghana2002 Tafo *Hybrids* *20013056/*	500EC	Spray, BBCH 67-84 And 66-86	0.255, 0. 254	61, 61 (0.79, 0.78% v/v)	2	0 6 13 20	Shell Shell Shell Shell	0.09, 0.08, ND ND, 0.01, ND ND, < 0.01, ND ND, < 0.01, ND	0.17 0.01 < 0.01 < 0;01
Ghana2002 Bososo *Several hybrids* *20013056/*	CS*	Spray, BBCH 67-76 and 66-85	0.250, 0. 243	60, 58 (1.24, 1.25% v/v)	2	0 7 14 21	Shell Shell Shell Shell	0.15, 0.07, ND 0.19, 0.10, < 0.01 0.06, 0.03, < 0.01 0.05, 0.03, < 0.01	0.22 0.29 0.09 0.08
Ghana Bososo 2002	500EC	Spray, BBCH 67-76 and 66-85	0.247, 0. 272	59, 65 (0.79%, v/v)	2	0 7 14	Shell Shell Shell	0.05, 0.06, ND ND, ND, ND ND, ND, < 0.01	0.11 < 0.01 < 0.01

COCOA	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety, report*	Form.	Method	kg ai/ha / applic'n	L/ha	No.				
Ivory Coast	CS*	Spray,	0.256,	60, 62	2	0	Shell	0.06, 0.03, ND	0.09
Yakassé Mé		BBCH59-73	0.262	(1.24, 1.25%		2	Shell	0.05, 0.03, ND	0.08
2001		and73-89		v/v)		7	Shell	0.03, 0.01, ND	0.04
Criollo /						14	Shell	0.04, 0.01, < 0.01	0.05
Ivory Coast	500EC	Spray,	0.279,	63, 63	2	0	Shell	0.07, 0.07, 0.02	0.16
Yakassé Mé		BBCH 59-73	0.27	(0.84, 0.83%		2	Shell	ND, < 0.01, ND	< 0.01
2001		and 73-89		v/v)		7	Shell	ND, < 0.01, < 0.01	< 0.01
Ivory Coast	CS*	Spray,	2x0.25,	58, 64	2	0	Shell	0.11, 0.07, ND	0.18
Akoupe		BBCH 61-73		(1.26% v/v)		3	Shell	0.07, 0.04, ND	0.11
2001		and 76-89				7	Shell	0.07, 0.05, < 0.01	0.12
Frances						14	Shell	0.02, < 0.01, ND	0.02
Ivory Coast	500EC	Spray,	2x0.26	58, 61	2	0	Shell	0.02, 0.02, ND	0.04
Akoupe		BBCH 61-73		(0.83% v/v)		3	Shell	ND, < 0.01, ND	< 0.01
2001		and 76-89				7	Shell	ND, < 0.01, ND	< 0.01
Frances						14	Shell	ND, ND, ND	< 0.01
Ivory Coast	CS*	Spray,	0.24,	56, 61	2	0	Shell	0.04, 0.02, ND	0.06
Monteso		BBCH 61-74	0.26	(1.27% v/v)		3	Shell	0.07, 0.04, ND	0.11
2001		and 73-89				7	Shell	0.04, 0.02, ND	0.06
Ghana						14	Shell	0.01, < 0.01, ND	0.01
Ivory Coast	500EC	Spray	0.25,	57, 63	2	0	Shell	0.01, 0.01, ND	0.02
Monteso		, BBCH 61-74	0.28	(0.83% v/v)		3	Shell	ND, < 0.01, ND	< 0.01
Ivory Coast	CS*	Spray,	0.24, 0.25	57, 58	2	0	Shell	0.04, 0.02, ND	0.06
Akoupe		BBCH 61-74		(1.26% v/v)		3	Shell	< 0.01, < 0.01, ND	< 0.01
						7	Shell	0.02, < 0.01, ND	0.02
Ivory Coast	500EC	Spray	0.25, 0.26	57, 59	2	0	Shell	0.01, 0.01, ND	0.02
Akoupe		, BBCH 61-74		(0.83% v/v)		3	Shell	ND, ND, ND	< 0.01

Table 86. Endosulfan residues in cotton lint from supervised trials in Europe.

COTTON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety,* repor*t*	Form.	Method	kg ai/ha / applic'n	L/ha	No.				
Spain 2002	CS	spray	0.840	550	3	0	Bolls	0.65, 0.56, 0.02	1.23
tabladilla				0.15%		20	Lint	0.37, 0.43, 0.52	1.32
Spain 2002	CS	spray	0.840	550	3	0	Bolls	0.53, 0.46, < 0.02	0.99
Roca 02 R 172				0.15%		20	Lint	0.09, 0.10, 0.07	0.26
Greece 2002	CS	spray	0.840	600	3	0	Bolls	0.93, 0.77, 0.09	1.79
Sig 12502R172				0.14%		28	Lint	0.16, 0.23 0.17	0.56
Greece 2002	CS	spray	0.840	600	3	0	Bolls	0.34, 0.35, 0.13	0.82
Sig 125 2R172				0.14%		28	Lint	0.02, 0.02, 0.02	0.06
Spain 2002	33 EC	spray	0.84	550	3	0	Bolls	0.17, 0.29, 0.04	0.50
tabladilla 170				0.15%		20	Lint	0.06, 0.13, 0.44	0.63
Spain 2002	33 EC	spray	0.84	550	3	0	Bolls	0.50, 0.52, 0.04	1.06
Roca 02R170				0.15%		20	Lint	0.02, 0.10, 0.16	0.28
Greece 2002	33 EC	spray	0.84	600	3	0	Bolls	0.94, 1.30, 0.28	2.52
Sig 12502R170				0.14%		28	Lint	0.02, 0.09 0.23	0.34
Greece 2002	33 EC	spray	0.84	600	3	0	Bolls	0.12, 0.19, 0.11	0.42
Sig 12502R170				0.14%		28	Lint	< 0.02,< 0.02, 0.03	0.03
Greece 2002	33 EC	spray	0.84	600	3	0	Bolls	1.40, 1.80, 0.21	3.41
midas02R170				0.14%		28	Lint	0.10, 0.35, 0.45	0.90
Spain 2001	CS	spray	0.84	1000	3	0	Bolls	0.46, 0.36, 0.15	0.97
Sonia 02R170				0.084%		21	Lint	0.15, 0.11, 0.16	0.42
Spain 2001	33 EC	spray	0.84	1000	3	0	Bolls	0.18, 0.15, < 0.02	0.33
sonia01R170				0.084%		14	Lint	< 0.02, 0.04, 0.09	0.13
Spain 2001	CS	spray	0.84	1000	3	0	Bolls	0.67, 0.40, 0.02	1.09
sonia01R170				0.084%		14	Lint	0.03, 0.02, 0.05	0.10

COTTON	Application					PHI days	Sample analysed	Residues of alpha, beta endosulfan, Endosulfan sulfate, mg/kg	Total Residues mg/kg
Country, Year of trial *Variety,* report	Form.	Method	kg ai/ha / applic'n	L/ha	No.				
Spain 2001 01 R 170	33 EC	spray	0.84	1000 0.084%	3	0 14	Bolls Lint	1.10, 0.69, 0.16 < 0.02, < 0.02, 0.07	1.95 0.07
Spain 2001 *bravada 170*	CS	spray	0.84	1000 0.084%	3	0 14	Bolls Lint	0.89, 0.52, 0.40 0.16, 0.34, 0.36	1.81 0.86
Spain 2001 01 R 170	CS	spray	0.49	1000 0.05%	3	0 14	Bolls Lint	0.54, 0.28, 0.04 0.16, 0.33, 0.32	0.86 0.81
Greece 2001 *SG 1251R170*	CS	spray	0.84	600 0.14%	3	0 14	Bolls Lint	< 0.02, < 0.02, < 0.02 0.08, 0.09, 0.04	< 0.02 0.21
Greece 2001 *SG 125 01R170*	CS	spray	0.84	600 0.14%	3	0 14	Bolls Lint	0.12, 0.11, < 0.02 1.90, 1.10, 0.05	0.23 3.05
Greece 2001 *SG 12501R170*	CS	spray	0.49	600 0.08%	3	0 14	Bolls Lint	0.05, 0.03, < 0.02 0.95, 0.53, 0.03	0.08 1.51
Greece 2001 01 R 170	33 EC	spray	0.84	600 0.14%	3	0 14	Bolls Lint	0.14, 0.10, < 0.02 <.0.02, 0.06, 0.08	0.24 0.14

FATE OF RESIDUES IN STORAGE AND PROCESSING

In storage

No data for endosulfan in storage was submitted.

In processing

The meeting received information on the fate of endosulfan residues during processing for potato, tomato, citrus, apples, peach, grape, pineapple, soybean, coffee and tea.

A study was provided on the fate of endosulfan to hydrolysis conditions likely during commercial food processing. Maurer (2002) investigated the hydrolysis of [6, 7, 8, 9-U-^{14}C]-endosulfan under conditions representing food processing operations. The treatment was carried out at two incubation rates: 0.1 mg/L and 1.0 mg/L. Each experiment was conducted using replicate samples. Residues were analysed using radio-HPLC and radio-TLC. α -endosulfan and β endosulfan were the main components following pasteurisation at both treatment levels; small amounts of endosulfan-diol were also found.

In the brewing, baking and boiling simulation the hydrolysis product endosulfan diol was the major single compound at both incubation levels. The sum of α and β endosulfan represented nearly half of the applied radioactivity. Furthermore one degradation product at the 0.1 mg/L and three degradation products at the 1.0 mg/L level were observed representing less than 3.4% of applied radioactivity each.

The sterilisation process resulted in a complete degradation of endosulfan. Endosulfan diol was the major degradation product amounting to approximately 75% of the radioactivity applied. With one exception, the compounds represent more polar compounds than endosulfan diol. None of the other reference standards used in HPLC or TLC investigations in this study corresponded to one of the resulting radio-peaks in the chromatograms. However, each of these non-identified components represented only 0.5 to 8.1% of applied radioactivity (mean values).

Table 87. Recovery data after the simulation of processing

Process	rate	α -Endosulfan		β Endosulfan		Endosulfan diol		Identified		Sum of N.I.
	mg/L	%applied	mg/L	%applied	mg/L	%applied	mg/L	%applied	mg/L	%applied
Pasteurisation	0.1	68.29	0.07	29.15	0.03			97.44	0.1	
pH 4, 90 °C	1	64.95	0.64	26.35	0.259	3.98	0.039	95.28	0.938	5.8
Baking, boiling	0.1	34.28	0.036	13.04	0.014	41.97	0.044	89.29	0.094	2.9
pH 5, 100 °C	1	29.92	0.298	11.87	0.118	49.27	0.491	91.05	0.907	6.4
Sterilisation	0.1					71.68	0.075	71.68	0.075	23.0
pH 6, 120 °C	1					75.72	0.749	75.72	0.749	24.3

Potatoes were processed into potato flakes and chips (Brady, 1997) and wet peel (J. Englar). Residues in the raw material were below the LOQ even treated at five times the rate. Therefore no transfer factor can be estimated.

Seven studies were performed on processed tomato. Tomato fruits were treated twice at two field sites in Greece and Italy in 2002 at the rate of 1.06 kg ai/ha. and a PHI of 3 days (Erbel and Ertz, 003). Tomatoes were washed by moving them slowly in water. A reduction of residue concentrations occurs in the washing water, peeling water, juice, peeled fruits, canned peeled and canned unpeeled fruits. A small reduction of residue concentration may occur for washed fruit. Residues concentrated in peel (transfer factors were 12.1 and 16.7) and wet pomace (transfer factors were 11.5 and 5.6). Most residues were located on the exterior of the tomatoes.

In the second study tomato fruits were treated twice in two field sites in Spain and Italy in 1994, at 6 days before harvest, at growth stage 17/19, at a rate of 0.528 kg/ha (Sonder *et al*., 1996b). Wash water and canning liquid contained no residues above the LOQ. There were no residues in the juice. Residues were found only in pomace at 0.29 and 0.61 mg/kg. Transfer factors were as shown in the table below. Apparent residues in untreated samples were < 0.01 mg/kg.

In the third study tomato fruits were treated twice in two field sites in Spain and Italy in 1993., 14 days before harvest, at growth stage 17/19, at a rate of 0.528 kg/ha (Sonder *et al*., 1996a). Tomatoes were processed into paste, juice and into canned unpeeled tomatoes. Fruit contained total residues of 0.07 mg/kg at the sites in Spain, and at or about 0.02 mg/kg at the sites in Italy. The paste, made from tomatoes from the Spanish sites, contained residues at or about 0.02 mg/kg, tomato juice < 0.02 mg/kg, preserved tomatoes (canned and unpeeled) 0.025 and 0.035 mg/kg, and pomace 0.20 and 0.35 mg/kg. Residues in processed fractions for tomatoes from the two sites in Italy were less than the LOQ except for the pomace (0.15 mg/kg and 0.14 mg/kg). Apparent residues in untreated samples were below 0.01 mg/kg.

In the fourth study tomato fruits were treated three times, the last 2 days before harvest at a rate of 5.6 kg ai/ha at a field site in Fresno, California in 1995 (Brady, 1997b). Samples were processed into paste, puree and juice. In the treated samples total residues in the RAC were 2.28 mg/kg (the range was 1.99 to 2.69 mg/kg). In the puree total residues were 1.36 (the range was 1.31 to 1.39 mg/kg) and in the paste 2.78 mg/kg (the range was 1.59 to 3.49 mg/kg). The residue transfer factor for puree was 0.6 and for paste was 1.2. Apparent residues in untreated samples were < 0.05 mg/kg.

