ACEPHATE (095)

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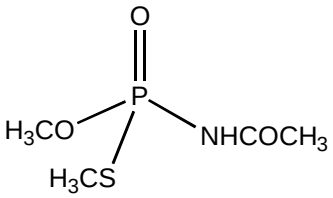
EXPLANATION

Acephate is a broad-spectrum organophosphate insecticide with uses on many crops. It has been evaluated several times by the JMPR, the initial evaluation being in 1976 and the latest residues evaluation being in 1996. The 2002 JMPR established an ADI and acute RfD for acephate of 0-0.01 mg/kg bw and 0.05 mg/kg bw respectively. It was listed under the Periodic Re-evaluation Programme of the 28th Session of the CCPR for residue review by the 2003 JMPR (ALINORM 97/24).

The Meeting received information on acephate metabolism and environmental fate, methods of residue analysis, freezer storage stability, national registered use patterns, supervised residue trials and national MRLs. Some information, on GAP and national MRLs, and residue data were submitted by the governments of Australia, Germany and the Netherlands.

IDENTITY

ISO common name:	acephate
Chemical names	
IUPAC:	*O*,*S*-dimethyl acetylphosphoramidothioate
CA:	*N*-[methoxy(methylthio)phosphinoyl]acetamide
CAS number:	30560-19-1
CIPAC number:	338
Synonyms/trade names:	Orthene, RE-12420, RIB 13824
Structural formula:	
Molecular formula:	$C_4H_{10}NO_3PS$
Molecular weight:	183.2

Physical and chemical properties

Pure active ingredient

Appearance:	white crystals
Boiling point:	not applicable
Vapour pressure:	2.26×10^{-4} Pa at 25°C (Leary and Schinski 1972, flow rate inappropriate to achieve equilibrium) $3.9 \pm 2.5 \times 10^{-4}$ Pa at 25°C (Reynolds, 1988)
Henry's law constant:	1.03×10^{-13} atm m^3 mol^{-1} (calculated using vapour pressure of Reynolds 1988) (Thornberry, 1987b)
Octanol/water partition coefficient:	log P_{ow} = -0.90 at 20 °C (Pack, 1983)
Hydrolysis of [S-methyl-^{14}C]acephate in sterile aqueous buffers:	pH 5, ca. 7% degradation in 31 days at 25°C, half-life 325 days (extrapolated) (Gaddamidi and Verrips, 1988)
	pH 7, ca. 12% degradation in 31 days at 25°C, half-life 169 days (extrapolated)
	pH 9, 60% degradation in 23 days at 25°C, half-life 18 days

Dissociation constant:	pKa = 8.35 at 20°C (Thornberry, 1987a)
Photostability in water:	In sunlight for 30 days at 25°C, hydrolysis occurred to the extent expected in the dark, with no additional degradation due to photolysis. With acetone added as a photosensitizer, the increase in degradation above hydrolysis was *ca.* 31% after 31 days (Gaddamidi, 1988)

Technical material

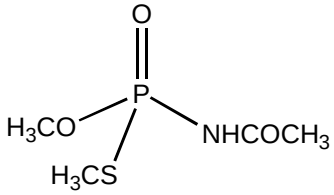
Appearance:	white powder
Melting point:	86.9-91.0°C (Thornberry, 1987a)
Relative density:	1.35 g/cm^3 at 25°C (Thornberry, 1987a)
Solubility in water:	801-835 g/l at 25°C (Thornberry, 1987a) 788 g/l at pH 4 (Baldwin, 2000) 761 g/l at pH 7 756 g/l at pH 9
Solubility in organic solvents:	*n*-hexane, 0.0086 g/100 ml at 25°C (Thornberry, 1987a)
	toluene, 1 g/100 ml at 25°C
	ethyl acetate, 4.8 g/100 ml at 25°C
	ethanol, 29.1 g/100 ml at 25°C

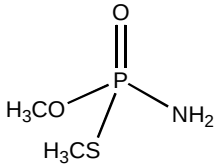
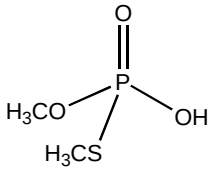
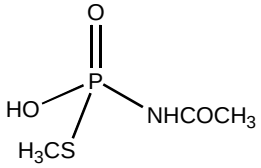
Formulations

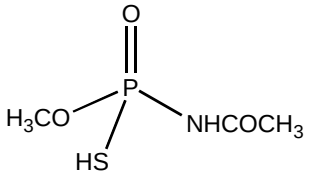
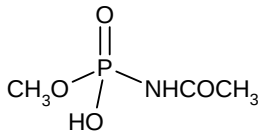
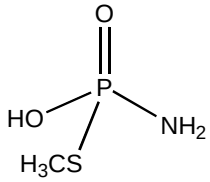
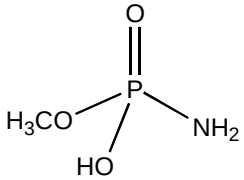
Acephate is available in the following formulations: soluble powders (SP), which may also be used for seed treatments; wettable powders (WP); granules (GR).

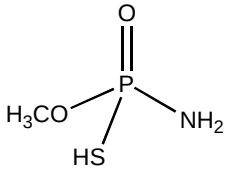
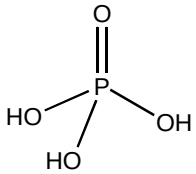
Names and codes

Acephate and its metabolites were given various trivial names, systematic names and code numbers in study reports. These are summarized below.

Metabolite No.	Term used in evaluation	Formula, CAS number/name, other names/codes used in study reports	Study reports
a.i.	acephate	 stoichiometric formula: $C_4H_{10}NO_3PS$ CAS No: 30560-19-1 CAS: *N*-[methoxy(methylthio)phosphinoyl] acetamide *O*,*S*-dimethylacetylphosphoramidothioate *O*,*S*-dimethyl *N*-acetylphosphoramidothioate RE-12420 RIB 13824 Orthene parent compound	animals rat dairy goat laying hen quail plants bean cabbage cotton lettuce tomato soil aerobic metabolism anaerobic metabolism photolysis water hydrolysis photolysis aerobic metabolism

Metabolite No.	Term used in evaluation	Formula, CAS number/name, other names/codes used in study reports	Study reports
	methamidophos	 stoichiometric formula: $C_2H_8NO_2PS$ CAS No: 10265-92-6 CAS: phosphoramidothioic acid, *O*,*S*-dimethyl ester *O*,*S*-dimethylphosphoramidothioate *O*,*S*-dimethylphosphoroamidothioate *O*,*S*-dimethylthiophosphoramidate KRJ 230184 RE-9006 SRA 5172 Ortho 9006 Monitor	<u>animals</u> rat dairy goat laying hen quail <u>plants</u> bean cabbage cotton lettuce tomato <u>soil</u> aerobic metabolism anaerobic metabolism photolysis <u>water</u> hydrolysis photolysis aerobic metabolism anaerobic metabolism
M01	DMPT	 stoichiometric formula: $C_2H_7O_3PS$ CAS No: 123438-23-3; 42576-53-4 CAS: phosphorothioic acid, *O*,*S*-dimethyl ester dimethyl phosphorothioate *O*,S-dimethyl O-phosphorothioate *O*,*S*-dimethyl phosphorothioate *O*,*S*-dimethyl phosphorothioate, sodium salt *O*,*S*-dimethyl phosphorothioic acid *O*,*S*-dimethyl phosphorothiolate *O*,*S*-dimethyl phosphorothiolate, NH_4^+ salt *O*,*S*-dimethyl phosphorothioate *O*,*S*-dimethyl thiophosphoric acid *O*,*S*-dimethyl thiophosphoric acid *O*,*S*-dimethyl *O*-hydrogen phosphorothioate DMPT Ortho 18421 RE-18421 = anion of M01	<u>animals</u> laying hen quail <u>plants</u> cotton <u>soil</u> aerobic metabolism anaerobic metabolism <u>water</u> hydrolysis photolysis aerobic metabolism anaerobic metabolism
	SMPT	 stoichiometric formula: $C_3H_8O_3PSN$ CAS No: 60394-17-4 CAS: phosphoramidothioic acid, acetyl-, *S*-methyl ester acetylphosphoramidothioic acid, *S*-methyl ester *S*-methyl *N*-acetylphosphoramidothioate *S*-methyl *N*-acetylphosphoroamidothioate *S*-methylacetylphosphoramidothioate *S*-methylacetylthiophosphoramidate *S*-methyl *O*-hydrogen acetylphosphoramidothioate RE-17245 SMPT	<u>animals</u> dairy goat laying hen quail <u>plants</u> bean cotton lettuce <u>soil</u> aerobic metabolism <u>water</u> hydrolysis photolysis aerobic metabolism anaerobic metabolism

Metabolite No.	Term used in evaluation	Formula, CAS number/name, other names/codes used in study reports	Study reports
	OMPT	 stoichiometric formula: $C_3H_8O_3PNS$ CAS No: 93240-94-9 CAS: acetylphosphoramidothioic acid, *O*-methyl ester *O*-methyl *N*-acetylphosporoamidothioate OMPT RE-17246	animals dairy goat laying hen
M24	OMAPAA	 stoichiometric formula: $C_3H_8O_4PN$ CAS No: 82452-61-7 CAS: phosphoramidic acid, acetyl-, monomethyl ester acetylphosphoramidic acid, monomethyl ester RE-18420 Monomethylacetylphosphoramidate *O*-methyl *N*-acethylphosphoramidate *O*-methyl *N*-acethylphosphoroamidate methyl hydrogen acetylphosphoramidate OMAPAA	animals dairy goat laying hen plants bean cotton lettuce soil aerobic metabolism anaerobic metabolism water hydrolysis aerobic metabolism
M05	SMPAA	 stoichiometric formula: CH_6O_2PNS CAS No: 17808-29-6 CAS: phosphoramidothioic acid-*S*-methyl ester *S*-methyl phosphoramidothioate *S*-methyl phosphoramidothiolate *S*-methyl phosphoramidothiolate, NH_4^+ salt *S*-methyl phosphoramidothioic acid *S*-methyl phosphoroamidothioate *S*-methyl *O*-hydrogen phosphoramidothioate SMPAA RE-54543 RIB 13823 SMPAA desmethamidophos desmethyl-methamidophos *O*-desmethyl methamidophos	animals dairy goat laying hen plants cotton water aerobic metabolism
M04	OMPAA	 stoichiometric formula: CH_6O_3PN CAS No: methylphosphoramidate *O*-methylphosphoramidate *O*-methyl phosphoric acid amide desthiomethyl-methamidophos	animal dairy goat laying hen

