KRESOXIM-METHYL (199)

EXPLANATION

Kresoxim-methyl was evaluated for the first time by the JMPR in 1998. The 1998 Meeting recommended MRLs for pome fruits, barley, cucumber, grapes, dried grapes, rye, straw and fodder (dry) of cereal grains, wheat, edible offal (mammalian), mammalian fats (except milk fats), meat (from mammals other than marine mammals), milks and poultry meat.

New information on registered uses, supervised residue trials, processing studies on citrus fruits, olives and sunflower, and metabolism in sugar beet was made available by the manufacturer to the Meeting. Information on current GAP was received from Germany and Japan.

The code numbers, names and structures of kresoxim-methyl and its metabolites referred to in this Evaluation are shown in Figure 1.

IDENTITY

Physical and chemical properties

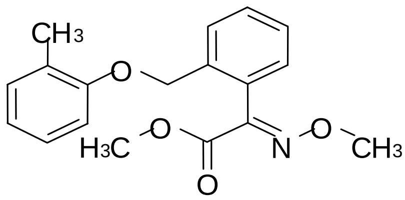
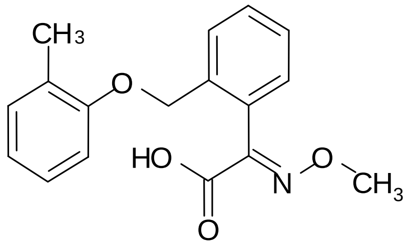
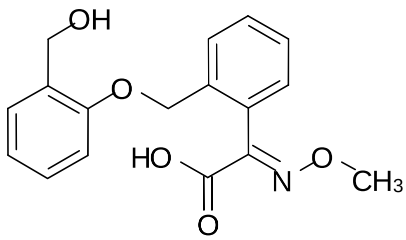
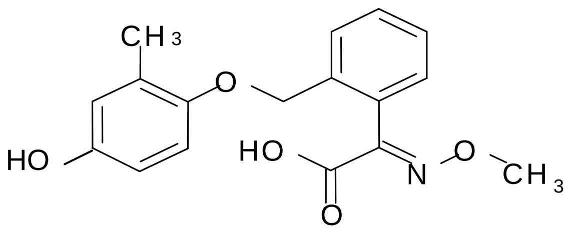
Information on vapour pressure was inadvertently reported for the (*Z*)-isomer of kresoxim-methyl instead of the free acid metabolite (BF 490-1 or 490M1) in the 1998 JMPR Evaluation, Part I. The entry should read:

Vapour pressure:	kresoxim-methyl: 2.3×10^{-6} Pa at 20°C (extrapolated) free acid (BF 490-1): $<1 \times 10^{-5}$ Pa (Gückel, 1992; Kästel, 1996)

The current Meeting received additional information on the octanol/water partition coefficient of the free acid at pH 4 and 9 as follows.

Octanol/water partition:	kresoxim-methyl (99.4%):	$\log K_{ow}$ = 3.40 at 25°C
	free acid (BF 490-1):	$\log K_{ow}$ = 0.15 (pH 7; 20°C),
		$\log K_{ow}$ = 2.74 (pH 4; 20°C),
		$\log K_{ow}$ = -2.85 (pH 9; 20°C)
	(Redeker, 1990; Türk, 1996)	

Figure 1. Structures and codes of kresoxim-methyl and related substances referred to in the monograph.

Code/Name	Chemical name Structure
Kresoxim-methyl BAS 409 F LAB 242 009	methyl (*E*)-methoxyimino[α-(*o*-tolyloxy)-*o*-tolyl]acetate 
490M1 BF 490-1	(E)-methoxyimino[α-(*o*-tolyloxy)-*o*-tolyl]acetic acid 
490M2 BF 490-2	α-[(*o*-hydroxymethyl)phenoxy]-*o*-tolyl(methoxyimino)acetic acid 
490M9 BF 490-9	α-(*p*-hydroxy-*o*-tolyloxy)-*o*-tolyl(methoxyimino)acetic acid 

METABOLISM AND ENVIRONMENTAL FATE

Plant metabolism

Sugar beet In German studies carried out in 1998-1999, [*phenyl*-^{14}C]kresoxim-methyl, in a 50% water dispersible granular formulation, was applied twice as a foliar spray to sugar beet (Victoria variety), at 150 g ai/ha (Veit, 1999). The first application took place 91 days after sowing (11/08/1998), corresponding to a growth stage of 39 (BBCH code), and the second 3 weeks later or 28 days before harvest (01/09/1998).

Samples were taken before and after the second treatment and at harvest, and stored in a freezer at –18ºC until extraction. An aliquot of a methanol extract of the leaves was stored in a freezer at –18ºC for 212 days to establish the stability of the residues during frozen storage.

High total radioactive residues (TRR) were found in the leaves (1.26 mg/kg as kresoxim-methyl equivalents at harvest and 1.43 mg/kg on the day of the last treatment as the sum of ^{14}C in methanol and water extracts and unextracted residue). The low TRR in the roots (0.009 mg/kg at harvest and 0.024 mg/kg on the day of the last treatment) indicated that only a small amount of the applied radioactivity was translocated from the leaves to the roots (Table 1).

Table 1. Total radioactive residues in sugar beet after [^{14}C]kresoxim-methyl treatment (2 x 150 kg ai/ha).

Sample, days after 2nd treatment	TRR determined by direct combustion, mg/kg	TRR calculated[1], mg/kg
Roots before 2nd treatment	0.007	0.007
Roots, 0 [2]	0.053	0.024
Leaves before 2nd treatment	0.610	0.543
Leaves, 0	1.846	1.434
Roots, 28	0.008	0.009
Leaves, 28	1.735	1.255

[1] Sum of the extracts (methanol and water) and the post-extraction residue (PES).
[2] Roots after 2nd treatment were harvested with the green part of the crop.

To determine the nature of the residue, methanol extraction was followed by two extractions with water and the determination of radioactivity by LSC. The radioactive residues in leaves were extracted by methanol and water at rates between 91.1% and 98.9% of the TRR. In root samples, where the levels of the TRR were much lower, the extractability was also lower and ranged from 63.3% to 93.2% (Table 2).

Table 2. Extractability of radioactivity in sugar beet after [^{14}C]kresoxim-methyl treatment (2 x 150 g ai/ha).