In the fifth study tomato fruits were treated four times at the rate of 0.2 to 0.4 kg ai/ha at a field site in Germany 1989 (Huth, 1999a). The tomatoes were harvested 7 days after the last application. Raw tomato fruit samples from the two sites, containing residues of 0.035 and 0.095 mg/kg were processed into cooked fruits, puree and juice. Cooked fruits contained about the same residue concentration as the raw samples, but puree and juice in both studies were free of residues.

In the sixth study (Huth, 1999a.) tomatoes were sprayed 5 times at a rate of 1.12 kg ai/ha/ application at 59, 52, 15, 7 and 0 days before harvest. (Florida 1984). Tomato samples from study A32878 were processed to seeds and peel, puree, puree 10–11% dry matter solids and puree 16% dry matter solids. Results were corrected for residues found in UTCs. Raw tomatoes contained endosulfan

residues of 0.12 mg/kg. The transfer factor for seeds and peel was 9.4 and for dry pomace was 22. The transfer factor for puree was 0.33. Apparent residues in untreated samples were < 0.01 mg/kg, except for one sample of seeds and peel, where alpha endosulfan was found at 0.017 mg/kg, and for dry pomace, where analytes were found up to 0.084 mg/kg. In the seventh study tomatoes were sprayed 5 times at a rate of 1.12 kg ai/ha/application at 73, 66, 14, 7 and 0 days before harvest. Sprays were made at 364 L (Huth, 1999a) Tomato samples were processed to juice, paste, cooked skins and peel, and dried skins and peel.

Table 88. Processing of Tomatoes to Tomato Juice, Pomace and Canned Tomatoes.

Processed Fraction	Residues of α, β Endosulfan, Endosulfan sulfate and endosulfan diol(mg/kg)	Total Endosulfan residues (mg/kg)	processing factors for α, β Endosulfan and Endosulfan diol	processing Factor total
Balance study for Trial R 10572 (Greece 2002)				
Tomato RAC	0.71, 0.35, ND,< 0.02	1.06		
Washed Tomatoes	0.44, 0.26, ND,< 0.02	0.70	0.62, 0.74	0.66
Washing Water	0.03, 0.02, 0.0007, 0.001	0.06	0.04, 0.06, 0.05	0.05
Peeled Tomatoes	< 0.02, < 0.02, ND, ND	< 0.02		< 0.02
Peel	11.4, 6.51, 0.03, 0.18	18.12	16.1, 18.6, 9.0	16.7
Peeling Water	0.05, 0.03, 0.0001, 0.002	0.08	0.07, 0.09, 0.1	0.06
Tomato Raw Juice	0.12, 0.09, ND, ND	0.21	0.17, 0.26, -	0.20
Tomato Juice pasteurised	0.12, 0.09, ND, ND	0.21	0.17, 0.26, -	0.20
Wet Tomato Pomace	3.65, 2.36, < 0.02,0.06	6.07	5.14, 6.74, 3.0	5.72
Canned Peeled Tomatoes (pasteurised)	0.05, 0.03, ND, ND	0.08	0.07, 0.09, -	0.07
Canned Unpeeled Tomatoes (sterilised)	0.32, 0.15, ND, < 0.02	0.47	0.45, 0.43, -	0.44
Follow Up study for Trial R 10572 (Greece 2002)				
Tomato Juice pasteurised	0.18, 0.10, ND, < 0.02	0.28	0.25, 0.29	0.27
Canned Peeled Tomatoes	0.05, 0.04, ND, 0.02	0.11	0.07, 0.11, 1.0,	0.10
Balance study for Trial R 10573 (Italy 2002)				
Tomato RAC	0.06, 0.04, ND	0.10		
Washed Tomatoes	0.06, 0.04, ND	0.10	1,	1
Washing Water	0.005, 0.004, 0.00014	0.009	0.08, 0.1	0.09
Peeled Tomatoes	ND, ND, ND	< 0.02	-, -	< 0.02
Peel	0.62, 0.53, 0.06	1.21	10.3, 13. 3	12.1
Peeling Water	0.01, 0.007, 0.0005	0.02	0.17, 0.2	0.2
Tomato Raw Juice	< 0.02, < 0.02, ND	< 0.02		< 0.20
Tomato Juice pasteurised	< 0.02, < 0.02, ND	< 0.02		< 0.02
Wet Tomato Pomace	0.63, 0.45, 0.07	1.15	10.5, 11.3	11.5
Canned Peeled Tomatoes (pasteurised)	< 0.02, ND, ND	< 0.02		< 0.02
Canned Unpeeled Tomatoes (sterilised)	0.03, 0.02, < 0.02	0.05	0.5, 0.5	0.5
Follow Up study for Trial R 10573 (Italy 2002)				
Tomato Juice (pasteurised)	< 0.02, < 0.02, ND	< 0.02		< 0.20
Canned Peeled Tomatoes	< 0.02, < 0.02, ND	< 0.02		< 0.20

Table 89. Processing of Tomatoes to Tomato Juice, Pomace and Canned Tomatoes.

Processed Fraction	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Endosulfan residues (mg/kg)	Transfer Factor	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Endosulfan residues (mg/kg)	processing Factor
Spain, ESP 000103 (1994)				Italy, ITA000203		
Unwashed Fruit	0.04, 0.04, < 0.01	0.08		0.03, 0.03, < 0.01	0.06	
Washed Fruit	0.04, 0.04, < 0.01	0.08	1	0.03, 0.03, < 0.01	0.06	1
Preserved Fruit (unpeeled)	0.04, 0.04, < 0.01	0.08	1	0.033, 0.033, < 0.01	0.07	1.1
Canning Liquid	< 0.01, < 0.01, < 0.01	< 0.01		< 0.01, < 0.01, < 0.01	< 0.01	< 0.17
Juice	< 0.01, < 0.01, < 0.01	< 0.01	< 0.12	< 0.01, < 0.01, < 0.01	< 0.01	< 0.17
Pomace	0.34, 0.24, 0.03	0.61	7.6	0.15, 0.12, 0.02	0.29	4.5

Processed Fraction	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Endosulfan residues (mg/kg)	Transfer Factor	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Endosulfan residues (mg/kg)	processing Factor
Wash Water	< 0.01, < 0.01, < 0.01	< 0.01		< 0.01, < 0.01, < 0.01	< 0.01	
	Spain 1, ESP000203			Spain-2, ESP000303		
Unwashed Fruit	0.03, 0.03, < 0.01	0.06		0.03, 0.03, < 0.01	0.06	
Washed Fruit	0.01, 0.02, < 0.01	0.03	0.50	0.02,0.03, < 0.01	0.05	0.84
Preserved Fruit (unpeeled)	0.01, 0.01, < 0.01	0.02	0.33	0.01, 0.02, < 0.01	0.03	0.50
Canning Liquid	< 0.01, < 0.01, < 0.01	< 0.01	< 0.16	< 0.01, < 0.01, < 0.01	< 0.01	< 0.16
Juice	< 0.01, < 0.01, < 0.01	< 0.01	< 0.16	< 0.01, < 0.01, < 0.01	< 0.01	< 0.16
Paste	< 0.01, 0.01, < 0.01	0.01	0.16	< 0.01, 0.02, < 0.01	0.02	0.33
Pomace	0.08, 0.09, 0.03	0.20	3.30.	0.14, 0.19, 0.015	0.35	5.80.
Wash Water	< 0.01, < 0.01, < 0.01	< 0.01	< 0.16	< 0.01, < 0.01, < 0.01	< 0.01	< 0.16
	Italy-1, ESP000103			Italy-2, ESP000203		
Unwashed Fruit	< 0.01, 0.01, < 0.01	0.01		< 0.01, 0.01, < 0.01	0.01	
Washed Fruit	< 0.01, 0.01, < 0.01	0.01		0.01, 0.01, < 0.01	0.02	
Preserved Fruit (unpeeled)	< 0.01, < 0.01, < 0.01	< 0.01		0.01, 0.01, < 0.01	0.02	
Canning Liquid	< 0.01, 0.01, < 0.01	0.01		< 0.01, < 0.01, < 0.01	< 0.01	
Juice	< 0.01, < 0.01, < 0.01	< 0.01		< 0.01, < 0.01, < 0.01	< 0.01	
Paste	< 0.01, < 0.01, < 0.01	< 0.01		< 0.01, < 0.01, < 0.01	< 0.01	
Pomace	0.05, 0.06, 0.04	0.15		0.06, 0.06, 0.015	0.14	
Wash Water	< 0.01, < 0.01, < 0.01	< 0.01		< 0.01, < 0.01, < 0.01	< 0.01	

Table 90. Processing of Tomatoes to Puree and Paste in USA

Processed Fraction	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Endosulfan residues (mg/kg)	Transfer Factor (Total Endosulfan)
Fruit	1.29, 1.40, < 0.05 A 1.04 1.12, < 0.05 B 0.93, 1.06, < 0.05 C	2.69 2.16 1.98	
Puree	0.66, 0.72, < 0.05 A 0.67, 0.72, < 0.05 B 0.63, 0.68, < 0.05 C	1.38 1.39 1.31	0.51 0.64 0.66
Paste	0.74, 0.85, < 0.05 A 1.60, 1.83, 0.06 B 1.44, 1.76, 0.05 C	1.59 3.49 3.25	0.59 1.62 1.63

Table 91. Processing of Tomatoes to Cooked Fruit, Puree and Juice.

Study No., Location	Sample analysed	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Residues (mg/kg)	Transfer Factor
A49970 DEU89170721 Bonheim	Fruit	0.01, 0.02, < 0.01	0.03	
	Washings	< 0.01, < 0.01, < 0.01	< 0.01	
	Cooking water	< 0.01, < 0.01, < 0.01	< 0.01	
	Cooked Fruit	0.01, 0.02, 0.01	0.04	
	Puree	< 0.01, < 0.01, < 0.01	< 0.01	
	Juice	< 0.01, < 0.01, < 0.01	< 0.01	

Table 92. Processing of Tomatoes to Cooked Fruit, Puree and Juice.

Study No., Location	Sample analysed	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Residues (mg/kg)	Transfer Factor
A49971 DEU89170741 Kestlerbach	Fruit	0.04, 0.05, < 0.01	0.09	
	Washings	< 0.01, < 0.01, < 0.01	< 0.01	
	Cooking water	< 0.01, < 0.01, < 0.01	< 0.01	
	Cooked Fruit	0.05, 0.04, < 0.01	0.09	1.0
	Puree	< 0.01, < 0.01, < 0.01	< 0.01	< 0.01
	Juice	< 0.01, < 0.01, < 0.01	< 0.01	< 0.01

Table 93. Processing of Tomatoes to Puree and Pomace

Study No. Location	Sample analysed	Residues of α, β Endosulfan and Endosulfan sulfate(mg/kg)	Total Residues, mg/kg	Control sample	Transfer Factor
A32878	Fruit*	0.049, 0.058, < 0.01			
		0.047, 0.081, < 0.01	0.12	< 0.01, < 0.01, < 0.01	
	Chopped fruit	0.082, 0.081, < 0.01	0.16	< 0.01, < 0.01, < 0.01	1.4
A32879	Seeds, peel	0.571, 0.546, 0.047	1.15	0.017, 0.01, < 0.01	10
	Puree	0.018, 0.019, < 0.01	0.04	< 0.01, < 0.01, < 0.01	0.33
	Puree 10/11% solids	< 0.01, 0.025, < 0.01	0.03	< 0.01, < 0.01, < 0.01	0.27
A32879	Puree 16% solids	< 0.01, 0.033, < 0.01	0.03	< 0.01, < 0.01, < 0.01	0.27
A32881	Dry Pomace	1.354, 1.245, 0.111	2.71	0.084, 0.053, 0.031	24.6

* Duplicate analyses of same sample

Table 94. Processing of Tomatoes to Tomato Juice, Paste and Cooked Skins and Peel.

Study No. in C004071	Sample analysed	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total Residues (mg/kg)	Transfer Factor
A32880	Fruit*	0.045, 0.052, < 0.01	0.09	
	Whole Pack (peeled)	< 0.01, < 0.01, < 0.01	< 0.01	< 0.10
	Juice	0.023, 0.021, < 0.01	0.044	0.49
	Paste	0.026, 0.036, 0.026	0.09	1
	Cooked skins and peel	1.830, 1.975, 0.138	3.94	43.7
	Dry skins and peel	1.492, 2.827, 0.244	4.56	50.2

Soybean plants were treated with 3 applications from 0.50 to 0.53 kg ai/ha and harvested between 30 and 43 days in three trials in Brazil (Huth, 1999). The transfer factors were 4.1 and 4.3 for crude oil.

A second study (Dorr and Krebs, 1982) from Brazil, where EC and ULV formulations were applied at the rate of 0.17 to 0.5 kg ai/ha, a transfer factor of 1.67 for crude oil was found.

A third study (Fox, 1979) was conducted by fortification with a mixture of alpha, beta and endosulfan sulfate at 0.06, 0.42 and 0.36 mg/kg respectively of untreated soybeans. After steaming at 120°C during 60 minutes, 60% and 28% of the dose of alpha and beta endosulfan were recovered. For refining the fortification was 0.1, 0.3 and 0.3 for 0.7 and 1.4 mg/kg of alpha, beta and sulfate endosulfan and 0.1, 0.7 and 0.6 in a second experiment.

The report (Their, 1979) describes experiments in which untreated soybean flour was spiked with (0.02 mg/kg α-endosulfan + 0.02 mg/kg β-endosulfan + 0.3 mg/kg endosulfan sulfate) in one experiment, and 0.35 mg/kg α/β-endosulfan mixture in a second experiment. The flour was baked for 2 hours at 200ºC. Residues were reduced to 7 to 22% of the initially spiked amount.

Table 95. Processing of Soybean seeds to Crude oil and Press cake.