Metabolite No.	Term used in evaluation	Formula, CAS number/name, other names/codes used in study reports	Study reports
	OMPATA	 stoichiometric formula: CH_6NO_2PS CAS No: 44252-17-7 CAS: phosphoramidothioic acid, *O*-methyl ester *O*-methyl thiophosphoramidate *O*-methyl phosphoramidothiol	<u>water</u> aerobic metabolism
	acetamide	CH_3-CO·NH_2 stoichiometric formula: C_2H_5ON CAS No: 60-35-5 CAS: acetic acid amide acetamide	<u>animals</u> dairy goat laying hen <u>plants</u> cotton
M06	phosphoric acid	 stoichiometric formula: H_3PO_4 CAS No: 7664-38-2 CAS: phosphoric acid inorganic phosphate phosphate PA IV	<u>animal</u> dairy goat laying hen
M08	methyl mercaptan	CH_3-SH stoichiometric formula: CH_3SH CAS No: 74-93-1 CAS: methyl mercaptan	<u>soil</u> anaerobic metabolism <u>water</u> hydrolysis aerobic metabolism
	dimethyl disulfide	CH_3-S-S-CH_3 stoichiometric formula: $C_2H_6S_2$ CAS No: 624-92-0 CAS: disulfide, dimethyl dimethyl disulfide methyl disulfide dimethylsulphide	<u>soil</u> anaerobic metabolism <u>water</u> hydrolysis aerobic metabolism
	dimethyl sulfide	CH_3-S-CH_3 stoichiometric formula: C_2H_6S CAS No: 75-18-3 CAS: dimethyl sulfide	<u>soil</u> anaerobic metabolism <u>water</u> hydrolysis

METABOLISM

Animal metabolism

The Meeting received animal metabolism studies for acephate on lactating goats, Japanese quail and laying hens.

<u>Goats</u>

Three study reports described the metabolism of ^{14}C-acephate in lactating goats.

In the first study, Crossley and Lee (1972) studied the fate of [*S*-methyl-^{14}C]acephate and [*S*-methyl-^{14}C]methamidophos in lactating goats (*ca.* 18-20 kg bw). Four goats were orally dosed by capsule for seven consecutive days. The dosing regime was equivalent to 20 ppm acephate in the diet for goat A, 2 ppm methamidophos for goat B, 20 ppm acephate + 2 ppm methamidophos for goat C and 5 ppm acephate + 0.5 ppm methamidophos for goat D. Animals were slaughtered 11 days after the final dose. Radioactivity in milk was extracted with ethyl acetate and tissues with ethyl acetate

and acetonitrile. Analysis of residues was by GC and TLC.

For goat A, 76% (urine 72%, faeces 3.5%, milk 0.88%) of the administered dose was excreted during the course of the study; for goat B, 26% (urine 18%, faeces 4.7%, milk 3.2%); for goat C, 72% (urine 64%, faeces 5.4%, milk 2.5%); and for goat D, 62% (urine 53%, faeces 6.4%, milk 2.8%). Total accountability of the administered dose, assuming fat and muscle comprise 5 and 40% of body weight, was estimated to be 88, 69, 93 and 93% for goats A, B, C and D, respectively.

Significant ^{14}C residues were observed in tissues of goats slaughtered 11 days after the final dose (Table 1). Characterization of the ^{14}C residues was made difficult by the low levels that were extracted with ethyl acetate, a procedure expected to remove quantitatively the residues of acephate and methamidophos, as well as those of closely related metabolites.

Table 1. Distribution of ^{14}C residues in goats slaughtered 11 days after last dosing with [*S*-methyl-^{14}C]acephate and/or [*S*-methyl-^{14}C]methamidophos (Crossley and Lee, 1972).

Tissue	TRR (mg/kg expressed as acephate)			
	20 ppm acephate	2 ppm methamidophos [1/]	20 ppm acephate + 2 ppm methamidophos	5 ppm acephate + 0.5 ppm methamidophos
Liver	0.70	0.22	1.2	0.59
Kidney	0.32	0.16	0.75	0.31
Fat	0.69	0.16	1.1	0.19
Muscle	0.40	0.16	0.90	0.40
Milk				
evening 4th dose	0.93	0.26	1.93	0.84
24 h post dose	1.0	0.30	1.79	0.80
48 h post dose	0.44	0.14	0.37	0.25
168 h post dose	0.07	0.03	0.09	0.25

[1/] TRR expressed as mg methamidophos/kg.

The relative extraction efficiencies for samples of heart and muscle fortified with acephate at 0.19 and 0.02 mg/kg, respectively, were 99, 5.8 and 106% for heart extracted with ethyl acetate, hexane and acetonitrile, respectively, and 106, 0.8 and 103% for muscle extracted with the same solvents.

Selected ethyl acetate extracts were evaporated to dryness and the residue extracted with acetonitrile. Based on the differential extraction of ^{14}C (Table 2), it was concluded that the ^{14}C partitioned into acetonitrile was likely to be attributable to acephate, methamidophos or closely related compounds, while the remainder was likely to be associated with generally labelled metabolic pool material.

Table 2. Estimated combined acephate/methamidophos contents, as %TRR, in tissues extracted by ethyl acetate (EtAc) and then partitioned from ethyl acetate into acetonitrile (CH_3CN)[1] (Crossley and Lee, 1972).

Tissue	20 ppm acephate		2 ppm methamidophos [1/]		20 ppm acephate + 2 ppm methamidophos		5 ppm acephate + 0.5 ppm methamidophos	
	EtAc	CH_3CN	EtAc	CH_3CN	EtAc	CH_3CN	EtAc	CH_3CN
Liver	2.6	1.6	2.9	-	3.6	2.1	2.6	-
Kidney	4.4	-	4.1	-	5.8	0.87	4.0	-
Fat [2/]	-	1.0	-	2.0	0	0.8	-	-
Muscle	2.7	-	5.0	-	5.1	0.87	2.8	-

[1/] Selected ethyl acetate extracts were evaporated to dryness and the residue extracted with acetonitrile.
[2/] Fat was partitioned with hexane/acetonitrile instead of ethyl acetate.

Samples of milk were analyzed for acephate and methamidophos by gas chromatography. The proportion of acephate and/or methamidophos residue as a percentage of total ^{14}C decreased with time (Table 3). Fractionation of a milk sample collected following the 6th dose for goat A (20 ppm acephate dose) indicated that the majority of the ^{14}C was associated with natural components: 3.3% as fat, 9.9% as protein/casein, 38% as lactose and 30% in the ethyl acetate final fraction (total accounted 81%).

Table 3. Acephate and methamidophos residues in milk measured by gas chromatography, as a proportion of ^{14}C residues [1/] (Crossley and Lee, 1972).

Milk	Residue [2/] (mg/kg)			
	20 ppm acephate	2 ppm methamidophos [3/]	20 ppm acephate + 2 ppm methamidophos	5 ppm acephate + 0.5 ppm methamidophos
Evening, 4th dose	0.44 (47%)	0.003[2] (1.2%)	0.43 (22%)	0.10 (12%)
48 h post-dose	0.01 (2.3%)	<0.002 (<1.4%)	<0.005 (<1.4%)	<0.005 (<2%)
216 h post-dose	<0.005	<0.002		<0.005

[1/] Figures in brackets are %TRR.
[2/] Note, no acephate was detected in the milk of methamidophos-dosed animals and no methamidophos was detected in the milk of acephate- or acephate/methamidophos-dosed animals.
[3/] TRR expressed as mg methamidophos/kg.

In a second study, Tucker (1974) administered daily doses totalling 40 mg/day of [*S*-methyl-^{14}C]acephate and 4 mg/day [*S*-methyl-^{14}C]methamidophos to two lactating goats (41-50 kg bw), after first pre-dosing for 7 days with unlabelled acephate and methamidophos. The ^{14}C dose was equivalent to feeding at approximately 28 ppm in the diet for the goat receiving acephate and 2.1 ppm in the diet for the goat receiving methamidophos and was administered in three separate daily doses for two consecutive days (in the morning, at noon and in the evening). Milk was collected morning and evening. The goats were slaughtered 3 hours after the last dose. Radioactive residues in tissues were extracted with acetonitrile to remove acephate and methamidophos, with water to remove conjugates and with HCl to remove "bound" residues. The water extracts were incubated with glucuronidase-aryl sulfatase or dilute HCl to hydrolyze conjugates. Samples were analyzed within one month of collection (Table 4).

None of the tissues contained bound or conjugated residues of acephate or methamidophos. DMPT (*O,S*-dimethyl-*O*-phosphorothioate, ORTHO 18421) or SMPT (*S*-methyl acetylphosphoramidothioate, ORTHO 17245) were not detected using TLC. Milk was fractionated by extraction with hexane, to remove fat, followed by treatment of the aqueous phase with ethanol, to precipitate proteins. The ethanol-soluble fraction was evaporated and the residue extracted with dichloromethane followed by methanol. The methanol-insoluble fraction contained lactose. The majority of the ^{14}C in milk was distributed in the protein and lactose fractions. Analysis of protein fractions isolated from milk showed that ^{14}C was distributed amongst the various amino acids, indicating that the S-methyl-^{14}C is released to the metabolic pool. Flushing acidified milk samples with air did not release any ^{14}C carbonate.

Table 4. Distribution of ^{14}C residues in tissues from goats dosed with [*S*-methyl-^{14}C]acephate and [*S*-methyl-^{14}C]methamidophos (Tucker, 1974).