Sample, days after 2nd treatment	^{14}C, mg/kg as kresoxim-methyl and % of TRR								
	TRR[1]	methanol		H_2O		ERR[2]		PES[3]	
		mg/kg	% of TRR	mg/kg	% of TRR	mg/kg	% of TRR	mg/kg	% of TRR
Roots before 2nd treatment	0.007	0.004	65.7	0.001	10.1	0.005	75.8	0.002	24.2
Roots, 0	0.024	0.022	91.4	<0.001	1.5	0.022	93.2	0.002	6.8
Leaves before 2nd treatment	0.543	0.526	96.7	0.005	1.0	0.531	97.7	0.012	2.3
Leaves, 0	1.434	1.409	98.3	0.008	0.6	1.417	98.9	0.017	1.2
Roots, 28	0.009	0.005	60.8	<0.001	2.5	0.005	63.3	0.003	36.6
Leaves, 28	1.255	1.110	88.5	0.033	2.6	1.143	91.1	0.112	8.9

[1] Calculated; see Table 1
[2] Extractable radioactive residues: sum of methanol and water extracts
[3] Post-extraction solids

The radioactivity in the methanol extracts of roots and leaves was characterized by solvent partition. Most of the radioactivity in the extract of leaves was found in the ethyl acetate phase (94.2% of the TRR on the day of the last treatment and 69.1% 28 days after the last treatment). The radioactivity in the methanol extract of roots taken 28 days after the second application was about equally divided between the ethyl acetate and water phases (Table 3).

Table 3. Partition characteristics of methanol-extracted radioactivity in sugar beet after [^{14}C]kresoxim-methyl treatment (2 x 150 g ai/ha).

Sample, days after last treatment	methanol mg/kg[1]	% recovery[2]	Ethyl acetate		Water	
			mg/kg[1]	% of TRR	mg/kg[1]	% of TRR
Roots, 0	0.022	90.9	0.017	68.4	0.003	10.9
Leaves, 0	1.409	105.0	1.351	94.2	0.129	9.0
Roots, 28	0.005	120.0	0.003	29.7	0.003	37.0
Leaves, 28	1.110	111.1	0.867	69.1	0.366	29.2

[1] As kresoxim-methyl
[2] 100 (mg/kg in ethyl acetate + mg/kg in water) ÷ (mg/kg in methanol)

Characterization and identification of radioactive residues in the extracts by HPLC indicated that the unchanged parent compound was the predominant residue in leaves and roots taken 28 days after the last application. A small amount of BF 490-1 (free acid metabolite) was detected in the water extracts and some water phases after solvent partition. In some cases an additional small peak was present in leaves corresponding to the sugar conjugate of BF 490-2. The extraction of the residual radioactive residues with aqueous ammonia released only a part of them.

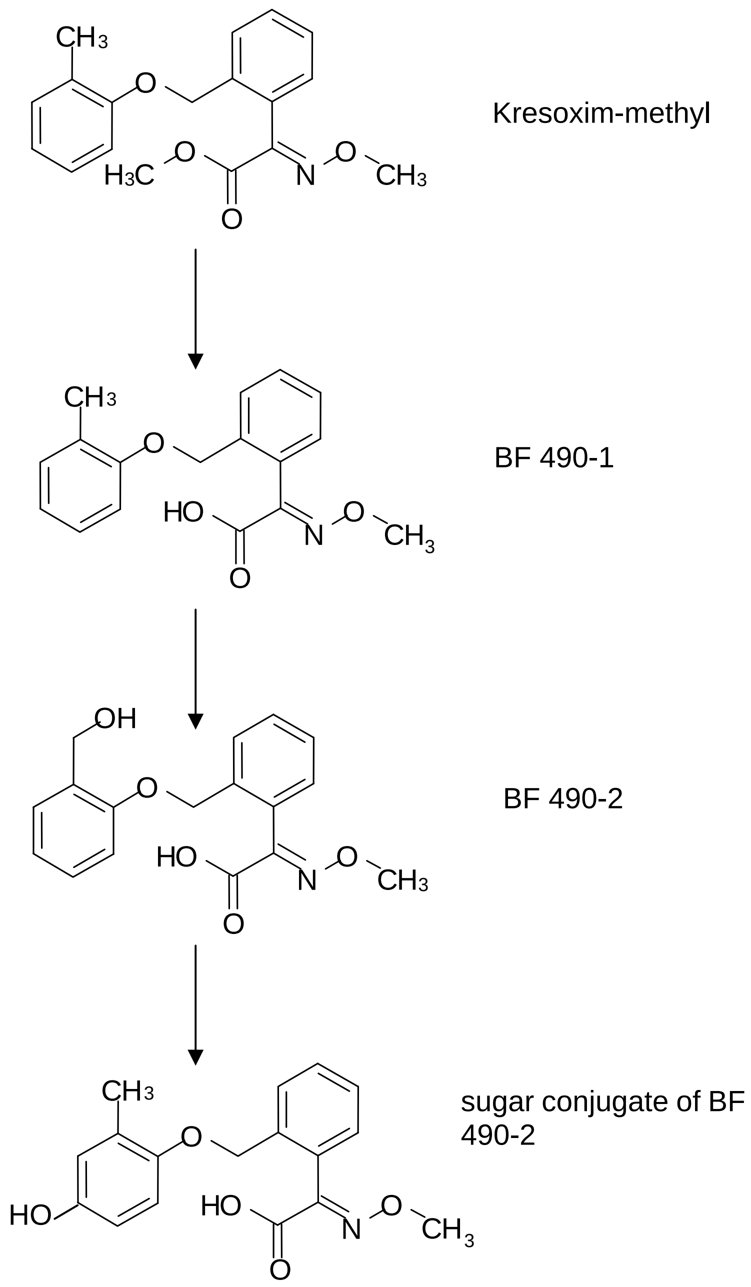
Table 4. Characterization of residues in the extracts of sugar beet leaves by HPLC.

Sample, Days after the last treatment	Compound or fraction	% of TRR	Concentration mg/kg
Leaves, 0	Kresoxim-methyl BF 490-1	98.3 0.6	1.409 0.008
	Total identified	98.9	1.417
	Unidentified radioactive residue	1.2	0.017
	Total	100.1	1.434
Leaves, 28	Kresoxim-methyl BF 490-1	88.5 2.6	1.110 0.033
	Total identified	91.1	1.143
	NH_4OH extract Final residue	2.3 2.0	0.029 0.026
	Total	95.4	1.198

In the storage stability study with the methanol extract of the leaves mentioned earlier the radiochromatogram of the stored extract of leaves sampled 28 days after the last application was similar to that of the extract before storage, indicating that the radioactive residues in the extract were stable in a freezer for approximately 7.5 months.