Processed Fraction	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total residues (mg/kg)	Transfer Factor	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total residues (mg/kg)	Transfer Factor	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total residues (mg/kg)	Transfer Factor
	A17979 (Hugh)			A17987I			A16110 (Hugh)		
seeds	0.02, 0.02, 0.3	0.34			0.60			0.30	
crude oil	0.1, 0.7, 0.6	1.40	4.1	0.1, 0.3, 0.3	0.70	1.16		1.30	4.33
press cake	(0.01), (0.01), < 0.01	(0.02	0.06	(0.01), (0.01), < 0.01	(0.02	0.05	(0.01), (0.01), < 0.01	(0.02)	0.07

Table 96. Processing of Soybean seeds to Crude and Refined Oil and Baking.

Process	Crushed grain	Bran	Crude oil	Refined oil
Residues of α, β Endosulfan and Endosulfan sulfate(mg/kg)	< 0.01,< 0.01,< 0.01 to 0.09	< 0.01,< 0.01,< 0.01 to 0.2	< 0.01,< 0.01, 0.02 to 0.2	< 0.01,< 0.01,< 0.01 to 0. 2
process		Baking Before	Baking after	
Residues of α, β Endosulfan and Endosulfan sulfate(mg/kg)		0.02,0.02,0,.3	0.004,0;02,0.05	
Residues of α, β Endosulfan and Endosulfan sulfate(mg/kg)		0.21,0.14,< 0.01	0.004,0;01<,0.01	

Cocoa was treated twice with CS and EC formulations in Ghana in 2002 (Balluth, 2003). The rates of applications ranged from 0.493 to 0.520 kg ai/ha. Samples were taken at 13/14, 20/21 and 27 days after the last application. Cocoa pods were separated and the beans and flesh were wrapped in untreated banana leaves, placed in wooden boxes, wrapped in plastic and sealed. After this period the fermentation was stopped. The beans were cleaned manually and frozen. Fermented beans were dried using natural sunlight in the same box used for fermentation. Residues in eight trials were mostly ND or less than the LOQ (< 0.01 mg/kg) in beans, fermented beans and dry beans. No transfer factors could be calculated.

In the second study by Balluth in 2002, cocoa was treated twice with CS and EC formulations in the Ivory Coast in 2001. The application rates were equivalent, the seasonal total ranging from 0.50 to 0.518 kg ai/ha. The spray interval was 25/27 days, and samples were taken 14 days after the last application. Residues in eight trials were mostly ND or less than the LOQ (< 0.01 mg/kg) in beans, fermented beans and dry beans. No transfer factors could be calculated.

Gomez (1996) studied the magnitude endosulfan residues in coffee and processed fractions. Coffee in two plots in 1994 (Brazil and one in Colombia) were sprayed three times at 30 day intervals at a 3× rate of 2.1 kg ai/ha/application, in a water volume of 500 L/ha. Green coffee beans were harvested 33 days after the last application.

The green coffee beans were roasted at 350–430 ºF for 6 minutes, cooled and ground. No residue of any analyte was found in the processed fractions, roast coffee and instant coffee.

Table 97. Processing of Green Coffee to Roasted Coffee.

Processed Fraction	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total residues (mg/kg)	Transfer Factor	Residues of α, β Endosulfan and Endosulfan sulfate (mg/kg)	Total residues (mg/kg)	Transfer Factor
	Brazil			Colombia		
Green beans	0.04, 0.08, 0.04	0.16		< 0.01, < 0.01, < 0.01	< 0.01	
Roast coffee	< 0.01, < 0.01, < 0.01	< 0.01	< 0.06	< 0.01, < 0.01, < 0.01	< 0.01	
Instant coffee	< 0.01, < 0.01, < 0.01	< 0.01	< 0.06	< 0.01, < 0.01, < 0.01	< 0.01	

RESIDUES IN ANIMAL COMMODITIES

The Meeting received two lactating dairy cow feeding studies and one lactating goat study which provided information indicating that residues in animal tissues and milk were likely through exposure to residues in the animal's diet.

Direct animal treatment

No study provided

Farm animal feeding study

Lactating cows

A dairy study (Keller and Bowman, 1959) was conducted with four groups of lactating Holstein cows using ^{14}C-endosulfan for 30 days. Targeted treatment rates were 0, 0.3, 3 and 30 ppm based on the diet. All animals exhibited normal appearance and behaviour. Food consumption and milk production were within normal limits. Residue levels at the end of the dosing period were proportional to dose in all tissues indicating absence of bioaccumulation. The highest residues were measured in the liver. Analysis in blood showed a gradual rise reaching a plateau at 21 days. In the recovery period of 14 days the residue levels declined significantly, though in most cases not below the detection limit.

Table 98. Residues (µg/g) in cows after 30 days application of ^{14}C-endosulfan.

Dietary Dose	0.3 ppm		3.0 ppm		30.0 ppm	
Recovery period	none	14 days	none	14 days	none	14 days
Liver	0.3	0.1	2.5	1.1	25	16
Kidneys	0.05	0.05	0.4	0.1	6	1
Omental fat**	0.07	< 0.02	0.7	0.1	7	0.1

**Limit of detection in omental fat: 0.02 µg/g

In a second study, groups of four lactating cows (animals weighing 520–680 kg) were dosed daily via corn oil in the diet with endosulfan 0, 4, 12 and 30 ppm in the diet for 28 consecutive days (Peatman *et al*., 1999). Milk was collected daily and frozen for residue analysis. All cows were sacrificed on day 29 of dosing (day 28 for control animals) and samples of muscle, liver, kidney and composite fat were taken. Samples were analysed by the method of FDA Pesticide Analytical Manual. The LOQs for α-endosulfan, β-endosulfan and endosulfan sulfate in milk, liver, kidney and muscle were each 0.01 mg/kg. In fat the LOQ for each analyte was 0.05 mg/kg.

Whole milk samples were analysed for all treated cows for days -1, 1, 4, 7, 10, 13, 16, 19, 22, 25 and 28 of dosing (day 9 also analysed for group 3). A residue plateau in milk was established in all three groups, between day 10 and day 13 of dosing (mean value).

For all samples analysed, the residue values for α-endosulfan and β-endosulfan were mostly below the respective LOQs (< 0.01 mg/kg). The maximum residues for α-endosulfan and β-endosulfan in tissues were 0.01, 0.02 mg/kg (liver) and 0.002, 0.08 mg/kg (fat). Residues of endosulfan sulfate were significant and accounted for the major portion of any residue measured.

Samples of whole milk, cream and skim milk were analysed from the 12 ppm dose group day 9 samples to provide some indication on the distribution of residues between milk and milk fat. Results are shown below.

Table 99. Endosulfan residues in milk and animal tissues.

Substrate	Nominal dose level (ppm diet)	Number of days dosing	Mean Residues of α- β- endosulfan, and endosulfan sulfate	Transfer factor for Endosulfan Sulfate
Whole milk	4	10-28	< 0.01, < 0.01, 0.07	0.018
	12	10-28	ND, < 0.01, 0.27	0.02
	30	10-28	ND, < 0.01, 0.62	0.02
Muscle	4	28	ND, < 0.01, 0.04	0.01
	12	28	< 0.01, < 0.01, 0.21	0.02
	30	28	< 0.01, < 0.01, 0.76	0.025
Liver	4	28	< 0.01, < 0.01, 0.71	0.18
	12	28	< 0.01, < 0.01, 2.0	0.17
	30	28	ND, < 0.01, 3.2	0.11
Kidney	4	28	< 0.01, < 0.01, 0.07	0.02
	12	28	< 0.01, < 0.01, 0.31	0.03
	30	28	ND, < 0.01, 0.67	0.02
Fat	4	28	ND, < 0.05, 1.4	0.35
	12	28	ND, < 0.05, 4.7	0.39
	30	28	< 0.05, 0.06, 9.9	0.33

Table 100 Endosulfan sulfate residues in milk, skim milk and cream (mg/kg).

Days dosing	Nominal dose level (ppm diet)	Whole milk	Skim milk	Cream
9	12	0.23	0.17(0.12,0.26;0.13)	1.0 (0.81,0.89,1.4)

This limited data provides a transfer factor (mean) of 4.3 from whole milk to cream.

Table 101. Mean endosulfan sulfate in whole milk in mg/kg.

day	4 ppm in the diet	12 ppm	30ppm
1	< 0.01	0.02	0.04
4	0.07	0.26	0.53
7	0.06	0.23	0.50
9		0.23	
10	0.07	0.27	0.56
13	0.07	0.27	0.61
16	0.07	0.24	0.62
19	0.07	0.26	0.66
22	0.06	0.24	0.64
25	0.07	0.34	0.56
28	0.06	0.28	0.66

Depuration

Data from the animals depurated for up to 21 days after cessation of dosing showed that residues fell significantly once dosing stopped.

Table 102. Residue levels in tissues after 21 days depuration, mean residues of as α-endosulfan, β-endosulfan and endosulfan sulfate.

Days depuration	Milk	Muscle	Liver	Kidney	Fat
-2	< 0.01,< 0.01, 0.94				
0		< 0.01,< 0.01, 0.76	ND,< 0.02, 3.2	ND < 0.01, 0.67	< 0.05,0.07, 9.9
1	< 0.01,< 0.01, 0.69				
4	< 0.01,< 0.01, 0.18				
7	< 0.01,< 0.01, 0.09	ND, ND, 0.06	ND, ND, 0.76	ND, ND, 0.10	ND, ND, 5.1
10	< 0.01,< 0.01, 0.15				

Mean data from animals in top dose group (28 days dosing).

In Australia a feeding study was conducted by Mawhinney (2001). Rations containing endosulfan were fed for twelve days, then replaced with clean feed and the rate of depletion of endosulfan sulfate residues in the fat of the trial animals was measured for a period of 28 days. Samples of subcutaneous fat were collected at days 1, 7, 14 and 21 post-treatment by means of biopsy. All trial animals were slaughtered at day 28 when samples of subcutaneous fat, perirenal fat, liver and kidney were collected from each carcass.

Table 103. Feeding diet and doses.

Treatment Group	Ration	Composition of Daily Endosulfan Dose (mg)			
		α-endosulfan	β-endosulfan	Endosulfan Sulfate	Total
1	Feedlot ration	0.1	0.3	0.6	1
2	Lucerne hay based diet containing incurred residues of endosulfan.	42	40	180	262
3	Lucerne hay based diet	2	6	12	20
4	Lucerne hay based diet	5	15	30	50
5	Lucerne hay based diet	5	15	----	20

The depletion rates calculated from data from treatment groups 2, 3, 4 and 5 were consistent with an average half-life of 7.2 days and a 95% confidence limit of 6.6 - 8.0 days. For treatment group 1, it was much longer at 25.4 days with a confidence limit of 18.8 - 39.1 days.

Group 1 animals were fed the lowest concentration of total endosulfan in their rations and none of the residual fat concentrations of endosulfan sulfate exceeded 0.04 mg/kg at any time in the trial.

From the trial data, feed contaminated at around 0.7 mg/kg, fed for around 12 days, would be expected to give rise to residues of endosulfan sulfate around 0.2 mg/kg in the fat of cattle.

Similarly, concentrations of total endosulfan in animal feed at 0.03 mg/kg could be expected to give rise to residues of endosulfan sulfate at around 0.01 mg/kg in the fat of cattle if fed for 12 days.

It was not possible, in this study, to confirm that the plateau concentration had been reached, in each case, by day 12, when the dosed rations were withdrawn. However, comparison of the bio magnification in these animals with that in the associated DAN.092 trial (these animals had been exposed for 30–35 days) strongly suggests it had been reached.

Under the conditions of this study, the bio magnification factor for total endosulfan, when it passes from fodder and is stored as endosulfan sulfate in the fatty tissues of cattle, was around 0.3**.**

There was no significant difference in the concentrations of endosulfan sulfate in the fat collected from the two subcutaneous sites, but on average, the subcutaneous fat residual concentrations were 1.6 times higher than those in the corresponding perirenal fats. On average the concentrations of endosulfan sulfate in subcutaneous fats were some four times higher than the concentrations in the corresponding liver tissues and some ten times higher than the concentrations in the corresponding kidney tissues.

Lactating goats

The distribution of endosulfan (technical grade) was investigated by Indranignsih *et al*., (1993) in lactating goats following repeated oral administration. Twelve adult lactating feral goats (25 to 40 kg body weight), each with one kid, were dosed orally with 1 mg/kg of non-labelled endosulfan for a period of 28 days using gelatine capsules. The applied dose of 1 mg/kg body weight corresponded to 29 ppm in the diet. Feed and water were given *ad libitum.* Groups of 3 animals were sacrificed for

tissue collection 1, 8, 15, and 21 days after the last treatment. Milk and venous blood samples were taken from each animal before being killed.

The highest residues were detected in organs and tissues of goats, which were slaughtered 24 hours after the 28-day feeding with endosulfan. These residues are presented in the Table 104.

Table 104. Endosulfan residues in organs/tissues/milk of goats 24 hours after daily dosing with technical grade Endosulfan at 1 mg/kg body weight for a period of 28 days (in mg/kg).

Organs/ tissues	Alpha-Endosulfan	Beta–Endosulfan	Endosulfan sulfate	Total Endosulfan residues **	Clearance half-life (d)
Liver	0.010	0.021	0.097	0.128	3,1
Kidney	0.220	0.059	0.012	0.291	-Not recorded
Fat	0.015	0.002	0.040	0.057	1.4
Muscle	0.033	0.009	< 0.001	0.043	1.1
Milk				0.020	

** Total Endosulfan residues = sum of α- and β-endosulfan and endosulfan sulfate. Values < 0.001 were taken as 0.001.

The residues in all organs and tissues decreased significantly (< 0.01 mg/kg) until the next sampling point (day 8), however with one remarkable exemption: The residues in the excretion organs, the kidneys, increased from 0.29 (day 1) to 0.47 mg/kg (day 8) and decreased again to approximately 0.2 mg/kg (day 15 of the 28-day feeding). The residues in milk became undetectable after one week. At day 21 residues in all tissues were non detectable.