Dose group	Tissue	Residue (mg/kg)[1/]				
		TRR (mg/kg) [1/]	Extracted with acetonitrile	Extracted with water	Extracted with 1M HCl	PES [2/]
28 ppm acephate	Liver	0.47	0.13	0.11	0.005	0.16
	Kidney	0.39	0.23	0.063	0.003	0.065
	Subcutaneous fat	0.054	0.028	0.006	<0.001	0.012
	Peritoneal fat	0.061	0.018	0.008	<0.001	0.023
	Muscle	0.18	0.11	0.030	0.011	0.018
2.1 ppm methamidophos	Liver	0.23	0.014	0.056	0.003	0.13
	Kidney	0.097	0.006	0.023	0.02	0.048
	Subcutaneous fat	0.008	0.001	0.001	<0.001	<0.003
	Peritoneal fat	0.014	<0.001	0.001	<0.001	<0.002
	Muscle	0.036	0.007	0.008	0.001	0.015

[1/] Expressed as acephate or methamidophos equivalents.
[2/] PES = post extraction solids.

Tissue and milk samples were analyzed for acephate and methamidophos, using TLC and an analytical method that had been utilized in residue trials and for regulatory purposes (Table 5). Acephate residues, in rank order, were: kidney > muscle > liver > fat, for the goat dosed with acephate at 28 ppm. Residues above the LOQ were not detected in the tissues of the goat dosed with methamidophos.

Table 5. Characterization of ^{14}C residues in tissues and milk from goats dosed with [*S*-methyl-^{14}C]acephate and [*S*-methyl-^{14}C]methamidophos (Tucker, 1974).

Dose group	Tissue	TRR	Acephate (mg/kg)		Methamidophos (mg/kg)	
			GC [1/]	TLC (acetonitrile extract)	GC[1/]	TLC [2/] (acetonitrile extract)
28 ppm Acephate	Liver	0.47	0.064	0.075	0.009	0.005
	Kidney	0.39	0.29	0.18	0.017	0.006
	Subcutaneous fat	0.054	0.04	0.021	0.0	0.0
	Peritoneal fat	0.061	0.021	0.014	0.0	0.0
	Muscle	0.18	0.14	0.085	0.009	0.004
	Milk (a.m. day 10)	0.42	0.15		0.008	
2.1 ppm methamidophos	Liver	0.23	-	-	<0.005	0.0
	Kidney	0.097	-	-	<0.005	NA
	Subcutaneous fat	0.008	-	-	<0.005	NA
	Peritoneal fat	0.014	-	-	<0.005	NA
	Muscle	0.036	-	-	<0.005	NA
	Milk (a.m. day 10)	0.14	-		<0.005	NA

NA = not analyzed.
[1/] Method RM-12A involved extraction with ethyl acetate and analysis by GC/FPD.
[2/] Recovery of methamidophos was *ca*. 50% by the TLC system used.

In the third study, Huhtanen and Turck (1996) dosed lactating dairy goats (50-58 kg bw), orally, twice daily with [carbonyl-^{14}C]- or [*S*-methyl-^{14}C]acephate for three consecutive days at the equivalent of 15 ppm in the diet. Animals were slaughtered within 18-20 hours of the last dose. Approximately 83% of the carbonyl- and 63% of the *S*-methyl-labelled administered radioactive dose was recovered. Radioactive residues in faeces and urine accounted for 73% and 53% of the administered dose for the carbonyl and S-methyl labels respectively. Radioactivity associated with $^{14}CO_2$ and other volatiles was detected but quantification was not attempted and this may account for the relatively low recovery of the administered dose. Samples of milk, liver, kidney, muscle and fat were extracted with acetonitrile, aqueous acetonitrile and ethyl acetate, to separate the ^{14}C residues into polar, non-polar and post-extraction solids (PES) fractions. Levels of radiolabel appearing in the tissues and milk are shown in Table 6.

Acephate accounted for a maximum of 26% of the TRR in tissues, with the majority of the ^{14}C associated with natural products, principally the proteins in liver, kidney and muscle and the lipids in fat tissue. Radiocarbon incorporated into the lipids of cream, the protein of casein and the lactose of whey accounted for 69 and 75% of the TRR, respectively, for the carbonyl and S-methyl labels in the day 2 milk samples. HPLC showed that ^{14}C-label was incorporated into capric and palmitic acids in the cream and into lactose in the whey samples.

Table 6. Characterization of ^{14}C in lactating goats orally dosed with [carbonyl-^{14}C]- or [*S*-methyl-^{14}C]acephate (Huhtanen and Turck, 1996).

Tissue	Milk (day 2)		Liver		Kidney		Muscle		Fat	
Label	C=O	*S*-Me	C=O	*S*-Me	C=O	*S*-Me	C=O	*S*-Me	C=O	*S*-Me
TRR (mg/kg)	0.68	0.53	1.0	1.1	0.36	0.50	0.20	0.17	0.10	0.018
%TRR										
Acephate	12	14	4.8	4.2	26	14	22	26	ND	ND
Methamidophos	NA	0.9	NA	<0.9	NA	<2.0	NA	<6.0	NA	ND
SMPT [1/]	NA	NA	2.5	0.6	1.7	ND	NA	NA	NA	NA
OMAPAA [1/]	NA	NA	6.9	NA	10	NA	NA	NA	NA	NA
SMPAA [1/]	NA	NA	NA	1.3	NA	5.6	NA	NA	NA	NA
DMPT [2/]	NA	NA	NA	ND	NA	ND	NA	NA	NA	NA
Acetamide [3/]	1.6	NA	4.5	NA	NA	NA	NA	NA	NA	NA
Lipids [4/]	56	6.4	2.2	4.2	14	6.6	5.5	3.4	85	51
Lactose [5/]	4.0	33	NA	NA	NA	NA	NA	NA	NA	NA
Proteins (PES [6/])	9.5	34	55	61	16	49	16	38	3.0	33
Total	83	88	76	72	58	77	44	73	88	84

NA = not applicable, either not ^{14}C-labelled or analysis not attempted.
ND = not detected.
[1/] Tentative assignment based on ^{14}C-TLC.
[2/] Identified by HPLC and TLC.

[3/] Identified by HPLC and TLC, acetamide is also an endogenous compound, reported to occur in bovine and poultry liver at levels of up to 0.11 mg/kg, milk at up to 0.5 mg/kg and eggs at up to 0.35 mg/kg.

[4/] Lipid TRR designated as "nonpolars" for liver, kidney and muscle. Saponification and separation of free fatty acids by HPLC indicated capric and palmitic acids in goats milk. It was known that these comprised 10 and 30% of goat milk fat respectively. The *p*-bromophenacyl derivatives were also prepared and characterized by comparison of HPLC retention times with authentic standards.

[5/] HPLC/TLC co-chromatography and by acid hydrolysis of the disaccharide into its constituent monosaccharides, galactose and glucose, followed by HPLC.

[6/] Proteins (PES) indicates the sum of ^{14}C-residues characterized as protein and post-extraction solids. This was based on lack of solubility under the extraction conditions used for other components and was attributed to denatured proteins in the case of milk.

Japanese quail

Warnock (1973) administered a single dose of 0.789 mg of [*S*-methyl-^{14}C]acephate to two Japanese quail (*Coturnix*), after dosing for 5 days with unlabelled acephate. The dose was equivalent to feeding at approximately 56 ppm in the diet. Most of the ^{14}C dose was excreted within the first 24 hours after dosing (approx 86%). A small amount was recovered as $^{14}CO_2$ in the expired breath and approximately 1.5% of the ^{14}C dose was located in the carcass, following slaughter at 3 days after dosing. Approximately 95% of the dose was accounted for at 3 days after dosing (90% excreta, 2.1% CO_2, 0.8% carcass, 1.6% rinse). Following extraction, the ^{14}C in the excreta and tissues was characterized by TLC and or GC. In addition to unchanged acephate (the major component of the radioactivity in excreta), the following metabolites were identified: methamidophos (*O,S*-dimethyl phosphoramidothioate, ORTHO 9006), SMPT (*S*-methyl acetyl phosphoramidothioate, ORTHO 17245) and DMPT (dimethylphosphorothioate). Only traces of acephate were detected in tissues, ≤0.009 mg/kg, with the majority of the ^{14}C assumed to have been incorporated into natural products.

Hens

Separate groups of White Leghorn laying hens (7 birds per group, 1.5-1.6 kg bw) were dosed *via* capsule with [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate, equivalent to approximately 10 ppm in the feed, for 3 consecutive days (Lee *et al.*, 1996). Eggs were collected twice daily. The birds were slaughtered within 20 hours of the final dose and samples of tissue were collected. Samples of egg white, muscle, liver and fat were extracted with acetonitrile, aqueous acetonitrile and ethyl acetate, to separate the ^{14}C residues into polar, non-polar and post-extraction solids (PES) fractions. These fractions were further characterized by TLC, HPLC, GC/MS and NMR. Levels of radiolabel appearing in the tissues and eggs are shown in Table 7.

Accountability of the administered dose was 68 and 85%, respectively, for the carbonyl and *S*-methyl label dose groups. The majority of the administered ^{14}C was recovered in excreta and cage washes (46% for the carbonyl and 76% for the *S*-methyl label). The proportion of the ^{14}C dose expired as $^{14}CO_2$ and other volatile compounds was 16% and 6%, for the carbonyl and *S*-methyl label groups respectively.

Acephate was identified as the major component of the ^{14}C residue in muscle, egg white and egg yolk, comprising 42-62% of the radiolabel in egg white, 5.3-33% in egg white and 41-64% in muscle. A large proportion of the ^{14}C radiolabel was incorporated into protein (20-43% for muscle, egg white and yolk) and into lipid (12-52% for egg yolk).

Table 7. Characterization of ^{14}C residues in tissues and eggs (%TRR) of laying hens dosed at the equivalent of 10 ppm in the feed for three days (Lee *et al.*, 1996).