The metabolic pathway of kresoxim-methyl in sugar beet is shown in Figure 2. Besides the parent compound only two metabolites could be detected, the free acid and the sugar conjugate of BF 490-2. These results were similar to the results of the other metabolism studies on apples and wheat (FAO/WHO, 1999) in which the parent compound was also the dominant radioactive residue and the same metabolites, BF 490-1 and the sugar conjugate of BF 490-2, were found.

Figure 2. The metabolic pathway of kresoxim-methyl in sugar beet.



USE PATTERN

Information on use patterns was received from Germany and Japan. The manufacturer provided information on new uses on citrus fruits and olives together with the relevant labels. The registered uses are summarized in Tables 5-8.

Table 5. Registered uses of kresoxim-methyl on fruit (field applications unless otherwise stated).

Commodity	Country	Form	Application			Max. no.	PHI, days	Pest or disease, notes
			Spray conc., kg ai/hl	Water vol., l/ha	kg ai/ha			
Apple	Japan	WG	0.016			3	1	Fruit spot Scab Powdery mildew Blossom blight
	Japan	WG	0.016-0.024			3	1	Anthracnose Ring rot Fly speck Sooty blotch Blotch
	Japan	WG	0.016-0.031			3	1	Alternaria blotch Rust
Citrus fruits	Japan	WG	0.016-0.024			3	14	Scab Melanose Grey mould Freckle
	Japan	WG	0.024			3	14	Brown spot
	South Africa	WG	0.01 + 0.5 l narrow range mineral oil			2	56	Guignardia citricarpa Apply only in combination with mineral oil as indicated. Apply as a medium- or full cover spray during mid November and follow up in mid January. Not to be sprayed on lemons.
Grapes	Germany	WG	0.0075	400-1600	0.03-0.12	3	35	Unicinula necator Wine grapes
	Japan	WG	0.016			3	14	Powdery mildew Rust
	Japan	WG	0.016-0.024			3	14	Anthracnose (Elisinoe ampelina) Downy mildew Swelling arm Ripe rot Gray mould Isariopsis leaf spot
Kiwifruit	Japan	WG	0.016-0.024			3	1	Gray mould
Olive	Spain	WG	0.005-0.01	1000		See note	30	Phomopsis helianthi <u>Number of applications:</u> 1 for oil olives when fruits are present (growth stage 85 BBCH), and 2 between harvest and flowering (growth stage 59 BBCH) (fresh green olives and oil olives)
Peach	Japan	WG	0.024			3	1	Scab Powdery mildew Brown rot Black spot
Pear, Oriental	Japan	WG	0.016			3	1	Scab
	Japan	WG	0.016-0.024			3	1	Physalospora canker Black spot Powdery mildew
Persimmon (Kaki)	Japan	WG	0.016			3	14	Powdery mildew Leaf spot Anthracnose Gray mould
Plum (*Prunus mume*)	Japan	WG	0.016-0.024			3	7	Scab
	Japan	WG	0.024			3	7	Powdery mildew

Commodity	Country	Form	Application			Max. no.	PHI, days	Pest or disease, notes
			Spray conc., kg ai/hl	Water vol., l/ha	kg ai/ha			
								Gray mould Shooty blotch
Pome fruits	Germany	WG	0.006	500 l/ha & m height of tree crown	0.0313 and m height of tree crown	4	35	Scab Powdery mildew Application rate for standard tree of 3 m height equivalent to 0.0938 kg ai/ha and 1500 l water/ha. Atomizing spraying: reduction of water up to fivefold
Strawberry	Germany	WG	0.0078	2000	0.155	3: 3	F	Powdery mildew Before flowering and post harvest
	Japan	SC	0.008-0.014			3	1	Powdery mildew

Table 6. Registered uses of kresoxim-methyl on vegetables.

Commodity	Country	Form	F or B	Application			Max. no	PHI, days	Pest or disease, notes
				Spray conc., kg ai/hl	Water vol., l/ha	kg ai/ha			
Carrot	Japan	SC	B	0.014			3	7	Cecospora leaf spot
	Japan	SC	B	0.014-0.021			3	7	Leaf blight
Chinese cabbage	Japan	SC	B	0.014			3	3	Alternaria leaf spot White spot Downy mildew
Cucumber	Japan	SC	B	0.014			3	1	Powdery mildew Downy mildew Corynesporaa leaf spot
Egg plant	Japan	SC	B	0.014			3	1	Powdery mildew Leaf mould
Garlic	Japan	SC	B	0.021			3	7	Rust
Melon	Japan	SC	B	0.014-0.021			3	1	Downy mildew Powdery mildew Gummy stem blight
Onion, Welsh	Japan	SC	B	0.021			3	7	Rust Alternaria leaf spot
Pepper, Sweet	Japan	SC	B	0.014			3	7	Powdery mildew
Pumpkin	Japan	SC	B	0.014			3	1	Powdery mildew
Sugar and fodder beets	Germany	SC	F	0.031-0.042	300-400	0.125	1	28	Powdery mildew Cercospora beticola, Rust In all not more than 1 treatment/year for this crop
Sugar beet	Japan	SC	B	0.014-0.021			3	21	Cercospora leaf spot
	Japan	SC	B	0.014			3	21	Leaf spot
Watermelon	Japan	SC	B	0.014-0.021			3	1	Anthracnose Gummy stem blight
	Japan	SC	B	0.021			3	1	Powdery mildew
Yam	Japan	SC	B	0.021			3	7	Cylindrosporium dioscoreae

F: field; B: both field and glasshouse.

Table 7. Registered uses of kresoxim-methyl on cereals (field applications).