The clearance of the residues is relatively rapid with half-lives in the range of 1–3 days.

RESIDUES IN FOOD IN COMMERCE OR AT CONSUMPTION

Monitoring data

Systematic monitoring of residues of endosulfan has been carried out for several years. Typical of these programs is the “Monitoring of Pesticide Residues in Products of Plant Origin in the European Union, Norway, Iceland (and Liechtenstein)”.

Monitoring in Europe in 1999, 2000 and 2001

The results for endosulfan are given in Tables 105–7.

Table 105. Results from the EU coordinated monitoring program for endosulfan residues.

Year	N° samples	N° samples Without residues	N° samples With residues Below MRL	%	N° samples With residues Above MRL	%	Residues maximum
2000	3318	3277	41	11.24	0	0	0.36 (head cabbage, EC-MRL:1.0)
2001	8478	8125	326	3.85	27	0.32	3.50 (lettuce, EC-MRL:1.0/0..05)

Table 106. Results from the EU coordinated monitoring program for pesticide residues for some pesticide analysed for in cauliflower, peppers, wheat grains, and melons.

Pesticide As example	N° samples	N° samples Without residues	N° samples With residues Below MRL	%	N° samples With residues Above MRL	%	Residues maximum
Endosulfan	4071	3387	678	16.7	6	0.15	1.5 (peppers, EC-MRL:1.0)

Some pesticides found most often with residues at or below the MRL (national or EC—MRL) and pesticides exceeding the MRLs (national or EC—MRLs) for different commodities in 1997, 1998 and 1999 are given in Table 107.

Table 107 Comparison of pesticides found most often and pesticides exceeding MRLs (national or EC-MRLs) analysed on different commodities in 1997, 1998 and 1999.

	Program 1997		Program 1998		Program 1999	
	Mandarin, pear, banana, bean, potato		Orange, peach, ,carrot, spinach		Cauliflower, pepper, wheat, melon	
	% samples With residues Below MRL	% samples With residues Above MRL	% samples With residues Below MRL	% samples With residues Above MRL	% samples With residues Below MRL	% samples With residues Above MRL
Deltamethrin	na	na	0.38	0	0.58	0
Diazinon	0.55	0	1.1	0.10	0.34	0.02
Endosulfan	1.3	0	2.0	0.02	16.7	0.15
Iprodione	1.3	0.13	4.0	0.30	1.1	0

Monitoring in Australia 2003-2004 and 2004-2005

Endosulfan was included in the Australian National Residue Survey program in 2003-2004 and 2004-2005 (Hamilton NRS, 2004 NRS 2005).

Table 108. Survey program in Australia for endosulfan.

Commodity	Limit of reporting, mg/kg	Australian MRL, mg/kg	Number of analyses 2003-2004	Number of analyses 2004-2005	Number of residues
Apple	0.05	2	214	221	0
Barley	0.02	0.2	280	73	0
Buffalo fat	0.02	0.2	10	10	0
Camel fat	0.02	0.2	10	10	0
Canola	0.02	1	57	19	0
Cattle fat	0.02	0.2	610	1096	0
Deer fat	0.02	0.2	25	26	0
Field pea	0.02	1	42	9	0
Game pig fat	0.02	0.2	66	75	0
Goat fat	0.02	0.2	97	99	0
Honey	0.02	not set	13		0
Horse fat	0.02	0.2	10	19	0
Kangaroo fat	0.02	0.2	77	75	0
Lupin	0.02	1	51	21	0
Macadamia nut	0.05	2	120	120	0
Oats	0.02	0.2	32	17	0
Onion	0.05	0.2	136	101	0
Ostrich fat	0.02	0.2 (not set)5	24	28	0
Pear	0.05	2	71	71	0
Pecan nuts	0.05	2	30		0
Pig fat	0.02	0.2	96	299	0
Sheep fat	0.02	0.2	753	725	0

Commodity	Limit of reporting, mg/kg	Australian MRL, mg/kg	Number of analyses 2003-2004	Number of analyses 2004-2005	Number of residues
Sorghum	0.02	0.2	72	31	0
Wheat	0.02	0.2	729	181	0
Wheat bran	0.02	0.2	33	10	0
Wheat flour	0.02	0.2	33	10	0

NATIONAL MAXIMUM RESIDUES LIMITS

Table 109. EU MRLs of endosulfan.

COMMODITY	EU MRL	NEW EU MRL#	FR	B	NL	GE	IT	UK
Citrus fruit	1.0	0.05*	1.00		0.50		1.00	
Tree nuts	0.1	0.1*	0.10	0.10	0.10	0.10	0.10	0.10
Pome fruit	1.0	0.3	1.00		0.30		1.00	
Stone fruit (peaches)	1.0	0.05*	0.50		0.50		1.00	
Table and wine grapes	1.0	0.5			0.50		1.00	
Strawberries			1.00				1.00	
Raspberries	1.0	0.05*	0.50				1.00	
Blackberries			1.00				1.00	
Red blackcurrants			1.00				1.00	
Other berries	0.05	0.05*		0.05				
Wild berries and fruit	0.05	0.05*				0.05		0.05
Kiwis	1.0	0.05*		1.0		1.00	1.00	1.00
Olives	1.0	0.05*						
Beetroot	0.2	0.05*	0.20	0.20			0.20	0.20
Carrots	0.2	0.05*	0.20	0.20		0.05	0.20	0.20
Celeriac	0.2	0.05*	0.20	0.20		0.05	0.20	0.20
Radishes	0.2	0.05*	0.20	0.20		0.05	0.20	0.05
Swedes	0.2	0.05*	0.20	0.20		0.05	0.20	0.20
Turnips	0.2	0.05*	0.20	0.20		0.05	0.20	0.20
Onions	1.0	0.05*				1.00	1.00	1.00
Peppers	1.0	1.0			1	1.00	1.00	
Tomatoes	1.0	0.5			0.50	1.00		
Cucurbits edible peel	1.0	0.05*	0.5		0.30	1.00	1.00	
Cucurbits inedible peel	1.0	0.05*	0.5			1.00	1.00	
Sweet corn	0.05	0.05*				0.05		
Flowering brassica	1.0	0.05*	1.00			0.05		
Head brassica	1.0	0.05*				0.05	1.00	
Leafy brassica	1.0	0.05*				0.05		
Kohlrabi	0.05	0.05*		0.05		0.05		
Lettuce and similar	1.0	0.05*	1.00			0.05	1.00	
Spinach an similar	1.0	0.05*					1.00	
Legume vegetables	1.0	0.05*	0.50				1.00	
Asparagus			1.00	0.05		0.05		
Cardoons	1.0	0.05*						
Celery	1.0	0.05*					1.00	
Globe artichokes	1.0	0.05*	1.00				1.00	
Leeks	1.0	0.05					1.00	

COMMODITY	EU MRL	NEW EU MRL#	FR	B	NL	GE	IT	UK
Cultivated mushrooms	1.0	0.05						
Cotton seed	0.3	5			0.3			
Other oilseeds	0.1	0.1*			0.5soya)			
Potatoes		0.05*		0.10	0.05	0.05	0.20	
Tea	30.0	30			30			
Cereals	0.1	0.05*						
Animal fats	0.1				0.1*			
Milk	0.004				0.004			

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Table 110. MRLs in USA, Canada, Japan, Mexico, South Africa and Codex.

Commodity	CAC	Canada	Japan	Mexico	South Africa	USA	USA
Alfalfa forage (green)	1.0		0.50	0.3		0.3	
Alfalfa, hay						1.0	
Almond hulls						1.0	1.0
Almonds						0.2	0.2N
Apples		2.0	0.50	2.0	0.5	2.0	2.0
Apricots		0.5	0.50	2.0	0.5	2.0	2.0
Artichokes		1.0	0.50		2.0		
Barley			0.50	0.1		0.1	0.1 (N)
Barley straw						0.2	0.2 (N)
Broccoli	0.5	2.0	0.50	2.0		2.0	2.0
Bean	0.5	2.0	0.50	2.0	1.0	2.0	2.0
Blueberries						0.1	0.1 (N)
Brussels sprouts		2.0	0.50	2.0		2.0	2.0
Cabbage, Savoy	2.0	2.0	0.50	2.0		2.0	2.0
Cabbages, Head	1.0	2.0	0.50			2.0	2.0
Cocoa beans	0.1		0.50				
Carrot	0.2		0.50			0.2	0.2
Cattle fat						0.2	0.2
Cattle liver							0.2
Cattle meat						0.2	0.2
Cauliflower	0.5	1.0	0.50	2.0		2.0	2.0
Celery	2.0	1.0	0.50	2.0		2.0	2.0
Cherries	1.0	2.0	0.50		0.5	2.0	2.0
Citrus					1.0		
Clover	1.0		0.50				
Coffee beans	0.1		0.50	0.04	0.5		
Common bean (pods and/or immature seeds)	0.5		0.50				
Corn				2?0		0.2	
Cotton seed	1.0		0.50	1.0	0.2	1.0	1.0
Cotton seed oil, Crude	0.5		0.50				
Cucumber	0.5	2.0	0.50	2.0	0.5	2.0	2.0
Eggplant		2.0	0.50	2.0		2.0	2.0
Fruits (except as otherwise listed)			0.50				
Garden pea (young pods)	0.5	0.5	0.50	2.0	0.5		
Grapes	1.0	1.0	0.50	2.0	0.5	2.0	2.0

Commodity	CAC	Canada	Japan	Mexico	South Africa	USA	USA
Hogs, meat							0.2
Hops				20			
Kale	1.0		0.50			2.0	2.0
Lettuce, Head	1.0	2.0	0.50	2.0		2.0	
Lettuce, Leaf	1.0		0.50				2.0
Maize	0.1		0.50	2.0			2.0
Meat (from mammals other than marine mammals)			0.50				
Melons, except watermelon	0.5	1.0	0.50	2.0		2.0	2.0
Milks	0.004		0.50			0.5	0.5
Onion, Bulb	0.2		0.50				
Oranges, Sweet, Sour	0.5		0.50				
Peach	1.0	2.0	0.50	2.0	0.5	2.0	2.0
Pear		2.0	0.50	2.0	0.5		2.0
Pecan						0.20	2.0
Pepper		1.0	0.50	2.0	1.00	2.0	2.0
Pineapple	2.0		0.50	2.0	0.05	2.0	2.0
Plums (including prunes)	1.0	2.0	0.50	2.0	0.5	2.0	2.0
Pome fruits	1.0	2.0	0.50				
Potato	0.2		0.5	0.20	0.05	0.2	0.2 (N) *
Pumpkins		2.0	0.50	2.0		2.0	2.0
Rape seed	0.5		0.50		1.0	0.2	
Rice	0.1		0.50				
Sorghum							
Soya bean (dry)	1.0		0.50				
Spinach	2.0	2.0	0.50		2.0		2.0
Squash, Summer	0.5	1.0	0.50	2.0	2.0		2.0
Sugar beet	0.1		0.50		0.1		
Sugar beet leaves or tops	1.0		0.50				
Sugar cane				0.5	0.1	0.5	
Sunflower seed	1.0		0.50	0.2	0.1	2.0	
Strawberries		1.0	0.50	2.0		2.0	
Sweet potato	0.2		0.50			0.2	
Tea, Green, Black	30.0		0.5				
Tobacco					2.0		
Tomato	0.5	1.0	0.50	2.0	0.5	2.0	
Trefoil	1.0		0.50				
Vegetables			0.50				
Wheat grain	0.2		0.50	0.1	0.5	0.1	
Wheat straw				0.1		0.2	

APPRAISAL

Endosulfan was listed in the periodic re-evaluation programme at the 36th Session of the CCPR for periodic review by the 2006 JMPR. The toxicology of endosulfan was reviewed within the periodic review program by the 1998 JMPR.

The Meeting received extensive information on the metabolism and environmental fate, methods of analysis, stability of residues in storage, registered use patterns, residue supervised trials data, farm animal feeding studies and the fate of residues during processing.

Animal metabolism

The Meeting received animal metabolism studies with endosulfan in rats, dairy cows, lactating sheep and laying hens.

Initial metabolism of endosulfan in rats involves either sulfoxidation to endosulfan sulphate, a fat-soluble metabolite, followed by desulfation to the diol, or direct hydrolysis to the diol followed by oxidation to the ether, the hydroxy ether, the dihydroxy ether, and to the main metabolite in urine and faeces, the lactone. A number of unidentified polar metabolites are probably the conjugates of known metabolites. The majority of an oral dose was excreted in the faeces (70–90%) and urine (9–20%) as polar metabolites. Highest radioactivity concentrations were observed in liver and kidney followed by fat. Repeated administration of radiolabeled endosulfan or a 2 year feeding study in rats did not show a bioaccumulation of residues in fatty tissues.

Dairy cows were dosed with [^{14}C]-endosulfan at a dose rate equivalent to 22 ppm in the diet for five consecutive days, equivalent to 0.64 mg/kg bw/day. Radioactivity was detected in all edible tissues and milk at between 0.05 and 3.57 mg/kg parent equivalent. The parent compound alpha and beta isomers were detected in tissues from 2 to 15%. The major metabolite identified in all tissues, including fat and milk, was endosulfan sulphate (12–89%) with endosulfan lactone being found in kidney and liver tissue, indicating that the endosulfan is readily cleaved following dosing to a dairy cow. Metabolites other than endosulfan sulphate reported in liver and kidney tissue were produced as a result of enzymatic and acid hydrolysis of polar material that predominated in these two tissues.