Tissue	Egg white, day 3		Egg yolk, day 3		Muscle		Liver		Fat	
Label	C=O	*S*-Me [1/]	C=O	*S*-Me	C=O	*S*-Me	C=O	*S*-Me [2/]	C=O	*S*-Me
TRR (mg/kg)	0.31	0.34	1.5	0.17	0.11	0.10	0.87	0.46	0.44	0.04
					%TRR					
Acephate	62	42	5.3	33	41	64	2.4	11	0.7	26
Methamidophos		9.5		ND		2.8		ND		2.7
SMPT [3/]	4.2	3.5	0.9	3.3	1.3		1.5	12	0.7	17
OMAPAA [4/]	0		0.2		1.6		4.2		0.3	
SMPAA [3/]		1.7		0.7		3.7		5.9		2.9

Tissue	Egg white, day 3		Egg yolk, day 3		Muscle		Liver		Fat	
Label	C=O	*S*-Me [1/]	C=O	*S*-Me	C=O	*S*-Me	C=O	*S*-Me [2/]	C=O	*S*-Me
DMPT [3/]		1.7		0.9		1.1		0.9		1.1
Acetamide [5/]	11		1.0		10		7.9		0.6	
Lipids [6/]	0.4	0.1	52	12	5.1	0.5	23	6.5	68	10
Proteins [7/]	29	28	20	41	43	32	34	49	5.3	42
Total	107	87	79	91	102	104	73	85	76	102

ND = not detected.

[1/] *S*-Me egg white contained an unknown, P-1, comprising 18% of the total ^{14}C residue.

[2/] *S*-Me liver contained an unknown, P-,2 comprising 9.3% of the total ^{14}C residue, but the concentration was too low for further characterization.

[3/] Identified by HPLC co-chromatography and by a derivatization (methylation with diazomethane) that converted SMPT to acephate, SMPAA to methamidophos and DMPT to methyl DMPT, which were then identified by HPLC and TLC co-chromatography.

[4/] Tentative identification based on HPLC retention time.

[5/] Identified by several HPLC methods and by co-injection of a ^{14}C-acetamide fraction which co-eluted. Acetamide is also an endogenous compound and is reported to occur in poultry liver at levels of up to 0.11 mg/kg and eggs at up to 0.35 mg/kg.

[6/] Saponification of the ethyl acetate extractable residues, under conditions expected to hydrolyze carboxylic acid esters and phosphate esters, to give fatty acid neutral fractions. HPLC of the fatty acid fraction indicated the presence of palmitic and oleic acids; confirmed by the preparation of the *p*-bromophenacyl esters, HPLC co-chromatography with authentic standards and also by GC/MS of the methyl ester derivatives.

[7/] The post-extraction solid fractions were hydrolyzed and the individual amino acids were acetylated, separated and purified by HPLC and characterized by MS and NMR.

In livestock, metabolism of acephate proceeds by the hydrolysis of the *O*-methyl-, *S*-methyl- and amide moieties, to form SMPT and OMAPAA (probably via OMPT) and methamidophos, respectively. The liberated carbon fragments enter the metabolic pool and are incorporated into natural products, principally proteins and lipids and, in the case of milk, lactose.

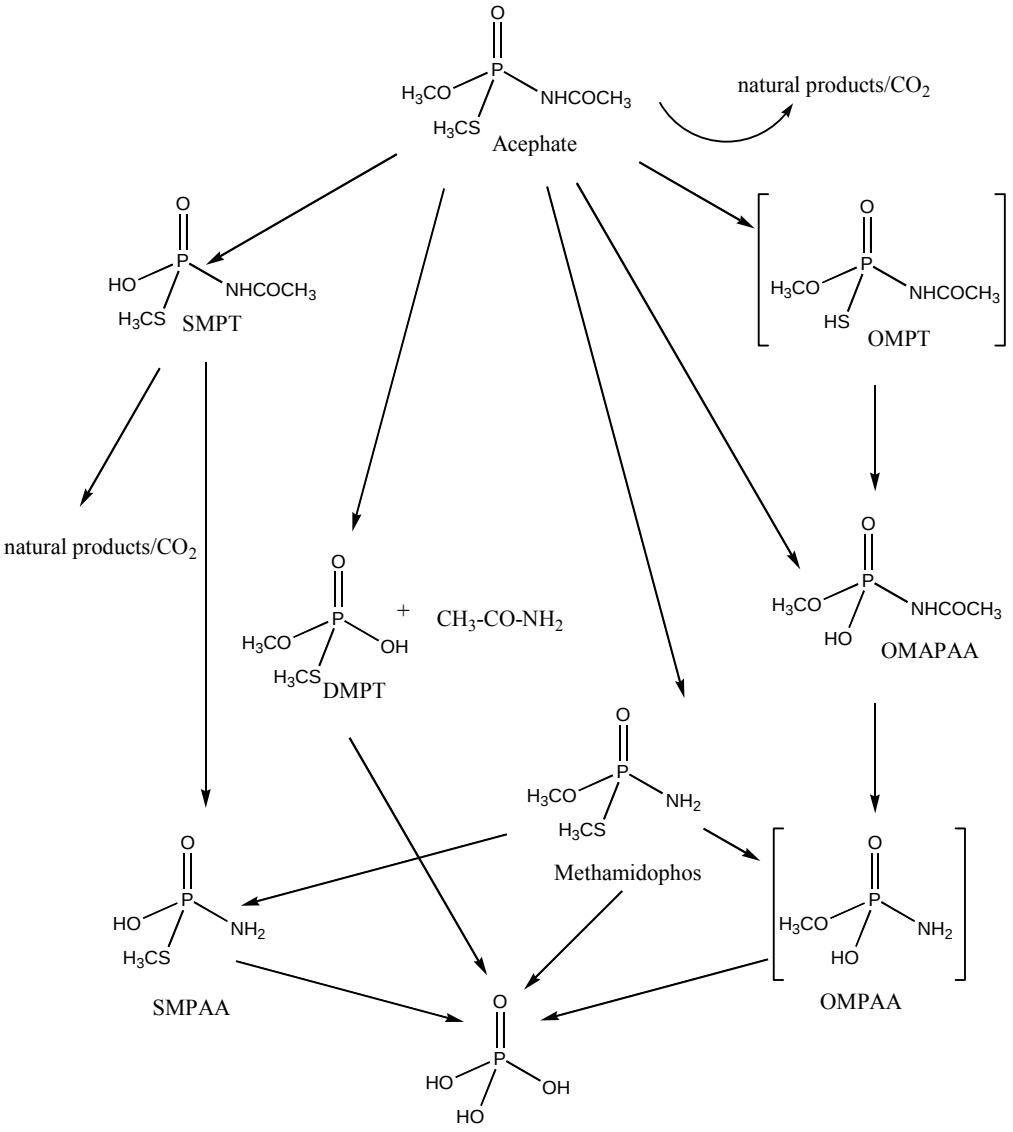


Figure 1. Proposed metabolic pathways of acephate in poultry and ruminants.

Plant metabolism

The Meeting received plant metabolism studies of acephate in bean, cabbage and tomato seedlings, as well as lettuce, cotton and bean plants.

Bean, cabbage and tomato seedlings

In a laboratory study, bean, cabbage and tomato seedlings, 2-4 weeks old, were treated with [*S*-methyl-^{14}C]acephate by application to the surface of the leaves or by stem injection (Tucker, 1972a). After one week, the radioactivity in the seedlings was extracted with acetonitrile and the extract analyzed by TLC for acephate, methamidophos and DMPT (*O,S*-dimethyl phosphorothioate) residues. The major component of the ^{14}C residue was acephate, accounting for 30-65% of the applied radioactivity. Methamidophos accounted for 1-4% of the applied radioactivity but DMPT was not detected.

Lettuce

Lettuce (variety Royal Green) were treated with three applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate, made to separate plots at one week intervals (Baker *et al.* 1996a). The

application rate was equivalent to 1.1 kg ai/ha, with plants harvested 20 days after the last application. Residues were sequentially extracted with aqueous acetonitrile, acidic and basic acetonitrile and by acid reflux (Table 8). The residues remaining in the post-extraction solids were classified as unextracted and were further characterized by sequential degradation. Identification and quantification of acephate residues and metabolites was by TLC and/or HPLC, with confirmation by MS and TLC/HPLC. SMPT and OMAPAA were confirmed by ^{31}P NMR.

The majority of the ^{14}C residue was extracted with aqueous acetonitrile. Further characterization of the aqueous acetonitrile extracts identified acephate as the major component of the ^{14}C residue, together with smaller amounts of OMAPAA, methamidophos and SMPT (Table 9). Two metabolites, P1 and P2, were isolated but not identified. Based on its properties, P1 was characterized as a neutral compound, more polar than acephate but not containing the –S-CH_3 moiety, while P2 was tentatively proposed to be OMAPAA. Sequential degradation of the post-extraction solids containing radioactivity indicated incorporation of ^{14}C into starch, protein, pectin, lignin, hemicellulose and cellulose fractions.

Table 8. Extractability of radiocarbon from lettuce treated with three applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate at 1.1 kg ai/ha (Baker *et al.* 1996a).

Label	TRR (mg/kg)	Residue extracted (mg/kg)					Un-extracted (PES)
		CH_3CN/H_2O	$CH_3CN/H^+/H_2O$	$CH_3CN/OH^-/H_2O$	Refluxed H^+	Total	
S-Me	3.3	2.3 (74%)	0.04 (1.4%)	0.18 (5.8%)	0.24 (7.5%)	2.8 (89%)	0.18 (5.7%)
C=O	1.7	1.3 (79%)	0.02 (1.2%)	0.037 (2.2%)	0.11 (6.5%)	15 (89%)	0.08 (5.0%)

Figures in brackets are %TRR.

Table 9. Characterization of radioactivity in aqueous acetonitrile extracts of lettuce treated with three applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate at 1.1 kg ai/ha (Baker *et al.* 1996a).