Commodity	Country	Form	Application			Max. no.	PHI, days	Pest or disease, notes
			Spray conc., kg ai/hl	Water vol., l/ha	kg ai/ha			
Barley	Germany	SE	0.03	400	0.125	2	35	Powdery mildew Puccinia hordei Rhynchosporium secalis Net blotch
	Germany	SE	0.026-0.053	200-400	0.105	2	35	Powdery mildew

Commodity	Country	Form	Application			Max. no.	PHI, days	Pest or disease, notes
			Spray conc., kg ai/hl	Water vol., l/ha	kg ai/ha			
	Germany	SC	0.03-0.06	200-400	0.125	2	35	Powdery mildew Puccinia hordei Rhynchosporium secalis Net blotch
	Japan	SC	0.014-0.021			3	14	Erysiphe graminis Fusarium nivale Fusarium roseum
Rye	Germany	SC	0.03-0.06	200-400	0.125	2	35	Powdery mildew Brown rust Rhynchosporium secalis
	Germany	SE	0.03	400	0.125	2	35	Powdery mildew Brown rust Rhynchosporium secalis
	Germany	SE	0.026-0.053	200-400	0.105	2	35	Powdery mildew
Triticale	Germany	SE	0.03	400	0.125	1	35	Septoria nodorum
	Germany	SC	0.03-0.06	200-400	0.125	1	35	Septoria nodorum
Wheat	Germany	SE	0.03	400	0.125	1	35	Cereal eyespot Fusarium spp.
	Germany	SE	0.03	400	0.125	2	35	Powdery mildew Brown rust Yellow rust Drechslera tritici-repentis Septoria tritici Septoria nodorum
	Germany	SE	0.026-0.053	200-400	0.105	2	35	Powdery mildew
	Germany	SC	0.03-0.06	200-400	0.125	2	35	Powdery mildew Brown rust Yellow rust Drechslera tritici-repentis Septoria tritici Septoria nodorum
	Japan	SC	0.014-0.021			3	14	Erysiphe graminis Fusarium nivale Fusarium roseum

Table 8. Registered uses of kresoxim-methyl on tea (field applications).

Commodity	Country	Form	Application			Max. no	PHI, days	Pest or disease, notes
			Spray conc., kg ai/hl	Water vol., l/ha	kg ai/ha			
Tea	Japan	SC	0.014			3	10	Pestalotia longiseta
	Japan	SC	0.014-0.021			3	10	Anthracnose Gray blight
	Japan	SC	0.021			3	10	Blister blight

RESIDUES RESULTING FROM SUPERVISED TRIALS

Trials were carried out under field conditions. They were reported in sufficient detail and acceptable analytical information was supplied. The residues were of parent kresoxim-methyl. In selecting residues for the estimation of maximum residue levels and STMRs the trials according to maximum GAP (i.e. minimum PHI, maximum dose rate and maximum number of treatments) have been used. The residues from these are double-underlined.

The residue trials were on citrus fruits, olives and sunflowers. The results are shown in Tables 9-11.

Table 9. Supervised residue trials on citrus fruits.

Location Variety	Date of last treatment	Form.	Application				Sample	Residues mg/kg	PHI, days	Report no.
			kg ai/ha	Water l/ha	kg ai/hl	No.				
Nelspruit, South Africa Valencia	22/01/96	WG 500 g/kg		3000 (11.3 l/tree)	0.01	2	Pulp	<0.01	0	#97/11299
								<0.01	7	
								<0.01	14	
								<0.01	28	
								<u><0.01</u>	56	
								<0.01	116	
							Peel	0.80	0	
								0.72	7	
								0.51	14	
								0.40	28	
								0.21	56	
								0.29	112	
							Whole fruit	0.27	0	
								0.28	7	
								0.19	14	
								0.13	28	
								<u>0.07</u>	56	
								0.06	112	
	22/01/96	WG 500 g/kg		3000 (11.3/tree)	0.02	2	Pulp	0.03	0	
								0.03	7	
								0.02	14	
								<0.01	28	
								<0.01	56	
								<0.01	112	
							Peel	2.2	0	
								2.1	7	
								1.7	14	
								1.1	28	
								0.85	56	
								0.93	112	
							Whole fruit	0.82	0	
								0.68	7	
								0.55	14	
								0.34	28	
								0.26	56	
								0.23	112	
	22/01/96	WG 500 g/kg		3000 (11.3/tree)	0.02 +0.5 l mineral oil/hl	2	Pulp	0.03	0	
								0.02	7	
								0.01	14	
								<0.01	28	
								<0.01	56	
								<0.01	112	
							Peel	3.0	0	
								3.1	7	
								2.1	14	
								1.8	28	

Location Variety	Date of last treatment	Form.	Application				Sample	Residues mg/kg	PHI, days	Report no.
			kg ai/ha	Water l/ha	kg ai/hl	No.				
								1.1	56	
								1.1	112	
							Whole fruit	1.1	0	
								1.1	7	
								0.80	14	
								0.57	28	
								0.32	56	
								0.30	112	
Nelspruit, South Africa Valencia	22/01/96	WG 500 g/kg		3000 (11.3/tree)	0.01	3	Pulp	<0.01	0	#97/11323
								<0.01	7	
								<0.01	14	
								<0.01	28	
								<0.01	56	
							Peel	0.61	0	
								0.75	7	
								0.71	14	
								0.49	28	
								0.28	56	
							Whole fruit	0.22	0	
								0.25	7	
								0.24	14	
								0.15	28	
								0.09	56	
	22/01/96	WG 500 g/kg		3000 (11.3/tree)	0.02	3	Pulp	0.03	0	
								0.01	7	
								0.01	14	
								<0.01	28	
								<0.01	56	
							Peel	2.5	0	
								2.3	7	
								2.1	14	
								1.3	28	
								1.2	56	
							Whole fruit	0.88	0	
								0.77	7	
								0.67	14	
								0.42	28	
								0.33	56	
	22/01/96	WG 500 g/kg		3000 (11.3/tree)	0.02 +0.5 l mineral oil/hl	3	Pulp	0.09	0	
								0.05	7	
								0.06	14	
								0.03	28	
								0.03	56	
							Peel	5.0	0	
								5.0	7	
								4.3	14	
								2.5	28	