Following a single dose of [^{14}C]-endosulfan (methylene labelling) to two lactating East Friesian sheep at a dose rate equivalent to 0.3 ppm in the diet, approximately 90% of the administered ^{14}C-material was excreted in the urine and faeces. Endosulfan diol and endosulfan hydroxyether, but not parent, were found in urine while endosulfan was the major component of the residue in faeces. 1–2% of the radioactivity was found in milk collected 0–17 days after administration. The main metabolite was endosulfan sulphate with the highest concentration of 0.15 mg/kg (0–24 hours after dosing) and was clearly concentrated in cream. At sacrifice, 40 days after dosing, the radioactivity level was less than 0.02 mg eq/kg in most of the organs and tissues, with exemption of liver having a peak level of 0.03 mg eq/kg.

Laying hens were dosed with [^{14}C]-endosulfan at a dose rate equivalent to 10 ppm in the diet for 12 consecutive days; the radioactivity was detected in all edible tissues at a level ranging between 0.013 and 0.974 mg/kg parent equivalent. The major metabolite identified in all tissues (excluding egg white) was endosulfan sulphate (36–65%), with a small percentage of unchanged α- and β-endosulfan also seen, plus the products of hydrolysis and oxidation namely endosulfan diol and endosulfan lactone.

In summary, the primary residues found in animal tissues were the parent, endosulfan, both alpha and beta isomers, and to a larger extent, endosulfan sulphate. The metabolism studies are consistent with the view that the parent is converted to the sulphate *in situ* and the sulphate is more likely to be measured in tissues than the parent compound. While liver appears to be the target organ for metabolism of endosulfan, the above residue components are clearly present in significant amounts in fat. The high presence of these metabolites in fat is consistent with endosulfan being a fat-soluble pesticide. However, endosulfan and endosulfan sulphate do not bioaccumulate in organisms due to the extensive metabolism with enzymatic hydrolysis of endosulfan and endosulfan sulphate forming more polar metabolites.

Plant metabolism

The meeting received plant metabolism studies with endosulfan on tomato, cucumber, apple, sugar beet and soybean.

Young tomato plants were treated three times with ^{14}C-labelled endosulfan at intervals of 7 days, each time at an application rate of 635 g ai/ha. 90% of the total radioactive residues were

extracted from tomato fruit with acetone/water and shown to consist of the parent isomers, α- and β-endosulfan and the metabolite endosulfan sulphate. In leaves, trace amounts of free and considerable amounts of conjugated endosulfan diol were also observed.

A young apple tree was treated with ^{14}C-labelled formulated endosulfan at a rate which corresponded to 1.5 kg ai/ha. 90% of the total radioactive residues could be extracted from apples with acetone/water. These residues consisted almost exclusively of the parent isomers α- and β-endosulfan and to a very low extent the metabolite endosulfan sulphate. In leaves, endosulfan sulphate occurred as a major metabolite accounting for approximately 50% of the total radioactive residues. Only traces of endosulfan diol could be detected. The portion of non-extractable residues increased up to approximately 10% at day 21 after treatment.

Cucumber plants were treated three times with ^{14}C -labelled endosulfan at intervals of 7 days, each time at a nominal application rate of 530 g ai/ha. The total radioactive residues in the leaves decreased from 185 mg/kg to 52 mg/kg parent equivalent 0 to 14 days after the last treatment. The corresponding levels in the fruit decreased only from 0.23 to 0.18 mg/kg eq. After 14 days and the third treatment with endosulfan, the major components α- and β-endosulfan and endosulfan sulphate contributed approximately 50% of the total radioactive residues. Several smaller components did not exceed 0.05 mg/kg eq each.

Sugar beet plants were treated twice at 630 g ai/ha each and harvested 21 days later. In roots, 93.4% of TRR were extractable leaving 6.6% of TRR non-extractable. The organo-soluble radioactivity in roots consisted mainly of endosulfan sulphate (59.6% of TRR) followed by α- and β-endosulfan. In sugar beet leaves, more than 93% of TRR were extractable. In total, 51.9% of the TRR were identified in the leaves. A further 32.7% of the TRR was characterised as polar radioactivity. α--endosulfan, β-endosulfan and endosulfan sulphate were the major residue components in all plant parts.

Soybean plants were treated twice at 530 g ai/ha each. Applications were made at forage stage 61 days before harvest and hay stage 38 days before harvest. In forage just after the first treatment 98.5% of TRR were extractable with 75.4% on the plant surface. In hay 87% of the TRR were extractable and in beans at harvest 94.5%. In beans and hay the major metabolite was endosulfan sulphate with respectively 78.4 and 51.2% of the TRR. β-endosulfan and α-endosulfan were detected at 5 and 1.5% of the TRR for these two parts of the plant, respectively.

The metabolism of endosulfan in plants was characterised by decreasing levels of α-endosulfan and increasing levels of β-endosulfan and the subsequent formation of endosulfan sulphate which is the major metabolite.

Environmental fate in soil

The aerobic degradation of endosulfan in soil starts with the modification of the 7-membered dioxothiepin ring. Oxidation results in the formation of the main metabolite endosulfan sulphate. The microbially induced hydrolysis of endosulfan and of endosulfan sulphate leads to ring opening of the 7-membered ring and formation of endosulfan diol. The endosulfan diol is then condensed to endosulfan ether (minor pathway) or oxidised to endosulfan hydroxy carboxylic acid and its condensation product endosulfan lactone. The chlorinated bicyclic carbon skeleton was shown to be completely degraded by considerable formation of labelled carbon dioxide in the soil metabolism study with ring labelled endosulfan sulphate.

The half lives in the laboratory were in the range of 12–39 days for α-endosulfan, 58–264 days for β-endosulfan and about 150 days for endosulfan sulphate. It should be noted here that the former laboratory degradation studies lack in the microbial activity due to the small soil samples employed and the long incubation period without re-fertilisation of the soil microbes. Therefore, degradation studies in the field are a more realistic approach. In the field, the degradation half life is shortened to 7–21 days under Southern European summer conditions. However at colder fall and

winter temperatures, the half life increased to 75–93 days. It appears that the alpha isomer degrades faster (with a half life of 6–11 days) than the beta isomer (with a half life of 19–36 days) in the field.

The main soil metabolite endosulfan sulphate is more persistent than isomers of the parent, and degrades in the field with a half life of approximately 75–161 days depending on the study conditions. Other metabolites only appear at a low level in soil and are deemed not to be relevant.

A multi-year study showed only a slight increase in soil residue levels, from the first year, to form a relatively constant plateau level in subsequent years, even in Northern Europe with cold to moderate temperatures. There does not, therefore, appear to be significant long-term accumulation of endosulfan and its sulphate in soil. Furthermore, the plateau level decreased following termination of the application.

In a rotational crop study endosulfan residues taken up by root and leafy vegetable crops, sown immediately after soil treatment at a 6× exaggerated application rate, were generally lower than the corresponding residues in soil. The highest residues were 0.2 mg/kg in the leaf and 0.3 mg/kg in the tuber of carrots, being the critical crop at the application rate of 6.6 kg ai/ha. It should be noted that there were some varying residue levels reported applying to non-mature plants at the earlier samplings. Therefore, a significant reduction in the absolute residue level in rotational crops may be expected under normal circumstances, such as; when a 1× rate is used, when there is interception of the spray by the plants reducing the proportion reaching the (non-target) soil, and when partial degradation of the pesticide in soil could occur during the interval between application of endosulfan and planting of the rotational crop.

The Meeting concluded that the presence of endosulfan residues in succeeding crops from foliar application is unlikely to be significant.

Methods of residue analysis

Methods of analysis of residues of endosulfan in plants and animal products used GC/ECD.

The methods for plant material have been validated on a wide range of crops and processed products. The principle of most methods involves a solvent extraction step followed by different matrix dependant clean up steps such as GPC, Florisil or silica gel column chromatography. The final determination is carried out by GC mostly with ECD. For enforcement purposes of plant material the method derived from the Dutch multi-residue method MRM-1 is suitable. The limit of quantification (LOQ) is typically about 0.02 mg/kg for α-endosulfan, β-endosulfan and endosulfan sulphate.

For the analysis of animal matrices, after extraction with an appropriate solvent and partition in acetonitrile, α-endosulfan, β-endosulfan and endosulfan sulphate were determined after purification by GC/ECD. The LOQ is typically about 0.025 mg/kg for α-endosulfan, β-endosulfan and endosulfan sulphate.

Stability of residues in stored analytical samples

The storage stability of endosulfan and its important metabolites was tested in plant materials and animal tissues and products. The results of all the studies indicate that the compounds are stable in frozen storage in the tested plant commodities for 18 to 24 months and in animal commodities for at least one year.

Definition of the residue

Based on the results of various plant and animal metabolism studies, endosulfan (α- and β- isomer) and its main metabolite endosulfan sulphate are the relevant residue components.

Results from metabolism studies on the distribution ratio of residues between muscle and fat show that the residues are fat soluble which is confirmed by the log P_{OW} of 4.6-4.7 for α-endosulfan

and 4.3-4.8 for β-endosulfan and 3.8 for endosulfan sulphate. Endosulfan residues are considered as fat soluble.

The Meeting concluded that the residue definition for enforcement and dietary intake purposes in plant and animal commodities is the sum of α- and β- isomer and its main metabolite endosulfan sulphate.

Results of supervised residue trials

Citrus fruits

Endosulfan is registered for foliar application to citrus fruits in Angola, Australia, Central America, Chile, Morocco, Mozambique, Saudi Arabia and South Africa. The GAP in Australia for citrus fruits is 10.5 g ai/hL with a PHI of 3 days. Endosulfan residues from supervised trials conducted in Australia according to the GAP were: 0.03, 0.16 and 0.19 mg/kg for lemons; 0.07 and 0.11 mg/kg for mandarins; and 0.05 and 0.08 mg/kg for oranges.

The Meeting considered seven supervised trials insufficient to estimate a maximum residue level for citrus fruit and withdraw the previous recommendation for oranges, sweet, sour (0.5 mg/kg).

Pome fruits

Endosulfan is registered in apples in Australia, Canada, Central America, Chile, China, Japan, Namibia, Saudi Arabia, South Africa, the USA and Zimbabwe. Results of supervised trials in Australia were reported, but those trials were not conducted according to the GAP of Australia (66.5 g ai/hL and a PHI of 28 days).

Endosulfan residues from five trials in the USA according to the US GAP (3.36 kg ai/ha/year, three applications at 66.5 g ai/hL with a PHI 21 days) were 0.16, 0.27, 0.36, 0.54 and 0.77 mg/kg.

Endosulfan residue from one trial in South Africa following GAP (1.18 kg ai /ha and a PHI of 14 days) were 0.60 mg/kg. The Meeting considered that the residues were from the same population and thus could be combined. Endosulfan residues in trials that matched GAP in ranked order were: 0.16, 0.27, 0.36, 0.54, 0.60 and 0.77 mg/kg.

Endosulfan is registered in pear in Australia, Canada, Central America, Chile, Cyprus, Greece, Japan, South Africa and the USA. Results of four supervised trials in Australia were reported, but those trials were not conducted according to the GAP (66.5 g ai/hL and a PHI of 28 days).

The Meeting considered there were insufficient trials to recommend a maximum residue level for pome fruits. The previous recommendation of 1 mg/kg for pome fruit was withdrawn.

Cherries

Supervised trials on sweet and sour cherries were performed in the USA according to GAP (3.36 kg ai/ha/year, 2 × 260 g ai/hL with a PHI of 21 days; 350 EC formulation).

Endosulfan residues obtained in sour cherry trials were as follows:

EC formulation (airblast spray): 0.12, 0.29, 0.34, 0.37, 0.53, 0.54, 0.63 (2), 0.85, 1.1 mg/kg

WP formulation (airblast spray): < 0.05 (7), 0.06 (2), 0.09 mg/kg.

Endosulfan residues obtained in sweet cherry trials were as follows:

EC formulation (airblast spray): 0.14, 0.41, 0.44, 0.52, 0.57, 0.92, 1.4 mg/kg

EC formulation (mist blower): 0.1, 0.14, 0.16 mg/kg

WP formulation (airblast spray): < 0.05, 0.06, 0.08, 0.1, 0.14, 0.20, 0.34 mg/kg and

WP formulation (mist blower): 0.31, 0.72, 0.78 mg/kg.

The residues obtained using WP and EC formulations from airblast and mist blower sprayers do not represent the same population. As a result only residues obtained from the application of the EC formulation with an airblast sprayer were considered. The results for the trials on sour and sweet cherries were combined, resulting in endosulfan residues in ranked order were: 0.12, 0.14, 0.29, 0.34, 0.37, 0.41, 0.44, 0.52, 0.53, 0.54, 0.57, 0.63 (2), 0.85, 0.92, 1.1, and 1.4 mg/kg.

The Meeting recommended a maximum residue level for cherries of 2 mg/kg to replace the previous recommendation of 1 mg/kg, an HR value of 1.4 mg/kg and an STMR value of 0.53 mg/kg.

Apricot, nectarine and peach

The Meeting received results of supervised trials on apricot, nectarine and peach conducted in Australia, but there is no GAP for these commodities. For peach, supervised trials were also reported from Europe (no GAP available) and the USA. The US trials were not conducted according to the GAP (3.36 kg ai /ha/year, 2 × 340 g ai/hL with a PHI of 21 or 2 × 66.5 g ai/hL and a PHI of 30 days).

The Meeting considered there were insufficient trials to recommend a maximum residue level for apricot, nectarine, or peach. The previous recommendation for peach of 1 mg/kg was withdrawn.