Label	TRR (mg/kg)	Acephate	Methamidophos	SMPT	Metabolite P1 [1/]	Metabolite P2 [2/]	Balance
S-Me	2.3	1.2 (53%)	0.27 (11%)	0.26 (11%)	0.32 (14%)	-	0.24 (11%)
C=O	1.7	0.60 (45%)	-	0.20 (15%)	-	0.39 (29%)	0.15 (11%)

Figures in brackets are %TRR.

[1/] Identified as a neutral compound that was more polar than acephate and did not contain the –S-CH_3 moiety, probably a natural product.

[2/] Tentatively identified as OMAPAA, based on ^{31}P NMR.

Cotton

Alam *et al.* (1996) applied [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate to separate plots of cotton plants (variety ACALA GC-510), as three applications of 1.1 kg ai/ha at seven day intervals. The plots were harvested 21 days after the last application and the open bolls ginned to separate the fuzzy seed from the lint. The seed was processed to separate the seed meal from the hulls and the dry bracts were collected to simulate gin trash. The plant material was extracted with acetonitrile/hexane followed by acetonitrile. Following phase separation of the combined extracts, the acetonitrile fraction was again partitioned with hexane. The remaining solids were extracted firstly with hexane and then with water. The ^{14}C in the extracts was characterized by TLC with co-chromatography, HPLC and ^{31}P NMR. The post-extraction solids were further characterized, following sequential hydrolysis by pronase, aqueous HCl and aqueous NaOH (Tables 10 and 11).

Gin trash had the highest levels of residue. This is to be expected as the seed would be protected by the bolls and the majority of ^{14}C in seeds probably arose from translocation. In gin trash, acephate was the major component of the ^{14}C residue, followed by OMAPAA and SMPT. In seed, acephate was present at trace levels, with OMAPAA the major metabolite observed.

Table 10. Extractability of radiocarbon from cotton treated with three applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate at 1.1 kg ai/ha (Alam *et al.,* 1996).

Label	Matrix	TRR (mg/kg)	Residue extracted (mg/kg)				Un-extracted (PES)
			Hexane (non-polar)	CH_3CN (intermediate)	Aqueous (polar)	Total	
S-Me	Seed meal	2.9	1.1 (37%)	0.086 (2.9%)	0.58 (20%)	60%	1.2 (41%)
	Seed hulls	1.9	0.26 (14%)	0.080 (4.2%)	0.35 (19%)	37%	1.2 (64%)
	Gin trash	12	0.046 (0.4%)	5.4 (46%)	4.6 (40%)	86%	1.7 (14%)
C=O	Seed meal	0.52	0.10 (20%)	0.036 (6.9%)	0.19 (37%)	64%	0.08 (5.0%)
	Seed hulls	0.45	0.017 (3.8%)	0.11 (24%)	0.15 (33%)	61%	0.18 (40%)
	Gin trash	12	0.17 (1.3%)	5.1 (41%)	6.3 (51%)	93%	0.79 (6.4%)

Figures in brackets are %TRR.

Table 11. Characterization of ^{14}C in samples of cotton plants treated with three foliar applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate at 1.1 kg ai/ha (Alam *et al.,* 1996).

Sample	Fraction/compound	carbonyl-^{14}C label		S-methyl-^{14}C label	
		%TRR	mg/kg [1/]	%TRR	mg/kg [1/]
Seed meal	Lipid/triglyceride [2/]	20	0.10	37	1.1
	Acetamide [3/]	2.5	0.013	-	-
	Methamidophos	-	-	0.5	0.014
	Acephate	2.0	0.01	0.8	0.025
	SMPT [4/]	1.0	0.005	3.3	0.096
	OMAPAA [4/]	22	0.11	1.0	0.029
	Origin	17	0.087	17	0.50
	Total extracted	64	0.33	59	1.7
	PES [5/]	36	0.19	41	1.2
	Total residue	100	0.52	100	2.9
Seed hull	Lipid/triglyceride [2/]	3.8	0.017	14	0.26
	Acetamide [3/]	9.6	0.043	-	-
	Acephate	7.3	0.033	2.3	0.043
	SMPT [4/]	2.4	0.011	4.2	0.079
	OMAPAA [4/]	24	0.11	0.8	0.015
	Origin	12	0.056	16	0.29
	Total extracted	60	0.27	36	0.69
	PES [6/]	40	0.18	64	1.2
	Total residue	100	0.45	100	1.9
Gin trash	Lipid/triglyceride [2/]	1.3	0.17	0.4	0.046
	Acetamide [3/]	1.7	0.21	-	-
	Methamidophos	-	-	1.6	0.19
	Acephate	40	4.9	41	4.8
	DMPT	-	-	4.3	0.50
	SMPT [4/]	17	2.1	29	3.4
	OMAPAA [4/]	27	3.3	0.9	0.11
	Origin	6.8	0.84	8.8	1.0
	Total extracted	94	11	86	10
	PES [7/]	6.4	0.79	14	1.7
	Total residue	100	12	100	12

[1/] Values of mg/kg expressed as ^{14}C-acephate equivalent.

[2/] Saponification and preparation of the bromophenacyl esters by reaction with 2,4'-dibromoacetophenone in the presence of 18-crown-6 catalyst. HPLC confirmed the presence of linoleic acid (major component) and minor amounts of oleic and palmitic acids, which co-eluted. It has been reported (Considine and Considine, 1992; Fischer and Jefferies, 1995) that cottonseed oil contains lineolic acid (40-52%), oleic acid (13-19%) and palmitic acid (26-35%).

[3/] TLC and HPLC co-chromatography.

[4/] TLC and, for gin trash, ^{31}P NMR.

[5/] Sequential hydrolysis and fractionation of the seed meal post-extraction solids gave: 2.4-5.5% pronase-soluble protein; 12-15% acid hydrosylate;, 0.9-2.9% lignin fraction; 3-5.3% base hydrosylate; 6.4-8.7% cellulose; accounting for approximately 77-85% of the total radioactivity in the post-extraction solids.

[6/] Sequential hydrolysis and fractionation of the hull post-extraction solids gave: 3.6-6.6% pronase-soluble protein; 7.9-9.7% acid hydrosylate;, 4.3-11% lignin fraction; 8.9-13% base hydrosylate; 6.8- 19% cellulose; accounting for approximately 86-90% of the total radioactivity in the post-extraction solids.

[7/] Sequential hydrolysis and fractionation of the gin trash post-extraction solids gave: 2.0-3.4% pronase-soluble protein; 2.0-2.2% acid hydrolysate; 0.2-1.8% lignin fraction;, 0.5-3.0% base hydrosylate; 0.5-0.8% cellulose; accounting for approximately 79-81% of the total radioactivity in the post-extraction solids.

Post-extraction solids (PES) contained significant proportions of the radioactivity in the seed meal and hull samples, with PES hydrolysis fractions indicating inclusion of the ^{14}C into lignin, fatty acids of triglycerides and water-soluble materials.

Beans

Baker *et al.* (1996b) treated separate plots of bean plants with three applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate, at 1.1 kg ai/ha and 7 day intervals. Mature beans and plant material (stalk, foliage and immature beans = bean forage) were harvested 14 days after the last application. Residues were extracted with aqueous acetonitrile, acidified aqueous acetonitrile and by acid reflux. The remaining residue in the solids was classified as unextracted and was further characterized by sequential degradation (extraction with aqueous phosphate buffer, α-amylase, pronase, acetic acid and KOH). The identification and quantification of ^{14}C residues was initially by TLC and HPLC, with confirmation by TLC/HPLC, mass spectrometry and in some cases ^{31}P-NMR (SMPT, OMAPAA) (Tables 12 and 13).

As with lettuce, the majority of the ^{14}C residue was recovered in the aqueous acetonitrile extract.

Table 12. Extractability of radiocarbon from beans treated with three applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate at 1.1 kg ai/ha (Baker *et al.,* 1996b).

Label	Sample	TRR (mg/kg)	Extracted residue (mg/kg)				Unextracted (PES)
			CH_3CN/H_2O	$CH_3CN/H^+/H_2O$	Refluxed H^+	Total	
S-Me	Beans	16	7.4 (46%)	0.20 (1.2%)	4.8 (30%)	12 (77%)	0.78 (4.8%)
	Forage	74	76 (102%)	0.67 (0.9%)	3.2 (4.2%)	80 (107%)	2.1 (2.8%)
C=O	Beans	12	10 (82%)	0.14 (1.1%)	1.1 (8.6%)	11 (92%)	0.44 (3.5%)
	Forage	85	82 (96%)	1.0 (1.2%)	3.6 (4.3%)	86 (101%)	1.6 (1.8%)

Figures in brackets are %TRR.

The major components of the residues, other than natural products, were acephate and OMAPAA, together with smaller amounts of methamidophos and SMPT. Three polar metabolites were isolated but could not be identified. They each accounted for <10% of the TRR in beans and bean forage.

Table 13. Characterization of ^{14}C in beans and foliage from plants treated with three applications of [carbonyl-^{14}C]acephate and [*S*-methyl-^{14}C]acephate at 1.1 kg ai/ha (Baker *et al.,* 1996b).

	Radioactive residue (mg/kg as acephate)			
	S-methyl-^{14}C label		Carbonyl-^{14}C label	
	Bean	Forage	Bean	Forage
TRR (mg/kg)	16	74	12	85
CH_3CN/H_2O	7.4 (46%)	76 (102%)	10 (83%)	82 (96%)
Acephate	2.2 (14%)	55 (74%)	1.8 (15%)	53 (62%)
Methamidophos	1.2 (7.3%)	5.7 (7.7%)	-	-
SMPT [1/]	1.4 (8.6%)	11 (14%)	0.87 (7.0%)	5.5 (6.5%)
OMAPAA [1/]	-	-	7.0 (57%)	19 (23%)
P1 [2/]	1.1 (6.9%)	2.0 (2.7%)	-	-
O' [2/]	0.53 (3.3%)	1.1 (1.5%)	-	-
P2 [2/]	0.88 (5.5%)	0.68 (0.92%)	-	-
A' [3/]	-	-	ND	1.9 (2.2%)
Origin	-	-	0.30 (2.4%)	2.0 (2.4%)
Starch fraction [4/]	1.0 (6.4%)	2.3 (3.1%)	0.35 (2.8%)	1.2 (1.4%)
Protein fraction [5/]	0.33 (2.0%)	0.75 (1.0%)	0.12 (0.98%)	0.28 (0.33%)
Pectin fraction	-	-	0.12 (0.94%)	0.49 (0.57%)
Lignin fraction [6/]	0.19 (1.2%)	0.66 (0.89%)	0.05 (0.4%)	0.39 (0.46%)
Hemicellulose fraction [7/]	1.2 (7.5%)	1.5 (2.0%)	0.35 (2.8%)	0.88 (1.0%)
Cellulose fraction [8/]	0.19 (1.2%)	0.17 (0.23%)	0.04 (0.34%)	0.06 (0.07%)
%TRR identified	65%	109%	89%	100%

Figures in brackets are %TRR.
ND = not detected.
[1/] Identified by TLC and ^{31}P NMR.