Location Variety	Date of last treatment	Form.	Application kg ai/ha	Water l/ha	kg ai/hl	No.	Sample	Residues mg/kg	PHI, days	Report no.
								2.4	56	
							Whole fruit	1.9	0	
								1.8	7	
								1.6	14	
								0.77	28	
								0.64	56	
Malelane, South Africa Valencia	22/01/98	WG 500 g/kg		8000	0.01	2	Pulp	0.10	0	#99/10181
								<0.01	84	
							Peel	1.8	0	
								0.43	84	
							Whole fruit	0.69	0	
								0.21	84	
	22/01/98	WG 500 g/kg		8000	0.02	2	Pulp	0.24	0	
								0.02	84	
							Peel	3.1	0	
								0.73	84	
							Whole fruit	1.4	0	
								0.35	84	
	19/11/97	WG 500 g/kg		8000	0.01	1	Fresh	0.28	0	
								0.05	28	
								0.04	56	
								0.01	105	
							Peel	3.6	0	
								0.71	28	
								0.43	56	
								0.32	105	
							Whole fruit	2.2	0	
								0.39	28	
								0.21	56	
								0.15	105	
	19/11/97	WG 500 g/kg		8000	0.02	1	Fresh	0.76	0	
								0.04	28	
								0.04	56	
								<0.01	105	
							Peel	3.6	0	
								0.91	28	
								0.59	56	
								0.38	105	
							Whole fruit	2.0	0	
								0.43	28	
								0.26	56	
								0.14	105	
	22/01/98	WG 500 g/kg		8000	0.01	1	Pulp	0.12	0	
								<0.01 a	27	
								<0.01 a	48	
								<0.01 a	90	

Location Variety	Date of last treatment	Form.	Application				Sample	Residues mg/kg	PHI, days	Report no.
			kg ai/ha	Water l/ha	kg ai/hl	No.				
							Peel	1.6	0	
								<0.01 a	27	
								<0.01 a	48	
								<0.01 a	90	
							Whole fruit	0.74	0	
								<0.01 a	27	
								<0.01 a	48	
								<0.01 a	90	
	22/01/98	WG 500 g/kg		8000	0.02	1	Pulp	0.17	0	
								<0.01 a	27	
								<0.01 a	48	
								<0.01 a	90	
							Peel	2.6	0	
								<0.01 a	27	
								<0.01 a	48	
								<0.01 a	90	
							Whole fruit	1.1	0	
								<0.01 a	27	
								<0.01 a	48	
								<0.01 a	90	
A van der Westhuizen, South Africa Valencia	20/01/98	WG 500 g/kg		2000 (5 l/tree)	0.01	2	Pulp	<0.01	54	#98/11401
								<0.01	85	
							Peel	0.64	54	
								0.62	85	
							Whole fruit	0.57 b	0	
								0.26 b	28	
								0.19	54	
								0.16	85	
	17/11/97	WG 500 g/kg		2000 (5 l/tree)	0.01	1	Pulp	<0.01	118	
							Peel	0.29	118	
							Whole fruit	0.41 b	24	
								0.22 b	64	
								0.07 b	92	
								0.11	118	
	20/01/97	WG 500 g/kg		2000 (5 l/tree)	0.01	1	Pulp	<0.01	54	
							Peel	0.45	54	
							Whole fruit	0.58 b	0	
								0.14 b	28	
								0.13	54	
	17/11/97	WG 500 g/kg		2000 (5 l/tree)	0.02	1	Fresh	<0.01	92	
								<0.01	118	
							Peel	0.44	92	
								0.55	118	
							Whole fruit	0.85 b	24	

Location Variety	Date of last treatment	Form.	Application				Sample	Residues mg/kg	PHI, days	Report no.
			kg ai/ha	Water l/ha	kg ai/hl	No.				
								0.28 b	64	
								0.17	92	
								0.20	118	
	20/01/98	WG 500 g/kg		2000 (5 l/tree)	0.02	1	Pulp	<0.01	54	
							Peel	1.0	54	
							Whole fruit	1.2 b	0	
								0.59 b	28	
								0.34	54	
A van der Westhuizen, Letsitele, South Africa Marsh	20/01/98	WG 500 g/kg		2000 (5/tree)	0.01	2	Pulp	0.01	0	#98/11303
								<u><0.01</u>	14	
							Peel	1.1	0	
								0.60	14	
								0.67	28	
								0.52	44	
								0.42	63	
							Whole fruit	0.45	0	
								0.23	14	
								0.22	28	
								<u>0.18</u>	44	
								0.14	63	
	17/11/97	WG 500 g/kg		2000 (5/tree)	0.01	1	Pulp	<0.01	64	
							Peel	0.27	64	
								0.27	78	
								0.26	82	
								0.16	108	
								0.21	128	
							Whole fruit	<u>0.11</u>	64	
								0.10	78	
								0.09	82	
								0.06	108	
								0.07	128	
	20/1/98	WG 500 g/kg		2000 (5/tree)	0.01	1	Pulp	0.05	0	
								<u><0.01</u>	14	
							Peel	0.61	0	
								0.21	14	
								0.17	28	
								0.18	44	
								0.20	63	
							Whole fruit	0.30	0	
								0.08	14	
								0.06	28	
								<u>0.06</u>	44	
								0.06	63	
	17/11/97	WG 500 g/kg		2000 (5/tree)	0.02	1	Pulp	<0.01	64	

Location Variety	Date of last treatment	Form.	Application				Sample	Residues mg/kg	PHI, days	Report no.
			kg ai/ha	Water l/ha	kg ai/hl	No.				
								<0.01	78	
								<0.01	92	
								<0.01	108	
								<0.01	128	
							Peel	0.38	64	
								0.39	78	
								0.34	92	
								0.41	108	
								0.31	128	
							Whole fruit	0.16	64	
								0.15	78	
								0.11	92	
								0.12	108	
								0.09	128	
	20/01/98	WG 500 g/kg		2000 (5/tree)	0.02	1	Pulp	0.11	0	
								0.04	14	
								0.03	28	
								<0.01	44	
								<0.01	63	
							Peel	1.5	0	
								1.6	14	
								0.89	28	
								0.58	44	
								0.67	63	
							Whole fruit	0.59	0	
								0.60	14	
								0.34	28	
								0.17	44	
								0.18	63	

[1] Re-analysed to confirm results.
[2] No data available for the pulp and peel.
The residue contents of the peel and pulp were determined separately and the content in the whole fruit calculated.

Table 10. Supervised residue trials on olives.