Plums (including prunes)

Neither residue data nor information on GAP for the use of endosulfan in plums was submitted.

The Meeting recommended withdrawal of the previous recommendation of 1 mg/kg for plums (including prunes).

Grapes

Endosulfan is registered for use on grapes in Canada, Central America, Chile, Croatia, Japan, Namibia, South Africa, Turkey and the USA.

Endosulfan residues from one trial in the USA conducted according to the GAP (3.36 kg ai/ha/year, 3 × 70 g ai/hL and a PHI of 7 days) was 0.75 mg/kg.

The Meeting considered one supervised residue trial insufficient to estimate a maximum residue level for grapes. The previous recommendation for grapes of 1 mg/kg was recommended for withdrawal.

Pineapple

The Meeting received results of supervised trials conducted on pineapple in the USA. As these trials were not conducted according to the US GAP (2.5 kg ai/ha, 3.36 kg ai/ha/year, with a PHI of 7 days), the Meeting could not consider them for the estimation of a maximum residue limit for pineapple.

The Meeting recommended withdrawal of the previous recommendation of 2 mg/kg (Po).

Other tropical fruits (avocado, custard apple, litchi, mango, papaya, persimmon)

The Meeting received results of supervised trials conducted in Australia on avocado, custard apple, litchi, mango, pawpaw (papaya) and persimmon.

In Australia, the GAP specifies an application rate of 70 g ai/hL for avocado, custard apple, mango and persimmon and an application rate of 52.5 g ai/hL for litchi and papaya. The PHI is 7 days, except for avocado (14 days).

Endosulfan residues obtained from the trials in Australia according to the corresponding GAPs were 0.01 and 0.11 mg/kg for avocado; 0.1 and 0.35 mg/kg for custard apple; 1.0 and 1.3

mg/kg for litchi; 0.17 and 0.20 mg/kg for mango; 0.1 and 0.18 mg/kg for papaya; and 0.55 and 0.89 mg/kg for persimmons.

The Meeting decided to combine endosulfan residues for avocado, custard apple, mango and papaya for mutual support, the residues in ranked order were: 0.01, 0.1 (2), 0.11, 0.17, 0.18, 0.20 and 0.35 mg/kg.

The Meeting estimated a maximum residue level of 0.5 mg/kg, an HR value of 0.35 mg/kg and an STMR value of 0.14 mg/kg for avocado, custard apple, mango and papaya.

The Meeting decided to combine endosulfan residues for litchi and persimmon for mutual support, with the residues being, in ranked order, 0.55, 0.89, 1.0, and 1.3 mg/kg.

The Meeting estimated a maximum residue level of 2 mg/kg, an HR value of 1.3 mg/kg and an STMR value of 0.95 mg/kg for litchi and persimmon.

Onion, bulb

Neither residue data nor information on GAP on the use of endosulfan in onions was submitted.

The Meeting recommended withdrawal of the previous recommendation of 0.2 mg/kg for onion, bulb.

Cabbages, head

Endosulfan is registered for foliar application on cabbage in Australia, Canada, Central America, Chile, Japan, New Zealand, Turkey and the USA.

Endosulfan residues in head cabbages from two trials in the USA according to that countries GAP (1.27 kg ai /ha with a PHI of 7 days) were 0.05 and 0.24 mg/kg, and from two trials in Australia according to its GAP (0.735 kg ai /ha with a PHI of 7 days) 0.026 and 0.1 mg/kg. The Meeting considered four supervised trials insufficient to estimate a maximum residue level for cabbage.

The Meeting recommended withdrawal of the previous recommendations of 1 mg/kg for head cabbage and of 2 mg/kg for Savoy cabbage.

Brussels sprouts

Endosulfan is registered for foliar application to Brussels sprouts in Canada, Central America, Namibia, South Africa and the USA.

Two trials from the USA were done according to the Canadian GAP (0.7 kg ai /ha with a PHI of 7 days), resulting in endosulfan residues of 0.68 and 0.94 mg/kg.

The Meeting considered two supervised trials insufficient to recommend a maximum residue level for Brussels sprouts.

Broccoli

Endosulfan is registered for foliar application to broccoli in Australia, Canada, Central America and in the USA.

Endosulfan residues from 17 trials from the USA, according to the GAP (1.27 kg ai /ha with a PHI of 7 days) were 0.22, 0.26, 0.28, 0.36, 0.37, 0.56, 0.57, 0.74, 0.79, 0.88, 0.97, 1.07, 1.31, 1.32, 1.86, 2.04, and 2.40 mg/kg.

Endosulfan residues from three trials in Australia, conforming to that countries GAP (0.735 kg ai /ha with a PHI of 7 days) were 0.17, 0.29 and 0.60 mg/kg.

The Meeting considered the trials to all be from similar populations and decided to combine the data for the purpose of maximum residue level recommendation. Endosulfan residues in ranked

order were (n = 20): 0.17, 0.22, 0.26, 0.28, 0.29, 0.36, 0.37, 0.56, 0.57, 0.60, 0.74, 0.79, 0.88, 0.97, 1.07, 1.31, 1.32, 1.86, 2.04, and 2.4 mg/kg.

The Meeting estimated a maximum residue level for broccoli of 3 mg/kg to replace the previous recommendation of 0.5 mg/kg, an HR value of 2.4 mg/kg and an STMR value of 0.67 mg/kg.

Cauliflower

Endosulfan is registered for foliar application to cauliflower in Australia, Canada, Central America, Japan, New Zealand and the USA.

Endosulfan residues in cauliflower from two US trials conforming to the Canadian GAP (0.875 kg ai/ha with a PHI of 7 days) were < 0.05 and 0.1 mg/kg. Residues from one Australian trial at GAP (0.735 kg ai/ha with a PHI of 7 days) was 0.09 mg/kg. The Meeting considered three supervised trials insufficient to recommend a maximum residue level for cauliflower.

The Meeting recommended withdrawal of the previous recommendations of 0.5 mg/kg for cauliflower.

Cucumber

The Meeting received results of supervised trials on cucumbers conducted in Europe, Australia and the USA. No GAP was available for cucumber in Europe. The GAP in Australia specifies an application concentration of 70 g ai/hL and a PHI of 3 days. The GAP in the USA specifies an application rate of 1.27 kg ai/ha (3.36 kg ai/ha/year) and a PHI of 2 days.

Endosulfan residues from 20 trials in the USA at the GAP, in ranked order, were 0.18, 0.19, 0.22, 0.23, 0.24, 0.28, 0.30 (2), 0.31 (2), 0.32 (3), 0.36 (2), 0.40, 0.42, 0.53, 0.58 and 0.64 mg/kg. Endosulfan residues from two trials on cucumbers in Australia at the GAP were 0.09 and 0.11 mg/kg. The combined residues in cucumber were 0.09, 0.11, 0.18, 0.19, 0.22, 0.23, 0.24, 0.28, 0.30 (2), 0.31 (2), 0.32 (3), 0.36 (2), 0.40, 0.42, 0.53, 0.58 and 0.64 mg/kg.

The Meeting estimated a maximum residue level of 1 mg/kg to replace the previous recommendation of 0.5 mg/kg, an STMR value of 0.31 mg/kg and an HR value of 0.64 mg/kg.

Melons, except watermelon

The Meeting received results of supervised trials on melons conducted in Europe, Australia and the USA. No GAP was available for melons in Europe. The GAP in Australia specifies an application concentration of 70 g ai/hL and a PHI of 3 days. The GAP in the USA specifies an application rate of 1.27 kg ai/ha (3.36 kg ai/ha/year) and a PHI of 2 days.

Endosulfan residues from 12 trials in the USA at the GAP were 0.05, 0.22, 0.24, 0.30 (2), 0.34, 0.35, 0.40, 0.41, 0.45, 0.49 and 0.60 mg/kg in the whole fruit. Endosulfan residues from two trials on melons in Australia at the GAP were 0.55 and 1.2 mg/kg in the whole fruit. The combined residue data, in rank order, were: 0.05, 0.22, 0.24, 0.30 (2), 0.34, 0.35, 0.40, 0.41, 0.45, 0.49, 0.55, 0.60 and 1.2 mg/kg in the whole fruit.

No pulp samples were analyzed in the US and Australian trials. The Meeting decided to use results for pulp and whole fruit reported for trials in Southern Europe, obtaining pulp to whole fruit ratios of < 0.1, < 0.13, 0.17, < 0.25 (2), < 0.29, < 0.50, <1.0 (2) with a median of < 0.25.

Based on the whole fruit data, the Meeting estimated a maximum residue level of 2 mg/kg to replace the previous recommendation of 0.5 mg/kg. Based on the melon pulp vs. whole fruit residue ratio, the Meeting estimated an STMR value of 0.09 mg/kg and an HR value of 0.3 mg/kg for melon pulp.

Squash, summer

The Meeting received results of supervised trials on summer squash conducted in Spain and the USA and on zucchini in Australia.

Endosulfan residues from 12 trials in the USA at the GAP, in ranked order, were < 0.05, 0.05, 0.07, 0.08, 0.09, 0.13, 0.14, 0.15, 0.16 (2), 0.17 and 0.23 mg/kg. For zucchini, residues from four Australian trials, at the GAP, were 0.05, 0.06, and 0.09 (2) mg/kg. The combined summer squash and zucchini residues were < 0.05, 0.05, 0.05, 0.06, 0.07, 0.08, 0.09 (3), 0.13, 0.14, 0.15, 0.16 (2), 0.17 and 0.23 mg/kg.

The Meeting estimated a maximum residue level for summer squash of 0.5 mg/kg which confirms the previous recommendation, an STMR of 0.09 mg/kg and an HR of 0.23 mg/kg.

Peppers

Endosulfan is registered for use as a foliar spray on peppers in Australia, Canada, Cyprus, Greece, and the USA. The Meeting received results of supervised trials on peppers conducted in the USA, Australia and Spain. No GAP was available from Spain and the GAP from Greece did not specify a PHI.

Endosulfan residues in two trials from the USA according to Canadian GAP (1.125 kg ai/ha with a PHI of 2 days) were 0.05 and 0.22 mg/kg. Endosulfan residues in two Australian trials at the GAP (66.5 g ai/hL with a PHI of 3 days) were 0.36 and 0.40 mg/kg.

The Meeting considered four trials insufficient to recommend a maximum residue limit for peppers.

Tomato

Endosulfan is registered for use as a foliar spray on tomatoes in Angola, Australia, Canada, Central America, Chile, Cyprus, Ecuador, Greece, Japan, Morocco, Mozambique, Namibia, New Zealand, South Africa, Spain, the USA, Venezuela and Zimbabwe. The Meeting received results of supervised trials on tomatoes conducted in the USA, Australia, Germany, Greece, Italy, Portugal and Spain.

In the USA, endosulfan is registered for the use on tomatoes at 1.27 kg ai/ha (3.36 kg ai/ha/year) with a PHI of 2 days. In field trials in the USA that matched the GAP, the endosulfan residues were 0.03, 0.04, < 0.05, < 0.05, 0.07, 0.1, 0.16, 0.21, 0.22, 0.24, 0.25, 0.25, 0.25, 0.27, 0.27, 0.27, 0.27, 0.28, 0.29, 0.33, 0.33, 0.34, 0.35, 0.38, 0.42, 0.45, 0.45, 0.47, 0.66, 0.73, 0.83 and 0.85 mg/kg (n = 32).

In Australia, endosulfan residues from field trials after application of 0.15 – 0.17 kg ai/hL and a PHI of 3 days were < 0.005, 0.06, 0.07 and 0.09 mg/kg but did not match the GAP (66.5 g ai/hL).

Endosulfan residues conducted outdoor in Southern Europe according to the GAP of Spain (0.53 kg ai/ha and a PHI of 3 days) were: 0.03, 0.03, 0.04, 0.05, 0.07, 0.07, 0.1, 0.11, 0.13, 0.13, 0.13, 0.15, 0.15, 0.19, 0.19, 0.19, 0.21, 0.22, 0.24, 0.28, 0.43 and 0.79 mg/kg (n = 22).

Endosulfan residues conducted indoor in Southern Europe according to the GAP of Spain were: 0.05, 0.07, 0.09, 0.1, 0.11, 0.12, 0.16, 0.17, 0.19, 0.20, 0.21, 0.21, 0.21, 0.23, 0.24, 0.27, 0.28, 0.29, 0.32, 0.35, 0.37, 0.41, 0.60, 0.65 and 0.72 mg/kg (n = 25).

The Meeting agreed to combine the results of the trials in the USA and Southern Europe, resulting in endosulfan residues of (in ranked order):

0.03(3), 0.04, 0.04, < 0.05, < 0.05, 0.05, 0.05, 0.07 (4), 0.09, 0.1(3), 0.11, 0.11, 0.12, 0.13(3), 0.15, 0.15, 0.16, 0.16, 0.17, 0.19(4), 0.20, 0.21(5), 0.22, 0.22, 0.23, 0.24(3), 0.25(3), 0.27(4), 0.28(3), 0.29, 0.29, 0.32, 0.33, 0.33, 0.34, 0.35, 0.35, 0.37, 0.38, 0.41, 0.42, 0.43, 0.45, 0.45, 0.47, 0.60, 0.65, 0.66, 0.72, 0.73, 0.79, 0.83 and 0.85 mg/kg (n = 79).

The Meeting estimated a maximum residue level for tomatoes of 1 mg/kg to replace the previous recommendation of 0.5 mg/kg, an HR value of 0.85 mg/kg and an STMR value of 0.22 mg/kg.

Eggplant

The Meeting received results of supervised trials on eggplant from Australia. Four trials were conducted according to the GAP of Australia (0.735 kg ai/ha with a PHI of 7 days), resulting in endosulfan residues of < 0.005, < 0.005, 0.006 and 0.06 mg/kg.