[2/] P1, O', P2 are very polar, neutral molecules, thought to be related to natural products.
[3/] A' = an impurity in the [^{14}C=O]acephate test substance.
[4/] α-Amylase hydrolysis, TLC of the hydrolysate visualized by chromogenic reaction with iodine.
[5/] Pronase hydrolysis, TLC of the hydrolysate, visualized by chromogenic reaction with ninhydrin.
[6/] 0.4N acetic acid/sodium chlorite hydrolysis.
[7/] 6N acetic acid/sodium chlorite hydrolysis.
[8/] Aqueous KOH.

In plants, acephate is metabolized by ester/thioester and amide hydrolysis reactions, to form methamidophos, SMPT and OMAPAA as the major metabolites. Further metabolism results in the incorporation of acephate-derived fragments into plant natural products.

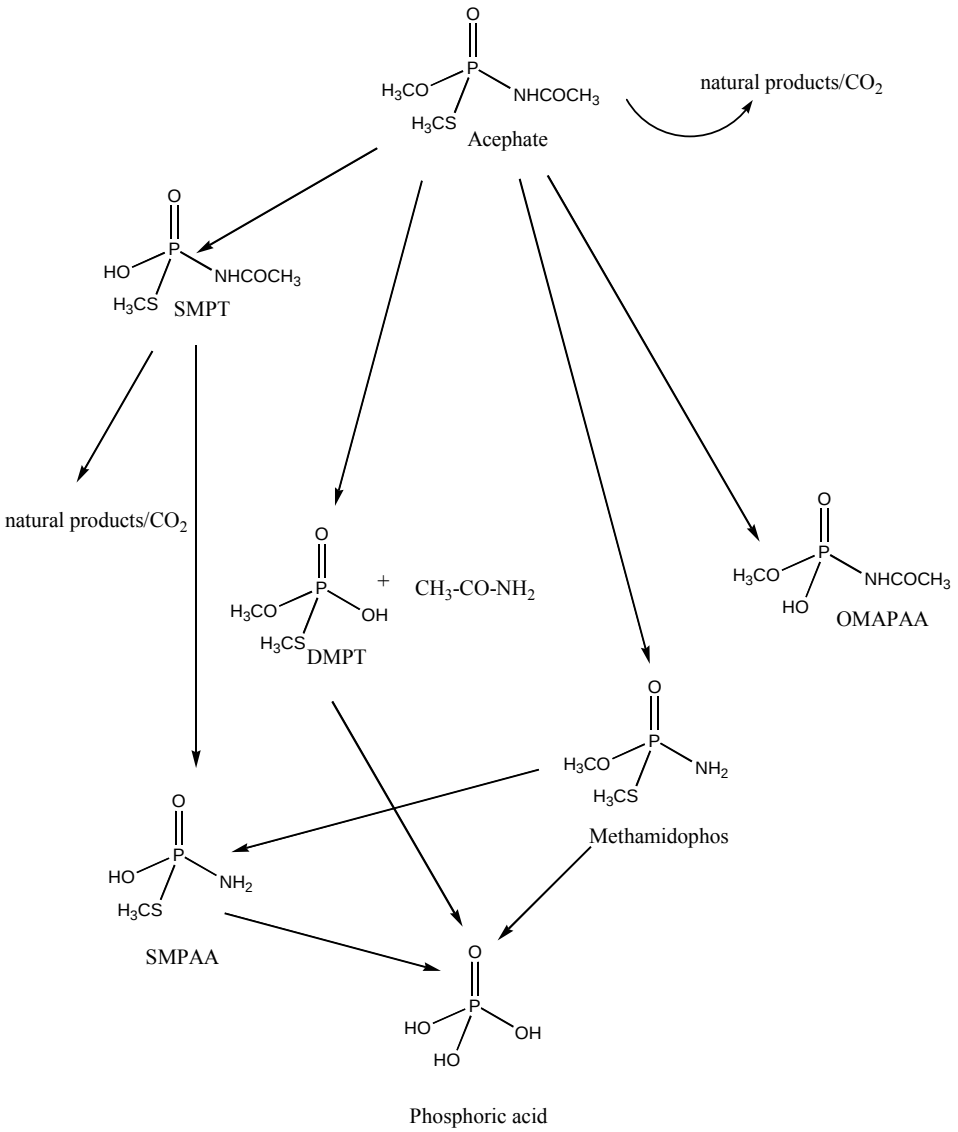


Figure 2. Proposed pathways of acephate metabolism in plants (lettuce, cotton, bean).

Environmental fate in soil

The Meeting received information on the behaviour and fate of acephate during soil and solution photolysis, aerobic soil metabolism and field dissipation. Information on the soil adsorption properties of acephate was also provided.

Photodegradation on soil

As anticipated from its UV absorption spectrum, acephate does not undergo significant direct

photolysis in solution or on the surface of soil. Chen (1987) studied the photolysis of [S-methyl-^{14}C]acephate on a sandy loam soil (Crevasse, Greenville, Mississippi). The soil (non-sterile), adjusted to 75% field moisture capacity, was treated at the equivalent of 1.1 kg ai/ha in borosilicate flasks and irradiated with natural sunlight for periods of up to 10 days. The degradation of acephate was more rapid in the dark controls than in the irradiated samples. A possible explanation for this observation was a difference in the microbial activity between the irradiated and dark control samples. The degradation products detected were CO_2, methamidophos and possibly DMPT and SMPT, and were similar in both irradiated and dark controls. Photodegradation was not observed.

Photolysis in sterile solution

Gaddamidi (1988) tested the stability of acephate solutions, at pH 7, to irradiation by natural light, in the presence or absence of 1% acetone as a photosensitizer. In sterile solutions and in the absence of photosensitizer, the illuminated and dark control samples gave similar results, indicating that any photolysis was insignificant compared to hydrolysis. After 35 days, acephate accounted for 85-87% of the initial dose, with small amounts of the degradation products methamidophos (1.6%), SMPT (RE-17245) (4.6%) and DMPT (RE-18421) (3.6%) being formed. Addition of the photosensitizer resulted in accelerated degradation, with 46% of the initial acephate being present after 35 days. The major degradation product was DMPT (41%) with smaller amounts of SMPT (2.5%) and methamidophos (8.6%) also detected.

Aerobic metabolism

Half-lives for the degradation of acephate in aerobic soil were generally ≤ 3 days. The principal mechanism of degradation appeared to be by microbial metabolism, which occurs faster under aerobic than anaerobic conditions. Observed degradation products included methamidophos, OMAPAA and DMPT and these intermediates were further degraded to CO_2.

Tucker (1972b) reported that acephate (at concentrations of 1 or 10 mg/kg) was rapidly lost from a wide variety of soils (eight soils, including a muck), when incubated at 24°C at field moisture capacity and open to the air. Acephate and methamidophos (10 mg/kg experiments only) were determined, following extraction of the soils with acidified methanol and analysis by GLC according to method RM-12A (Table 14). In all cases, half-lives in soils were ≤ 3 days at 10 ppm and ≤ 1.5 days at 1 ppm. Half-lives in the Ocoee muck soil were 6 days at 1 ppm and 13 days at 10 ppm. The average maximum concentration of methamidophos in the seven soils and the muck was approximately 10% of the initial acephate concentration, while the rate of decay of methamidophos was similar to that of acephate. The influence of soil micro-organisms on the degradation of acephate was investigated by comparing the degradation in sterile and non-sterile soils. In sterile Norwalk silty clay loam and Greenville clay, the level of acephate present after 4 days of incubation was approximately 90-100% of the initial level (11 mg/kg) while in non-sterile soils acephate was present at approximately 20% of the initial level.

The degradation of acephate was more rapid in Hanford loamy sand (%OM 0.9, pH 5.6), treated with acephate at 20 mg/kg, at 15% moisture (t½ 4 days) than at 5% moisture (t½ 7 days) (Leary, 1972a). Under the same conditions, the degradation half-lives for methamidophos were 12 days at 15% moisture and 9.5 days at 5% moisture. Increased moisture contact should generally promote microbial degradation.

Table 14. Rate of degradation of acephate following aerobic incubation of different soils (Tucker, 1972b).

Type	Origin	%OM	pH	t½ (days)	
				1 mg/kg [1/]	10 mg/kg [1/]
Clay	Clarksburg, Ca	4.3	7.1	1.5	1.5
Loam	Fresno, Ca	1.3	5.7	0.5	0.5
Clay	Kettleman City, Ca	1.2	7.7	1.5	3
Loamy sand	Ocoee, Fl	2.5	5.4	1	1
Sandy clay loam	Mt Holly, NJ	2.4	5.6	0.5	1
Silty clay loam	Norwalk, Iowa	4.1	6.2	NA	2
Clay	Greenville, Mississippi	1.9	5.7	NA	1.5

Type	Origin	%OM	pH	t½ (days)	
				1 mg/kg [1/]	10 mg/kg [1/]
Muck	Ocoee, Fl	68	5.3	6	13

NA = not analyzed.
[1/] Initial acephate concentration in soil, wet weight basis.