Location	Date of last treatment	Form.	Applications				Growth stage at last treatment[1]	Sample	Residues mg/kg	PHI, days	Report no.
			kg ai/ha	Water l/ha	kg ai/hl	No.					
Andalusia, Spain Picual	03/11/98	WG 500 g/kg	0.10	1000	0.01	1	79-85	Fruit	<u><0.05</u>	29	#99/10705
								Pomace	<0.05	29	
								Crude oil	0.17	29	
								Waste water	<0.05		
	03/11/98	WG 500 g/kg	0.096	960	0.01	1	79-85	Fruit	<u><0.05</u>	29	
								Pomace	<0.05	29	
								Crude oil	0.12	29	
								Waste water	<0.05		
Andalusia, Spain Martena	03/11/98	WG 500 g/kg	0.10	1000	0.01	1	79-85	Fruit	<u><0.05</u>	30	
								Pomace	0.05	30	

Location	Date of last treatment	Form.	Applications				Growth stage at last treatment[1]	Sample	Residues mg/kg	PHI, days	Report no.
			kg ai/ha	Water l/ha	kg ai/hl	No.					
								Crude oil	0.13	30	
								Waste water	<0.05		
Andalusia, Spain Hoj. blanca	03/11/98	WG 500 g/kg	0.099	990	0.01	1	79-85	Fruit	0.11	30	
								Pomace	0.12	30	
								Crude oil	0.49	30	
								Waste water	<0.05	30	
Spain	97	WG 500 g/kg	0.10	1000	0.01	1		Fruit	0.23	0	#99/10706
									0.11	15	
									0.09	30	
									<0.05	43	
								Pomace	0.07	30	
								Crude oil	0.28	30	
								Waste water	<0.05	30	
	97	WG 500 g/kg	0.10	1000	0.01	1		Fruit	0.12	0	
									0.05	15	
									≤0.05	30	
									<0.05	43	
								Pomace	<0.05	30	
								Crude oil	0.20	30	
								Waste water	<0.05	30	
	97	WG 500 g/kg	0.10	1000	0.01	1		Fruit	0.09	0	
									<0.05	15	
									≤0.05	30	
									<0.05	43	
								Pomace	<0.05	30	
								Crude oil	0.23	30	
								Waste water	<0.05	30	
	97	WG 500 g/kg	0.10	1000	0.01	1		Fruit	0.13	0	
									0.09	15	
									≤0.05	30	
									<0.05	43	
								Pomace	0.06	30	
								Crude oil	0.24	30	
								Waste water	<0.05	30	

[1] Growth stage according to BBCH codes for olives

Table 11. Supervised residue trials on sunflowers.

Location	Date of last treatment	Form.	Applications				Growth stage at last treatment[1]	Sample	Residues mg/kg	PHI, days	Report No
			kg ai/ha	Water l/ha	kg ai/hl	No.					
Cote D'Or, France Albena	05/06/96	SE 150 g/l [2]	0.11	320		1	51	Plant without roots	2.96	0	#98/10582
								Seed	<0.05	63	
									<0.05	91	
Cote D'Or, France Albena	05/06/96	SE 150 g/l [2]	0.11	320		1	51	Plant without roots	5.67	0	

Location	Date of last treatment	Form.	Applications				Growth stage at last treatment[1]	Sample	Residues mg/kg	PHI, days	Report No
			kg ai/ha	Water l/ha	kg ai/hl	No.					
								Seed	<0.05	69	
									<0.05	92	
Haute Garonne, France Select	11/06/96	SE 150 g/l [2]	0.10	284		1	51	Plant without roots	4.42	0	
								Seed	<0.05	69	
									<0.05	88	
Haute Garonne, France Apisol	12/06/96	SE 150 g/l [2]	0.099	280		1	51	Plant without roots	4.23	0	
								Seed	0.07	79	
									<0.05	90	
Gard, France DK 37-90	11/06/97	SE 150 g/l [2]	0.11	310		1	51-53	Plant without roots	4.11	0	#98/10583
								Seed	<0.05	72	
									<0.05	82	
Cote D'Or, France Rigasol	10/6/97	SE 150 g/l [2]	0.11	324		1	53	Plant without roots	5.20	0	
								Seed	<0.05	71	
									<0.05	78	
Haute Garonne, France Andora	04/06/97	SE 150 g/l [2]	0.095	272		1	51	Plant without roots	3.32	0	
								Seed	<0.05	69	
									<0.05	82	
Haute Garonne, France Fantasol	11/06/97	SE 150 g/l [2]	0.11	304		1	51-53	Plant without roots	4.11	0	
								Seed	<0.05	68	
									<0.05	86	

[1] Growth stage according to BBCH codes for sunflowers
[2] with 300 g fenpropimorph /l

FATE OF RESIDUES IN STORAGE AND PROCESSING

In processing

No information on processing of citrus fruits was available for the Meeting.

Residues in processed products of olives, crude oil and pomace, prepared according to the process shown in Figure 3, were determined in each residue trial on olives reported in Table 10. The figures are repeated, together with processing factors, in Table 12.

Figure 3. Extraction of oil from olives, industrial process. [1]