The Meeting estimated a maximum residue level for eggplant of 0.1 mg/kg, an HR value of 0.06 mg/kg and an STMR value of 0.006 mg/kg.

Sweet corn

The Meeting received results of supervised trials on sweet corn from Australia. As no GAP was available for Australia, the Meeting was not able to recommend a maximum residue limit for sweet corn.

Lettuce and kale

Endosulfan is registered for use on lettuce and kale from the USA. No residue data for lettuce and kale were submitted.

The Meeting recommended withdrawal of the previous recommendations of 1 mg/kg for kale, lettuce, head and lettuce, leaf.

Spinach

Endosulfan is registered for use on spinach in the USA. No residue data for spinach were submitted.

The Meeting recommended withdrawal of the previous recommendations of 2 mg/kg for spinach.

Beans

Endosulfan is registered for use as a foliar spray on beans in Angola, Canada, Central America, Chile, Japan, Peru, Myanmar, Namibia, South Africa, the USA and Zimbabwe. The Meeting received results of supervised trials on beans from Germany, Australia and the USA.

Only one trial in the USA conformed to the US GAP (3.36 kg ai/ha/year with a PHI of 3 days). In this trial the total endosulfan residue was 0.64 mg/kg.

The Meeting considered four supervised trials insufficient to estimate a maximum residue level for beans. The previous recommendations for broad bean (green pods and immature seeds) and common bean (pods and/or immature seeds) of 0.5 mg/kg were withdrawn.

Peas

The Meeting received results of supervised trials on peas from Australia. No GAP was available for Australia, therefore the Meeting was not able to recommend a maximum residue limit for peas.

The Meeting recommended withdrawal of the previous recommendation for garden pea (young pods) of 0.5 mg/kg.

Soybean (dry)

Endosulfan is registered for use on soybean in Australia, Brazil, Central America, Chile, Iran and Zimbabwe.

The Meeting received results of supervised trials on soybeans from Australia and Brazil. The trials in Australia were not conducted according to the GAP of Australia (350 g ai/ha with a PHI of 1 day).

Eighteen trials conducted in Brazil conformed to the Brazilian GAP (0.525 kg ai/ha and a PHI of 30 days). Endosulfan residues obtained in these trials were < 0.02, 0.05, 0.08, 0.09, 0.1 (2), 0.15, 0.20 (3), 0.25, 0.30 (2), 0.31, 0.40, 0.42, 0.45 and 0.60 mg/kg.

The Meeting estimated a maximum residue level for soybeans of 1 mg/kg which confirms the previous recommendation, and an STMR value of 0.2 mg/kg.

Carrot and beetroot

The Meeting received results of supervised trials on carrot and beetroot from Australia. The GAP of Australia for carrot and beetroot specifies a maximum application rate of 0.735 kg ai/ha and a PHI of 14 days.

For carrot, four trials were conducted according to the GAP, with endosulfan residues being < 0.005, 0.04, 0.1 and 0.13 mg/kg. Only one trial on beetroot conformed to the GAP, resulting in 0.25 mg/kg of endosulfan.

The Meeting considered five supervised trials insufficient to estimate a maximum residue level for carrot and beetroot. The Meeting recommended withdrawal of the previous recommendation for carrot of 0.2 mg/kg.

Potato and sweet potato

Endosulfan is registered for use as a foliar spray on sweet potatoes in Australia, Japan and the USA and on potatoes in Australia, Canada, Central America, Chile, Iran, Japan, New Zealand, Peru, Turkey, the USA and Zimbabwe.

The Meeting received results of supervised trials on potatoes in Australia, Europe (no GAP), and the USA. Three trials in Australia were conducted according to the GAP of Australia (0.735 kg ai /ha with a PHI of 14 days), resulting in endosulfan residues of < 0.005, 0.005 and 0.007 mg/kg. In a single trial reported in the USA, endosulfan residues < 0.05 mg/kg occurred at the rate of 5.56 kg ai/ha with 3 applications and a PHI of 1 day (US GAP: 3.36 kg ai/ha/year and a PHI of 1 day). Endosulfan residues in all trials on potatoes were below the LOQ of 0.05 mg/kg (even for two Australian trials conducted at a double application rate as compared to the GAP in Australia).

The Meeting received results of supervised trials on sweet potato in Australia and the USA. One trial in Australia was at the GAP (0.735 kg ai/ha with a PHI of 14 days) and the endosulfan residue was < 0.005 mg/kg. Sixteen trials in the USA were conducted according to the US GAP (3.36 kg ai/ha/year with a PHI of 1 day), resulting in endosulfan residues < 0.05 mg/kg.

The Meeting decided to use the results of supervised trials on sweet potato to support the recommendation for potato. The Meeting estimated a maximum residue level for potato and sweet potato of 0.05* mg/kg, an HR value of 0.05 and an STMR value of 0.05 mg/kg. The Meeting decided to withdraw the previous recommendations for potato and sweet potato of 0.2 mg/kg.

Sugar beet

Endosulfan is registered for foliar application to sugar beet in Canada, Chile and Japan. The Meeting received results of supervised trials on sugar beet in Italy. No GAP was available for Europe; therefore the Meeting was not able to recommend a maximum residue limit for sugar beet.

The Meeting recommended withdrawal of the previous recommendation of 0.1 mg/kg for sugar beet.

Celery

Endosulfan is registered for foliar application to celery in Canada, Central America, Australia and in the USA. The Meeting received results of supervised trials on celery from Australia and the USA.

Two trials in Australia were conducted according to Australian GAP (66.5 g ai/hL with a PHI of 7 days). Endosulfan residues were 0.29 and 1.1 mg/kg.

Twelve trials in the USA were conducted according to the GAP of the USA (1.12 kg ai/ha/year with a PHI of 4 days). Endosulfan residues were 1.0, 1.4, 1.8, 2.5, 2.6 (2), 2.9, 3.1 (2), 3.8, 4.1 and 5.0 mg/kg.

The Meeting considered the trials to all be from similar populations and decided to combine the residue data obtained from the US and Australian trials. Endosulfan residues in ranked order were: 0.29, 1.0, 1.1, 1.4, 1.8, 2.5, 2.6 (2), 2.9, 3.1 (2), 3.8, 4.1 and 5.0 mg/kg.

The Meeting estimated a maximum residue level for celery of 7 mg/kg to replace the previous recommendation of 2 mg/kg, an HR value of 5.0 mg/kg and an STMR value of 2.6 mg/kg.

Rhubarb

The Meeting received results of supervised trials on rhubarb in Australia. Endosulfan is not registered for use as a foliar spray on rhubarb in Australia and therefore the Meeting was not able to recommend a maximum residue limit for rhubarb.

Hazelnuts and macadamia nuts

Endosulfan is registered for foliar spraying on hazelnuts in Poland, Spain and Turkey and on macadamia nuts in Australia.

For hazelnuts, the Meeting received results of supervised trials from Italy. Two of the trials were performed according to the GAP of Spain (105 g ai/hL with a PHI of 30 days). Endosulfan residues were < 0.02 mg/kg.

For macadamia nuts, results of four supervised trials from Australia were reported. Three of the trials were conducted according to the GAP of Australia (70 g ai/hL with a PHI of 2 days) and one trial at 50% above the GAP. Endosulfan residues were < 0.005 mg/kg in all four trials.

The Meeting decided to use the results for hazelnuts and macadamia nuts for mutual support and estimated a maximum residue level for hazelnuts and macadamia nuts of 0.02(*) mg/kg, an HR of 0 mg/kg and a STMR of 0 mg/kg .

Cotton seed

Endosulfan is registered for use on cotton in Angola, Australia, Benin, Brazil, Burkina, Central America, China, Cyprus, Ecuador, Ethiopia, Greece, India, Iran, Ivory Coast, Madagascar, Mali, Morocco, Mozambique, Myanmar, Namibia, Pakistan, Peru, South Africa, Spain, Sudan, Thailand, Togo, Turkey, the USA, Venezuela and Zimbabwe. The Meeting received results of supervised trials on cotton conducted from Australia, Greece and Spain.

One trial in Australia, conducted according to Australian GAP (0.735 kg ai/ha with a PHI of 56 days), had a residue < 0.02 mg/kg.

Seven trials in Southern Europe with a CS formulation were according to the GAP of Southern Europe (0.84 kg ai/ha with a PHI of 21 days), resulting in endosulfan residues of < 0.02 (5) and 0.24 mg/kg. Three trials with an EC formulation in Southern Europe according the same GAP resulted in endosulfan residues of < 0.02 (3) and 0.06 mg/kg.

The Meeting considered the trials to all be from similar populations and decided to combine the residue data obtained from Australia and Southern Europe. Combined endosulfan residues, in ranked order, were: < 0.02 (9), 0.06 and 0.24 mg/kg.

The Meeting estimated a maximum residue level for cotton seed of 0.3 mg/kg to replace the previous recommendation of 1 mg/kg, and a STMR of 0.02 mg/kg.

Rape seed

Endosulfan is registered for use on oil seed in Australia. No residue data for rape seed were submitted.

The Meeting recommended withdrawal of the previous recommendation of 0.5 mg/kg for rape seed.

Sunflower seed

Endosulfan is registered for use on oil seed in Australia. No residue data for sunflower seed were submitted.

The Meeting recommended withdrawal of the previous recommendation of 1 mg/kg for sunflower seed.

Maize

Endosulfan is registered for use on cereals in Australia. No residue data for maize were submitted.

The Meeting recommended withdrawal of the previous recommendation of 0.1 mg/kg for maize.

Rice

Neither residue data nor information on GAP of the use of endosulfan in rice were submitted.

The Meeting recommended withdrawal of the previous recommendation of 0.1 mg/kg for rice.

Wheat

Endosulfan is registered for use on cereals (barley, oats, rye, wheat) in Australia and the USA. No residue data for cereals were submitted.

The Meeting recommended withdrawal of the previous recommendation of 0.2 mg/kg for wheat.

Cocoa beans

Endosulfan is registered for use on cocoa in Brazil, Cameroon, Ivory Coast, Malaysia and Nigeria. The Meeting received results of supervised trials on cocoa from Brazil, Ghana and the Ivory Coast.

The trials in Brazil were conducted at application rates below the rate specified in the Brazilian GAP (87.5 g ai/hL with a PHI of 30 days).

Eight trials from Ghana and one trial from the Ivory Coast were conducted according to the GAP of Cameroon (0.26 kg ai/ha, with a PHI of 28 day), resulting in endosulfan residues in beans of < 0.01 (9) mg/kg.

Nine trials from the Ivory Coast conformed to the GAP of the Ivory Coast (0.250 g ai/ha, with the PHI not specified). The highest residues from these trials were selected for consideration: < 0.01 (5), 0.01, 0.03 (2), 0.06, and 0.08 mg/kg.

Endosulfan residues obtained in the trials from Ghana and the Ivory Coast in ranked order were: < 0.01 (14), 0.01, 0.03 (2), 0.06 and 0.08 mg/kg.

The Meeting estimated a maximum residue level for cocoa beans of 0.2 mg/kg to replace the previous recommendation of 0.1 mg/kg, and an STMR value of 0.01 mg/kg.

Coffee beans

Endosulfan is registered for use on coffee in Brazil, Cameroon, Central America, Cuba, Ecuador, Namibia, Peru, South Africa, Sudan, Thailand and Zimbabwe.

Three trials from Colombia, two trials from Mexico, two trials from Guatemala and three trials from Brazil were conducted according to the GAP of Cuba (0.613 kg ai/ha with a PHI of 30 days). Endosulfan residues in ranked order were: < 0.01 (3), 0.01, 0.02 (2), 0.03, 0.06, 0.08 and 0.09 mg/kg.

The Meeting estimated a maximum residue level for coffee beans of 0.2 mg/kg to replace the previous recommendation of 0.1 mg/kg, and a STMR of 0.02 mg/kg.

Tea

Endosulfan is registered for use on tea in China, Japan and Malaysia. The Meeting received results of supervised trials from India, which could not be matched against provided GAPs from China, Japan or Malaysia. The Meeting was not able to recommend a maximum residue limit for tea.

The Meeting recommended withdrawal of the previous recommendation of 30 mg/kg for tea, green and black.

Fate of residues during processing

The hydrolysis of ^{14}C-endosulfan under conditions representing food processing operations was investigated. Following pasteurisation, baking, boiling and sterilisation simulation, α-endosulfan, β-endosulfan and the hydrolysis product endosulfan-diol were the main components found.

The effect of processing on the level of residues of endosulfan has been studied in oranges, apples, peaches, grapes, pineapples, tomatoes, potatoes, soybeans, coffee beans, cacao beans and tea.

The processing factors (PF) shown below were calculated from the total residues for the commodities for which MRLs, STMRs and HRs were estimated. The mean PF was calculated from three values, otherwise the median PF was calculated.

RAC	Processed product	No.	PF	Mean/median PF
Tomatoes	juice	10	< 0.1, < 0.12, < 0.16, < 0.16, < 0.17, < 0.20, < 0.20, 0.20, 0.27, 0.49	< 0.185
	paste	5	0.16, 0.33, 0.59, 1.0, 1.62, 1.63	0.59
	puree	5	< 0.1, 0.33, 0.51, 0.64, 0.66	0.51
	fruit, peeled and canned	4	0.075, 0.1, < 0.20, < 0.20	0.15
	fruit, unpeeled and canned	6	0.33, 0.44, 0.50, 0.50, 1.0,1.1	0.50
Soybeans	crude oil	3	1.17, 4.1, 4.33	3.2
Coffee beans	ground roast coffee	1	< 0.063	< 0.063
	instant coffee	1	< 0.063	< 0.063

Tomatoes were processed into juice, paste, puree, peeled canned fruit and unpeeled canned fruit with processing factors of < 0.185, 0.59, 0.51, 0.15 and 0.50, respectively. Based on the STMR value of 0.22 mg/kg for tomato, the STMR-Ps were 0.04 mg/kg, 0.13 mg/kg, 0.11 mg/kg, 0.03 mg/kg,

0.11 mg/kg, for residues in tomato juice, paste, puree, peeled canned fruit and unpeeled canned fruit, respectively.