In the same report as above, the aerobic soil metabolism was investigated in four soils (Fresno loam, Mt. Holly sandy clay loam, Norwalk silty clay loam and Ocoee loamy sand) treated with acephate at 1 ppm and incubated at field moisture capacity for up to 6 days in flow-through flasks (Tucker, 1972b). Exiting air was passed through methyl cellosolve and methyl cellosolve/ethanolamine traps placed in series. The anaerobic metabolism of acephate was studied with Ocoee loamy sand, in which case the flasks were flushed with nitrogen rather than air. Residues in the soils were extracted with acidified methanol and the extracts analyzed by TLC for acephate, methamidophos, and DMPT (Table 15). After 6 days incubation, 54, 76, 86 and 79% of the applied radioactivity was evolved as $^{14}CO_2$ from the loam, sandy clay loam, silty clay loam and loamy sand soils, respectively. Methamidophos accounted for 23, 3 and 1% of the applied ^{14}C after 2 days incubation in Fresno loam, Mt Holly sandy clay loam and Norwalk silty clay loam, respectively. DMPT was not detected at any sampling interval.

Table 15. Distribution of ^{14}C (%initial ^{14}C soil concentration) following the aerobic and anaerobic soil metabolism of [*S*-methyl-^{14}C]acephate (Tucker, 1972b).

Soil		Interval (days)	Soil			$^{14}CO_2$	Accountability
			Total ^{14}C in soil	Methanol extract			
				Acephate	Methamidophos		
Fresno loam	Aerobic	1	90	63	21	9	99
		2	74	43	23	20	94
		6	47	NA	NA	54	101
Mt Holly sandy clay loam	Aerobic	1	54	36	7	42	96
		2	33	18	3	57	90
		6	17	NA	NA	76	93
Norwalk silty clay loam	Aerobic	1	35	19	4	67	102
		2	22	5	1	81	103
		6	17	NA	NA	86	103
Ocoee loamy sand	Aerobic	3	32	4	10	69	101
		6	23	NA	NA	79	102
	Anaerobic	3	71	14	24	11	82
		6	54	NA	NA	26	80

The only compounds detected in acidified methanol extracts of Ocoee loamy sand, treated at 1 mg/kg with [*S*-methyl-^{14}C]acephate under aerobic and anaerobic conditions, were acephate and methamidophos (Tucker, 1972c). To investigate the presence of metabolites of acephate not detected in studies utilising [*S*-methyl-^{14}C]acephate (that is: OMAPAA, being *O*-methyl-*N*-acetyl phosphoroamidate or RE 18420; and OMPT, being *O*-methyl-*N*-acetyl phosphoramidothioate or RE 17246), the aerobic and anaerobic soil metabolism of acephate on Fresno loam was studied with an initial concentration of acephate in the soil of 50 mg/kg. The soil in both aerobic and anaerobic experiments was extracted with acidified methanol, following 0, 1, 2, 3, 4, 7 and 11 days incubation. Characterization of the extracts was by TLC co-chromatography. The half-life for acephate degradation was estimated to be 4.5 and 6.5 days under aerobic and anaerobic conditions, respectively. After 7 days incubation under aerobic conditions, the concentrations of acephate and metabolites identified by TLC were 12 mg/kg, 5 mg/kg, 6 mg/kg, <LOD (<6 mg/kg) and <LOD (<4 mg/kg) for acephate, methamidophos, OMAPAA, OMPT and SMPT (*S*-methyl-*N*-acetyl phosphoramidothioate, RE17245), respectively. It is unlikely that RE17245 was present below the LOD, as it would have been detected in the metabolism studies utilising [*S*-methyl-^{14}C]acephate. Under anaerobic conditions, the corresponding concentrations were 26, 0.8, 10, < 6 and < 4 mg/kg for acephate, methamidophos, OMAPAA, OMPT and SMPT, respectively.

Lentz (1996) treated a silt loam (sand 34%, silt 59%, clay 7%, %OC 0.3, pH 6.7, CEC 4.5 meq/100 g, microbiological activity; fungi 3.4×10^4 cfu/g, bacteria 6.9×10^6 cfu/g) with [*S*-methyl-^{14}C]acephate to give a final concentration of *ca.* 8 mg/kg. The soil was maintained in the dark at 25°C

and the volatile compounds and CO_2 evolved were collected in methanol and NaOH traps. Soil samples were analyzed by combustion/LSC and were also extracted with acetonitrile/methanol/acetic acid (75:25:1) and the extracts analyzed by HPLC and ^{31}P NMR. Samples were also extracted with saturated aqueous EDTA solutions and analyzed by ^{31}P NMR.

Table 16. Distribution of ^{14}C as a percentage of the applied radioactivity (Lentz, 1996).

Interval (days)	Soil				Volatiles		Accountability
	Extracted			Unextracted (PES)	CO_2	other	
	Acephate	Methamidophos	Other				
0	93	2.2	3.8	0.1	NA	NA	99
0.5	87	4.9	7.6	0.3	0.5	0	100
1	86	4.4	6.8	0.6	1.2	0.6	100
2	75	7.7	6.8	1.8	3.8	0.6	96
3	64	9.3	7.0	2.1	7.9	4.5	95
5	27	12	4.9	11	27	8.7	90
7	7.0	3.4	3.9	23	44	3.2	84
14	ND	ND	ND	27	58	3.3	90

NA = not analyzed.
ND = not detected.
PES = post-extraction solids.

Anaerobic metabolism

Panthani (1989) treated a sandy loam (sand 56%, silt 32%, clay 12%, %OC 0.9, pH 7.5, CEC 8.1 meq/100 g, field capacity at 0.3 bar 10%, bulk density 1.4 g/cm^3) with [*S*-methyl-^{14}C]acephate, to give a final concentration of 4.3 mg/kg. After treatment the soil moisture content was approximately 75% of field capacity. The soil was maintained in the dark at 25°C under a CO_2-free oxygen atmosphere for 3 days, corresponding to the approximate aerobic half-life, after which the system was converted to an anaerobic one by flushing with nitrogen. Evolved CO_2 and other volatile compounds were collected in methanol and NaOH traps. Soil samples were analyzed at 0, 1, 3, 33 and 63 days by combustion/LSC and also with extracts analyzed by TLC and HPLC.

Based on TLC and HPLC analysis of the soil extracts, the parent compound was initially present at 91% of the applied radioactivity at 0 days and decreased to 47% after 3 days of aerobic incubation. Following anaerobic incubation for a further 60 days (total aerobic + anaerobic incubation = 63 days), acephate was <1% of the initial level. The major degradation product extracted from the soil was DMPT, which accounted for 3.4% of the applied radioactivity at 1 day. Volatile organic compounds accounted for a maximum of 3.7% of the applied radioactivity at 63 days, while evolved CO_2 accounted for 69% of the applied radioactivity. Unextracted [^{14}C] residues increased to a maximum of 17% of the applied radioactivity at 63 days. GC/FPD analysis detected a methyl mercaptan derivative in the volatile compounds (methanol) trap, together with small amounts of acephate and DMPT (Table 17).

Table 17. Characterization of ^{14}C in the soil (% applied radioactivity) (Panthani, 1989).

Incubation period (days)	Soil						Volatiles		Total
	Total ^{14}C	Extracted				Unextracted	CO_2	organics	
		Acephate	Methamidophos	DMPT	Others				
0	99	91	0.06	1.9	6.0	0.01	0	0	99
1	82	66	0.02	3.4	4.4	6.0	10	0.69	93
3	47	30	0	1.4	1.1	14	34	1.6	83
33	20	0.05	-	-	0.76	19	62	3.2	85
63	18	0.06	-	-	0.92	17	69	3.7	91

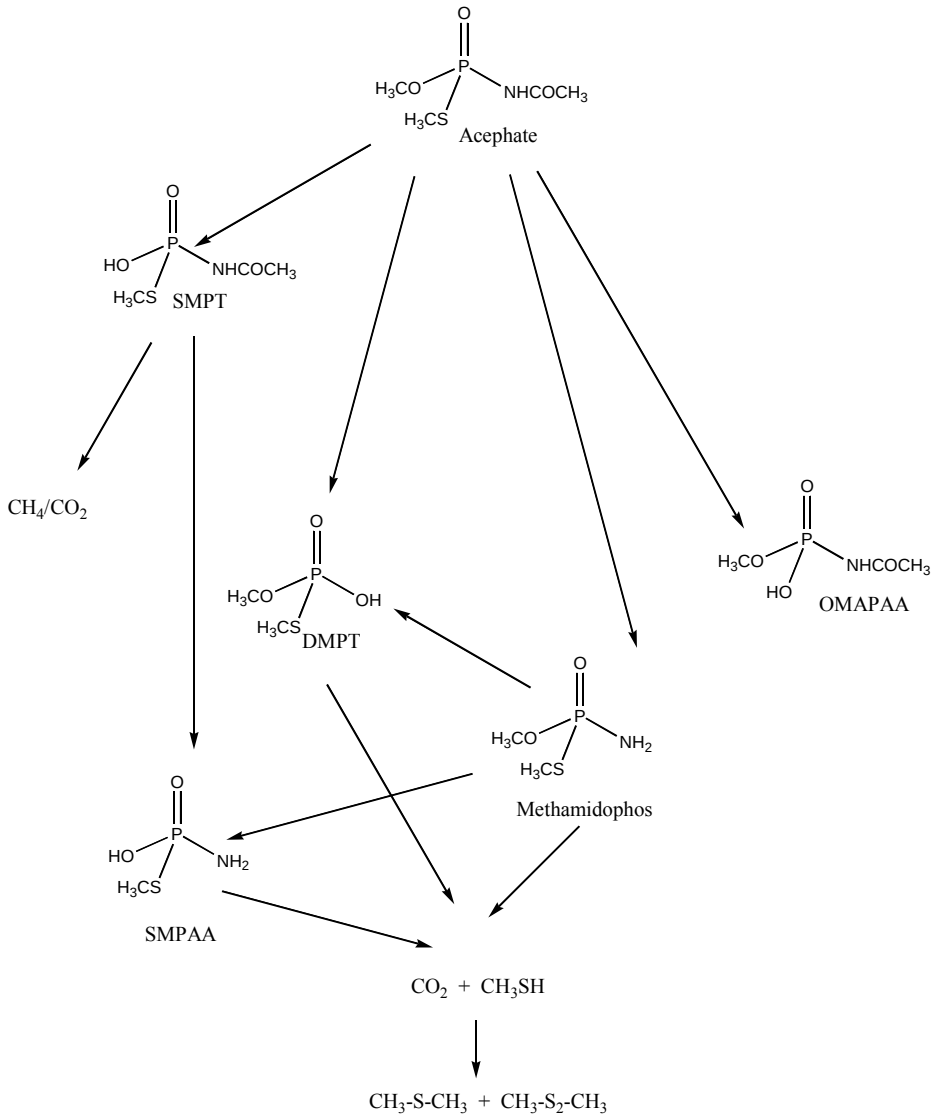


Figure 3. Proposed pathways of acephate metabolism in soil.