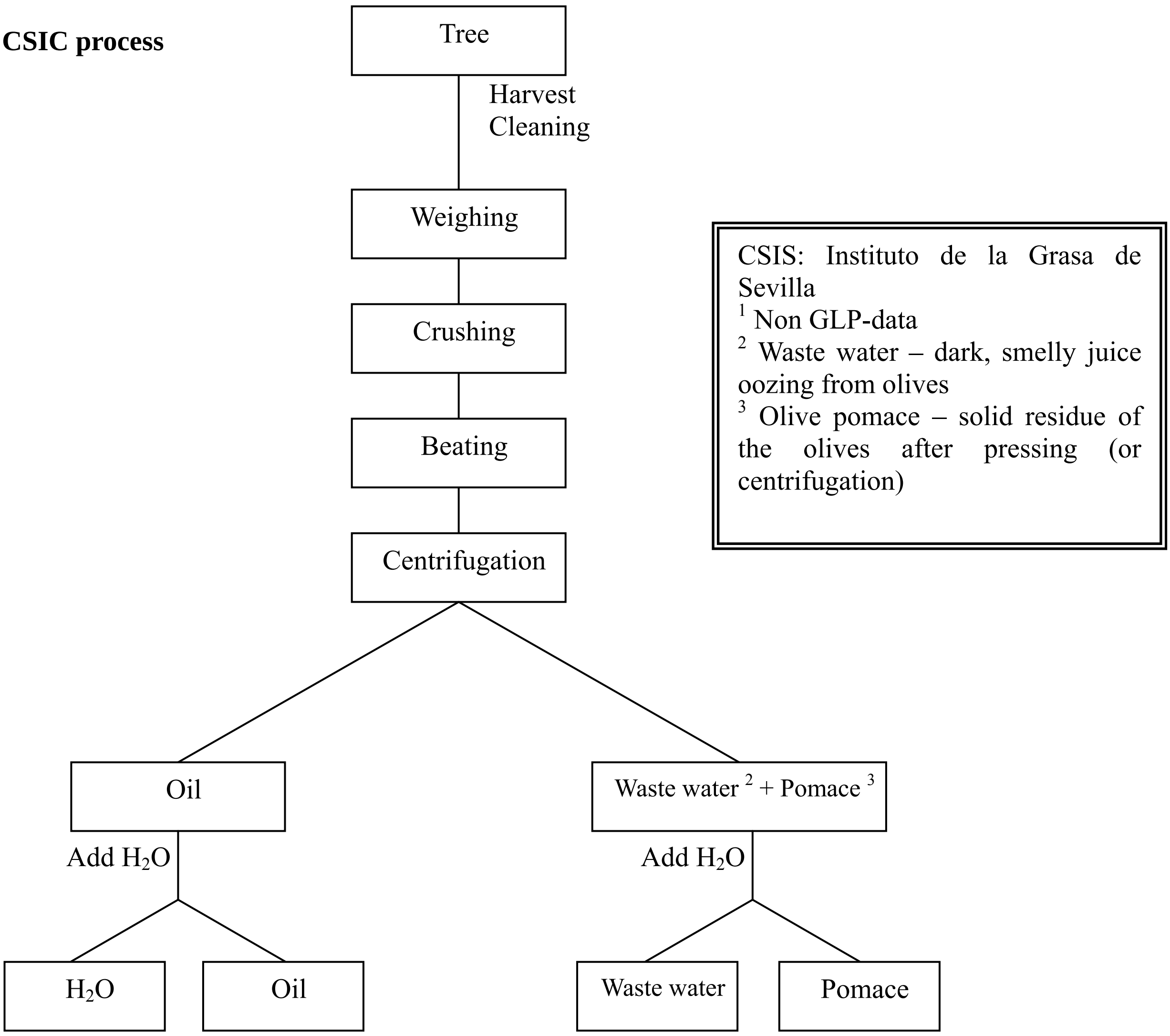


Table 12. Residues of kresoxim-methyl in processed products of olives.

Kresoxim-methyl, mg/kg, and (calculated processing factor)		
Fresh olive	Pomace	Crude oil
<0.05	<0.05	0.17 (>3.4)
<0.05	<0.05	0.12 (>2.4)
<0.05	0.05 (>1.0)	0.13 (>2.6)
0.11	0.12 (1.1)	0.49 (4.5)
0.09	0.07 (0.78)	0.28 (3.1)
<0.05	<0.05	0.20 (>4.0)
<0.05	<0.05	0.23 (>4.6)
<0.05	0.06 (>1.2)	0.24 (>4.8)
Mean factor (2 results)	0.94	3.8

Residues in the edible portion of food commodities

Apart from the processing studies on olives residues in the pulp of oranges and grapefruit are reported in Table 9.

NATIONAL MAXIMUM RESIDUE LIMITS

The national MRLs for citrus fruits, olive and sunflower seed and related products were reported (BASF, 2001).

Country	MRL, mg/kg, and commodity
European Union	0.05 citrus fruits 0.1 oilseeds 0.2 olives
France	0.20 sunflower seed oil (proposed)
Japan	2 mandarin, 10 citrus fruits other than mandarin
South Africa	0.5 citrus fruits
Spain	0.5 olive oil (proposed), 0.2 (grown for oil generation)(proposed), 0.05 olive (fresh green)

The definition of the residues in these commodities is kresoxim-methyl for all the MRLs listed.

APPRAISAL

Kresoxim-methyl was first evaluated for toxicology and residues by the Meeting in 1998. The 1998 Meeting allocated an ADI of 0–0.4 mg/kg bw and concluded that an acute RfD was unnecessary. The Meeting recommended that the definition of the residue both for compliance with MRLs and estimation of dietary intake be: 'commodities of plant origin, kresoxim-methyl; and commodities of animal origin, α-(*p*-hydroxy-*o*-tolyloxy)-*o*-tolyl(methoxyimino)acetic acid, expressed as kresoxim-methyl'. It estimated MRLs for pome fruits, barley, cucumber, grapes, dried grapes, rye, straw and fodder (dry) of cereal grains, wheat, edible offal (mammalian), mammalian fats (except milk fats), meat (from mammals other than marine mammals), milks and poultry meat. The IEDIs were 0% of the ADI for all of five GEMS/Food regional diets. The 1998 JMPR agreed that information was desirable on whether (E)-methoxyimino[α-*o*-tolyloxy)-*o*-tolyl]acetic acid was esterified to kresoxim-methyl when methanol was used for extraction in studies of metabolism and the analysis of samples from supervised trials.

New information on registered uses, the results of supervised residue trials and processing studies on citrus fruits, olive and sunflower and from a study of metabolism in sugar beet was made available by the manufacturer to the Meeting. Information on current GAP was received from Germany and Japan.

Metabolism

Plants

Sugar beet was sprayed with [phenyl-^{14}C]kresoxim-methyl at 0.15 kg ai/ha twice, the first time 91 days after sowing and the second 3 weeks later or 28 days before harvest. Most of the TRR was found in leaves at both 0 day (1.8 mg/kg determined by direct combustion and 1.4 mg/kg calculated as the sum of the methanol and water extracts and the residual residues) and 28 days after the second treatment (1.7 mg/kg by direct combustion and 1.2 mg/kg calculated). Only minor TRR were found in roots 0 day (0.053 mg/kg by combustion and 0.024 mg/kg calculated) and 28 days after the second application (0.008 mg/kg by combustion and 0.009 mg/kg calculated). These results indicate that only a small amount of the applied kresoxim-methyl was translocated from leaves to roots. Extraction with methanol and subsequently with water (twice) extracted most of radiolabelled residues (91.1–98.9% of the TRR in leaves and 63.3–93.3% in roots). The predominant component of the extracted residues was identified as the parent compound by HPLC. A small amount of a free acid metabolite, (E)-methoxyimino[α-(*o*-tolyloxy)-*o*-tolyl]acetic acid (BF 490-1), was detected in water extracts and some water phases after solvent partition, and an additional small peak corresponding to the sugar conjugate of α-[(*o*-hydroxymethyl)phenoxy]-*o*-tolyl(methoxyimino)acetic acid (BF 490-2) was found in some ases. The result of a study of stability in storage showed that the radiolabelled residues in the methanol extract of sugar beet leaves were stable at –18ºC for approximately 7.5 months. These results confirm the definition of the residue in commodities of plant origin recommended by the 1998 JMPR and agree with the results of the studies of metabolism in apple and wheat, which also demonstrated that the parent compound kresoxim-methyl was the dominant radiolabelled residue, with minor amounts of BF 490-1 and the sugar conjugate of BF 490-2 in various matrices of these crops. The question of whether BF 490-1 is esterified to kresoxim-methyl during methanol extraction remained unanswered.