Soya beans were processed into crude oil with a processing factor of 3.2. Based on the STMR value of 0.2 mg/kg for soya beans, the STMR-P was 0.64 mg/kg for soybean crude oil.

The Meeting recommended a maximum residue limit of 2 mg/kg for soybean crude oil, based on the highest residue of 0.6 mg/kg for soya beans and the processing factor of 3.2.

Coffee beans were processed into roasted coffee and instant coffee with a processing factor of < 0.063 for both. Based on the STMR value of 0.02 mg/kg for coffee beans, the STMR-Ps were 0.0013 mg/kg for roasted coffee and instant coffee.

For cotton seed, no processing studies were submitted. The previous recommendation of 0.5 mg/kg for cotton seed oil, crude, was recommended for withdrawal.

Farm animal dietary burden

The Meeting estimated the dietary burden of endosulfan residues in livestock (farm animals) on the basis of the livestock diets listed in Appendix IX of the *FAO Manual* (FAO 2002).

The maximum dietary burden calculations include the highest residues (HR) and STMR-P values which are used for the estimation of maximum residue levels in animal commodities such as milk, eggs, meat and offal. The STMR dietary burden calculations for livestock allow an estimate of the median residues in milk, eggs, meat and offal that can be used in the chronic dietary assessments and in this case STMR and STMR-P values for feeds are used.

The percentage dry matter (DM) is taken as 100% where highest residues and STMR values are expressed on a dry weight basis.

Calculation of the dietary burden for maximum residue estimation

Commodity	*Group*	*Residue (mg/kg)*	*% DM*	*highest residue or STMR*	Diet content (%)			*Residue (mg/kg)*		*Contribution*
					Beef cattle	Dairy cows	Poultry	*Beef cattle*	*Dairy cows*	*Poultry*
Cotton seed	*SO*	*0.24*	*88*	*HR*	10	25	NU	*0.027*	*0.068*	*NU*
Soya bean	*VD*	*0.6*	*89*	*HR*	15	15	20	*0.1*	*0.1*	*0.135*
Potato	*VR*	*0.05*	*20*	*HR*	75	40	NU	*0.19*	*0.1*	*NU*
Total					100	80	20	*0.32*	*0.27*	*0.13*

The calculated highest dietary burdens for beef cattle, dairy cattle and poultry are 0.32, 0.27 and 0.13 ppm, respectively.

Calculation of the dietary burden for STMR estimation

Commodity	*Group*	*Residue (mg/kg)*	*% DM*	*highest residue or STMR*	Diet content (%)			*Residue (mg/kg)*		*Contribution*
					Beef cattle	Dairy cows	Poultry	*Beef cattle*	*Dairy cows*	*Poultry*
Cotton seed	*SO*	*0.02*	*88*	*STMR*	10	25	NU	*0.002*	*0.006*	*NU*
Soya bean	*VD*	*0.2*	*89*	*STMR*	15	15	20	*0.034*	*0.034*	*0.045*
Potato	*VR*	*0.05*	*20*	*STMR*	75	40	NU	*0.188*	*0.1*	*NU*
Total					100	80	20	*0.22*	*0.14*	*0.04*

The STMR dietary burdens for beef cattle, dairy cattle and poultry are 0.22, 0.14 and 0.04 ppm, respectively.

Animal commodity maximum residue levels

The livestock dietary burdens used for the estimation of the maximum residue levels for animal commodities are 0.32 ppm for beef cattle, 0.27 ppm for dairy cattle and 0.13 ppm for poultry. The livestock dietary burdens used for the STMR estimation for dietary risk assessment are 0.22 ppm for beef cattle, 0.14 ppm for dairy cattle and 0.04 ppm for poultry.

For poultry, the maximum dietary burden is estimated as 0.13 ppm. As a poultry feeding study was not provided, the poultry metabolism study is used to estimate maximum residue levels for eggs and poultry tissues. In the poultry metabolism study, hens were orally dosed for 12 days at levels of ^{14}C endosulfan ranging 10 to 12 ppm. Scaling the TRR in eggs and poultry tissues for a maximum dietary burden of 0.13 ppm, residues in eggs, poultry muscle/fat and liver are 0.011 mg/kg, 0.013 mg/kg and 0.006 mg/kg respectively. The validated method of analysis for poultry tissues and eggs was conducted at concentrations of 0.025 mg/kg for each component of the residue definition, and as residues in poultry tissues and eggs are expected to be less than the validated LOQ of all of the components of the residue definition, the Meeting recommended maximum residue levels of 0.03* mg/kg for eggs, poultry meat and poultry edible offal. The STMR and HR values for eggs, poultry meat and poultry edible offal were 0.025 mg/kg.

For cattle, the maximum dietary burden for beef cattle and dairy cows is 0.32 and 0.27 ppm, respectively. The dietary burden for beef cattle will determine the estimates for meat, fat and edible offal while the dietary burden for dairy cows will determine the estimate for milk.

The maximum dietary burden of 0.32 ppm is below the lowest dose level in the cattle feeding study of 4 ppm. The target tissue for endosulfan residues in animal tissues is fat. The variation in residues in fat with dose level is significant and it is noted that at the 4 ppm dose level residues in composite fat were 1.2, 1.4 and 1.7 mg/kg. Using the highest residue of 1.7 mg/kg and scaling to 0.32 ppm, leads to an estimated residue of 0.14 mg/kg in fat. The Meeting noted that as the samples in the feeding study were composited fats and not from individual fat depots and as residues in meat producing animals are likely to be higher than milk producing animals, the Meeting recommended a maximum residue level of 0.2 mg/kg in meat on a fat basis. The previous recommendation of 0.1 mg/kg (fat) for meat (from mammals other than marine mammals) was withdrawn.

Similarly, scaling for residues in liver and kidney against the highest residues in the dose group leads to estimates of 0.078 mg/kg for liver and 0.006 mg/kg in kidney. On the basis of the estimates, the Meeting recommended maximum residue levels of 0.1 mg/kg for liver and 0.03* mg/kg for kidney.

For milk, residues in whole milk following dosing at 4 ppm ranged from 0.05 mg/kg to 0.08 mg/kg. Scaling for a dietary burden of 0.27 ppm, leads to an estimate of 0.005 mg/kg endosulfan in whole milk. Endosulfan is defined as fat-soluble, and residues in cream following dosing at 12 ppm ranged 0.81−1.42 mg/kg. Based on a dietary burden of 0.27 ppm for a dairy animal, residues in cream result in an estimate of 0.032 mg/kg. The Meeting recommended maximum residue levels of 0.1 mg/kg for milk fat and of 0.01 mg/kg for whole milk. The previous recommendation of 0.004 mg/kg F was withdrawn.

For dietary risk assessment, the STMR values are 0.09 mg/kg for meat/fat, 0.0039 mg/kg for muscle, 0.003 mg/kg for milk, 0.034 mg/kg for cream or milk fat, 0.054 mg/kg for liver and 0.004 mg/kg for kidney. The estimated HR values were 0.14 mg/kg for meat/fat, 0.0056 mg/kg for muscle, 0.078 mg/kg for liver and 0.006 for kidney.

RECOMMDENDATIONS

On the basis of the data from supervised trials, the Meeting concluded that the residue concentrations listed below are suitable for establishing MRLs and for assessing IEDIs and IESTIs.

Definition of the residue (for compliance with the MRL and for estimation of the dietary intake):

Sum of alpha endosulfan, beta endosulfan and endosulfan sulfate. This definition applies to plant and animal commodities.

The residue is fat soluble.

CCN	Commodity	MRL, mg/kg		STMR or STMR-P, mg/kg	HR or HR/P mg/kg
		New	Previous		
FI 0326	Avocado	0.5		0.14	0.35
VP 0522	Broad bean (green pods and immature seeds)	W	0.5		
VB 0400	Broccoli	3	0.5	0.67	2.4
VB 0403	Cabbage, Savoy	W	2		
VB 0041	Cabbages, Head	W	1		
SB 0715	Cacao beans	0.2	0.1	0.01	
VR 0577	Carrot	W	0.2		
VB 0404	Cauliflower	W	0.5	-	-
VS 0624	Celery	7	2	2.6	5.0
FS 0013	Cherries	2	1	0.53	1.4
SB 0716	Coffee beans	0.2	0.1	0.02	
	Coffee beans, roasted			0.0013	
	Coffee, instant			0.0013	
VP 0526	Common bean (pods and/or immature beans)	W	0.5		
SO 0691	Cotton seed	0.3	1	0.02	
OC 0691	Cotton seed oil, Crude	W	0.5		
VC 0424	Cucumber	1	0.5	0.31	0.64
FI 0322	Custard apple	0.5		0.14	0.35
PE 0112	Eggs	0.03*		0.025	0.025
VO 0440	Eggplant	0.1		0.006	0.06
VP 0528	Garden pea (young pods)	W	0.5		
FB 0269	Grapes	W	1		
TN 0666	Hazelnuts	0.02*		0	0
VL 0480	Kale	W	1		
MO 0098	Kidney of cattle, goats, pigs and sheep	0.03*		0.004	0.006
VL 0482	Lettuce, Head	W	1		
VL 0483	Lettuce, Leaf	W	1		
FI 0343	Litchi	2		0.95	1.3
MO 0098	Liver of cattle, goats, pigs and sheep	0.1		0.054	0.078
TN 0669	Macadamia nuts	0.02*		0	0
GC0645	Maize	W	0.1		
MM 0095	Meat (from mammals other than marine mammals)	0.2 (fat)	0.1 (fat)	fat 0.09 muscle 0.0039	fat 0.14 muscle 0.0056
FI 0345	Mango	0.5		0.14	0.35
VC 0046	Melons, except watermelon	2	0.5	0.09	0.3
ML 0106	Milks	0.01	0.004 F	0.003	
FM 0183	Milk fats	0.1		0.034	

CCN	Commodity	MRL, mg/kg		STMR or STMR-P, mg/kg	HR or HR/P mg/kg
		New	Previous		
VA 0385	Onion, Bulb	W	0.2		
FC 0004	Oranges, Sweet, Sour	W	0.5		
FI 0350	Papaya	0.5		0.14	0.35
FS 0247	Peach	W	1		
FI 0352	Persimmon	2		0.95	1.3
FI 0353	Pineapple	W	2 Po		
FS 0014	Plums (including prunes)	W	1		
FP 0009	Pome fruits	W	1		
VR 0589	Potato	0.05*	0.2	0.05	0.05
PM 0110	Poultry meat	0.03*		0.025	0.025
PO 0111	Poultry, edible offal of	0.03*		0.025	0.025
SO 0495	Rape seed	W	0.5		
GC 0649	Rice	W	0.1		
VD 0541	Soya bean (dry)	1	1	0.2	
OC 0541	Soya bean oil, crude	2		0.64	
VL 0502	Spinach	W	2		
VC 0431	Squash, Summer	0.5	0.5	0.09	0.23
VR 0596	Sugar beet	W	0.1		
SO 0702	Sunflower seed	W	1		
VR 0508	Sweet potato	0.05*	0.2	0.05	0.05
DT 1114	Tea, Green, Black	W	30		
VO 0448	Tomato	1	0.5	0.22	0.85
JF 0448	Tomato juice			0.04	
	Tomato paste			0.13	
	Tomato puree			0.11	
	Tomato canned fruit, unpeeled			0.11	
	Tomato canned fruit, peeled			0.03	
GC 0654	Wheat	W	0.2		

DIETARY RISK ASSESSMENT

Long-term intake

The evaluation of endosulfan resulted in recommendations for MRLs and STMR values for raw and processed commodities. Where data on consumption were available for the listed food commodities, dietary intakes were calculated for the 13 GEMS/Food Consumption Cluster Diets. The results are shown in Annex 3 of the 2006 JMPR Report.

The International Estimated Daily Intakes (IEDI) of endosulfan, based on estimated STMRs were 3–20% of the maximum ADI (0.006 mg/kg bw). The Meeting concluded that the long-term intake of residues of endosulfan from uses that have been considered by the JMPR is unlikely to present a public health concern.

Short-term intake

The International Estimated Short Term Intake (IESTI) of endosulfan calculated for the commodities for which residue levels were estimated. The results are shown in Annex 4 of the 2006 JMPR Report.

The IESTI of endosulfan calculated on the basis of the recommendations made by the JMPR represented for children 0–390% and for the general population 0–210% of the ARfD (0.02 mg/kg bw). The IESTI for broccoli for children was 390% and for the general population 210% of the ARfD, for celery 270% for children and 120% for the general population, 120% for cherries for children, and 110% for tomato for children.

The Meeting concluded that the short-term intake of residues of endosulfan resulting from the uses that have been considered by the JMPR, except the uses on broccoli, celery, cherries and tomatoes, is unlikely to present a public health concern.

The Meeting noted that no residue data relating to an alternative GAP were submitted. The information provided to the JMPR precludes an estimate that the dietary intake would be below the ARfD for consumption of broccoli, celery, cherries and tomatoes by children and broccoli and celery for the general population.

The meeting noted that the ARfD of endosulfan was established in 1998. Since then improvements in the toxicological assessment have been made, including the introduction of compound specific assessment factors. Consequently, it is recommended that the ARfD of endosulfan be reassessed at a future meeting for possible refinements.

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