Results of supervised trials

GAP for citrus fruits was reported for Japan and South Africa. Fifteen trials on Valencia orange and five trials on Marsh grapefruit were conducted in South Africa. The label in South Africa states that the water-dispersible granule formulation should be applied only with 0.5 l of narrow-range mineral oil per hl of spray solution. Trials conducted with and without mineral oil (0.02 kg ai/hl) showed a similar percentage decline in residue concentration. Therefore, the Meeting concluded that seven trials on Valencia orange and three trials on Marsh grapefruit conducted in accordance with South African GAP (maximum of two applications at 0.01 kg ai/hl; PHI, 56 days) but without mineral oil could be considered for estimating the maximum residue level.

Kresoxim-methyl persisted in whole fruit after the PHI of 56 days. As in most cases the concentration of residues 56–84 days after the last application was < 30%, the concentration of 0.21 mg/kg (in Malelane, 0.01 kg ai/hl, 8000 l, 84 days after last application) was taken into consideration for estimating the MRL and STMR value. The concentrations in whole fruit were < 0.01, 0.07, 0.09, 0.13, 0.19, 0.21 (2) and 0.22 mg/kg for orange and 0.06, 0.11 and 0.18 mg/kg for grapefruit. These values are within the same range. The combined values, in ranked order (median underlined), were: < 0.01, 0.06, 0.07, 0.09, 0.11, 0.13, 0.18, 0.19, 0.21 (2) and 0.22 mg/kg. The Meeting estimated a maximum residue level of 0.5 mg/kg for oranges and grapefruit. The concentrations of residues in the edible portion (flesh) resulting from use at the maximum GAP and comparable conditions were: ≤ 0.01 (7) and 0.04 mg/kg. The Meeting estimated an STMR value of 0.01 mg/kg for the edible portion (flesh or pulp) of oranges and grapefruit.

GAP for olives was reported for Spain. Eight trials were conducted, four of which were on oil olives. These trials could be considered to comply with the Spanish GAP for oil olives (maximum of one application after flowering; 0.005–0.01 kg ai/ha; 1000 l/ha; PHI, 30 days). The concentrations of residues in fruit, in ranked order, were: ≤ 0.05 (7) and 0.09 mg/kg. The Meeting estimated a maximum residue level of 0.2 mg/kg and an STMR value of 0.05 mg/kg for olives.

The results of eight trials on sunflower conducted in France, which were considered to comply with proposed French GAP (maximum of one application; 0.1 kg ai/ha; PHI, 60 days), and of a processing study became available to the Meeting. However, as the Committee was informed that there was no GAP for sunflower at the time of the review, the Meeting did not take action.

Fate of residues during processing

No information was available on the processing of citrus fruits to juice, pomace and citrus pulp, dry. As the concentration of residues of kresoxim-methyl in the flesh of oranges and grapefruits is usually < 0.01 mg/kg, the Meeting considered it unlikely that the concentrations in orange or grapefruit juice would significantly increase the dietary intake of kresoxim-methyl.

Olives were processed into oil and pomace in Spain according to the "Laboratories and Pilot Installations of the Experimental Oil Mill (Laboratorios e Instalaciones Piloto de la Almazara Experimental)", reflecting commercial practice. The concentrations of residues of kresoxim-methyl in crude oil and pomace were determined and reported in each trial. The concentrations in pomace were similar to those in fruit, while those in crude oil were about four times those in fruit (< 0.05–0.11 mg/kg in fruit, 0.12–0.49 mg/kg in crude oil).

The concentrations of residues in olive pomace and in crude oil in trials conducted according to GAP were ≤ 0.05 (4), 0.05, 0.06, 0.07 and 0.12 mg/kg and 0.12, 0.13, 0.17, 0.20, 0.23, 0.24, 0.28 and 0.49 mg/kg, respectively. The Meeting estimated a maximum residue level of 0.7 mg/kg and an STMR value of 0.22 mg/kg for olive oil, virgin. Since olive pomace is not generally regarded as a feedstuff, no maximum residue level was estimated.

RECOMMENDATIONS

On the basis of the data from supervised trials, the Meeting concluded that the concentrations of residues listed below were suitable for establishing maximum residue limits and for assessing the IEDI.

Definition of residue (for compliance with MRL and for estimating dietary intake from plant commodities): kresoxim-methyl

Definition of residue (for compliance with MRLs and for estimating dietary intake from animal commodities): α-(p-hydroxy-o-tolyloxy)-o-tolyl(methoxyimino)acetic acid, expressed as kresoxim-methyl

Commodity		Recommended MRL (mg/kg)		STMR or STMR-P (mg/kg)
CCN	Name	New	Previous	
FC 0203	Grapefruit	0.5	-	
	Edible portion of grapefruit			0.01
FT 0305	Olives	0.2	-	0.05
OC 0305	Olive oil, virgin	0.7	-	0.22
FC 0004	Oranges, Sweet, Sour	0.5	-	
	Edible portion of oranges			0.01

Further work or information

Desirable

- Experimental determination of whether (E)-methoxyimino[α-(*o*-tolyloxy)-*o*-tolyl]acetic acid is methylated to kresoxim-methyl when methanol is used as an extractant in studies of metabolism or analysis of samples from supervised trials (1998 JMPR)

Dietary risk assessment

Long-term intake

STMR values have been estimated for three commodities, and concentrations of residues in the edible portion of oranges and grapefruit have been estimated. IEDIs were calculated for the five GEMS/Food regional diets from the STMR values for 16 commodities estimated by the current Meeting and by the 1998 JMPR (Annex 3). The calculated IEDIs were 0% of the ADI for all regional diets. The Meeting concluded that intake of residues of kresoxim-methyl resulting from uses considered by the 1998 and current JMPR was unlikely to present a public health concern.

Short-term intake

The 1998 JMPR concluded that an acute RfD for kresoxim-methyl was unnecessary. The Meeting therefore concluded that the short-term dietary intake of kresoxim-methyl residues is unlikely to present a risk to consumers.

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