Mobility

Acephate and its metabolites, methamidophos and DMPT, can be classified as very mobile in soils. Pack and Verrips (1988) conducted batch equilibrium studies using [*S*-methyl-^{14}C]acephate, [*O*-methyl-^{14}C]methamidophos and [*S*-methyl-^{14}C]*O,S*-dimethyl phosphorothioate (DMPT) on five soils that ranged in texture from sand to clay loam. In four of the soils, acephate, methamidophos, and DMPT were not adsorbed in sufficient quantities to permit the calculation of Freundlich adsorption coefficients (Freundlich K_{ads}). For the clay loam soil (sand 38%, silt 30%, clay 32%, %OM 3.3, CEC 20 meq/100g, pH 5.8 density 1.3g/cm^3), the reported adsorption values for parent acephate and its degradation products are listed in the following table:

Acephate			Methamidophos			DMPT		
K_{ads}	1/n	r^2	K_{ads}	1/n	r^2	K_{ads}	1/n	r^2
0.090	1.06	0.96	0.029	0.64	0.93	0.030	0.69	0.92

Calculated K_{oc}s for acephate, methamidophos and DMPT in this clay loam soil were 4.7, 1.5, and 1.6 ml/g, respectively. The minimal adsorption of the acephate, methamidophos and DMPT precluded the determination of desorption values.

In a study of the mobility of ^{14}C-acephate and ^{14}C-methamidophos on TLC plates prepared with seven soils ranging from loamy sand to a clay, there was little adsorption of acephate or methamidophos, as demonstrated by the Rf values of 0.53-1.0 for acephate and 0.56-1.0 for

methamidophos (Tucker, 1971). In a column leaching experiment (Tucker, 1971), 15 cm columns of Ocoee loamy sand and Fresno loam were loaded with acephate on the top and leached with 10-25 cm of water. In the case of Ocoee loamy sand, all the ^{14}C was located in the leachate while for the Fresno loam after 10 cm of water, 13% was located in the leachate and 53% in the bottom 5 cm of the column and after 25 cm of water no ^{14}C was detected on the soil column while 86% of the applied ^{14}C was recovered in the leachate.

Warnock (1972) applied [*S*-methyl ^{14}C]acephate to Oakley sandy loam and aged the soil for 20 days at 20°C before applying the "aged" soil to the top of a 30 cm column of untreated soil as a 3 cm band. The soil column, wetted prior to addition of the aged soil, was leached with 1.27 cm of water daily for 42 days. The aged soil contained 14-18% of the ^{14}C initially added after 20 days, consistent with previous studies that showed significant microbial metabolism. After leaching for 46 days the soil contained 11-13% of the applied ^{14}C, while 0.25-0.28% was recovered in the leachate. Of the ^{14}C retained in the soil the majority was associated with the top ¼ of the column and ≤1.1% was able to be Soxhlet extracted using acetone, a treatment known to extract acephate and methamidophos residues.

When a sandy loam was treated with acephate at 9 mg/kg and left in a glasshouse for 21 weeks, with the addition of 1.27 cm water every two weeks to moisten the soil, the levels of acephate remaining in the soil were ≤0.05 mg/kg and no methamidophos was detected (Tucker 1972d). The acephate residues could be totally leached from the soil with 25 cm of simulated rain.

The results of field degradation studies confirm the results of the laboratory studies on the aerobic metabolism, where the degradation half-lives were generally < 3 days. Lai (1987a, 1987b, 1987c, 1987d) studied the field dissipation of acephate and methamidophos in plots of cauliflower (6 × 1.1 kg ai/ha), bell pepper (8 × 1.1 kg ai/ha, Fresno, CA), tobacco (6 × 0.84 kg ai/ha, Greenville, Mississippi) and soybean (6 × 1.1 kg ai/ha, Dallas, Iowa). The majority of the residue was confined to the top 15 cm of soil cores with little or no leaching to greater depths. Residues declined rapidly with degradation half-lives less than 3 days. Similar results were found following application to bare ground (Lai 1990). Acephate and methamidophos were not detected in soil cores below 15 cm. The half-life for degradation was also less than 3 days for both compounds. Acephate and methamidophos are not expected to persist in the field.

Environmental fate in water-sediment systems

The Meeting received information on the behaviour of acephate and acephate during sterile aqueous hydrolysis and on the fate of acephate in water-sediment systems.

Aqueous hydrolysis

In aqueous solution, acephate is stable against hydrolysis, except at high pH. Gaddamidi and Verrips (1988) tested the hydrolytic stability of [*S*-methyl-^{14}C]acephate in aqueous buffers solutions at 25°C at pH 5, 7 and 9 and [*O*-methyl-^{14}C]acephate at pH 9. Acephate was hydrolytically stable in pH 5 and 7 aqueous buffer solutions, with 93% and 88% of the applied radioactivity present as parent compound after 31 days. Minor degradation products in the pH 5 and 7 solutions were DMPT (maximum 4.4%) and SMPT (RE-17245, maximum 6.3%). In pH 9 aqueous buffer solution, 38 and 41% of the applied ^{14}C was present as acephate after 23 days in the [*S*-methyl-^{14}C]acephate and [*O*-methyl-^{14}C]acephate solutions, respectively. At pH 9, the major degradation product (formed at > 30% of the applied) was DMPT. Additional degradation products detected, depending on which methyl group was radiolabelled, were OMAPAA (RE-18420) and dimethyl disulfide, apparently formed from the dimerization of methyl mercaptan produced by hydrolysis at the P-S bond. Small amounts of methamidophos (<2.5%) were detected at pH 7 and 9. The material balances for the experiments were 97, 90 and 65% for [S-methyl-^{14}C]acephate at pH 5, 7 and 9, respectively, and 101% for [*O*-methyl-^{14}C]acephate at pH 9.

Aerobic sediment/water

Acephate is not persistent on incubation in aerobic sediment/water systems, having a half-life of < 4 weeks. The major degradation products under anaerobic conditions are methamidophos, DMPT,

carbon dioxide and methane.

The aerobic degradation and metabolism of acephate was studied in two water/sediment systems (McMillan-Staff and Knight, 2001). The sediments were classified as a loam (Adams Far, Manningtree, Essex: sand 40%, silt 47%, clay 13%, %OC 9.8, CEC 20 meq/100 g, pH_{CaCl2} 6.2, microbial biomass 171 µC/g soil) and a clay loam (Boarded Barns Farm, Ongar, Essex: sand 39%, silt 28%, clay 33%, %OC 6.7%, CEC 67 meq/100 g, pH_{CaCl2} 7.6, microbial biomass 242 µC/g soil). Test vessels, with sediment and water present in a ratio of 1:4-4.5 w/w, were acclimatised for 6 weeks at 20°C in the dark prior to introduction of the test compound. [*S*-methyl-^{14}C]acephate and [*O*-methyl-^{14}C]acephate were applied at 0.91 mg/flask (6 cm ID), estimated to be equivalent to application at 3.2 kg ai/ha. The oxygen content of the water was maintained at greater than 30% of the saturation value throughout the course of the experiment, including during the acclimatisation period. At intervals, water and sediment solvent extracts were analyzed by HPLC and/or TLC to determine the levels of acephate and metabolites (Tables 18-21).

Table 18. Mean distribution of the applied ^{14}C in the Manningtree aerobic aquatic test system (as % of the applied [*O*-methyl-^{14}C]acephate (McMillan-Staff and Knight, 2001).

Day	Water				Sediment					Volatiles traps		Total
	Aceph	Meth	DMPT	Other	Aceph	Meth	DMPT	Other	Un-extracted	CO_2	CH_4	
0	100	2.0	-	-								102
1	89	-	2.5	0.85					0.0	0.06		99
3	83	0.33	4.1	2.9					0.65	0.18		98
7	70	1.7	8.1	5.2	7.2	0.49	1.3	1.9	1.22	0.69		98
10	68	2.0	14	-	7.4	0.49	0.85	1.7	0.71	0.58	0.02	97
14	53	2.4	15	8.6	8.9	1.5	0.73	1.3	1.7	2.8	0.01	97
28	45	2.6	23	-	8.3	1.2	0.84	3.7	2.7	4.6	0.02	93
54	35	3.7	20	-	7.3	1.7	0.90	3.2	5.0	15	0.03	91
122	0	5.8	17	-	1.0	0.2	0.22	3.1	9.8	29	1.2	72

Aceph = acephate.
Meth = methamidophos.

Table 19. Mean distribution of the applied ^{14}C in the Manningtree aerobic aquatic test system (as % of the applied [*S*-methyl-^{14}C]acephate (McMillan-Staff and Knight, 2001).

Day	Water				Sediment					Volatiles traps		Total
	Aceph	Meth	DMPT	Other	Aceph	Meth	DMPT	Other	Unextracted	CO_2	CH_4	
0	97		2.4									99
1	87	0.29	4.4						0.95	0.45	0.11	99
3	79	1.3	3.4	1.3					1.7	1.4	0.21	97
7	65	2.3	6.7	2.7 [1/]	8.3	0.56	0.92	0.85 [2/]	2.4	2.4	1.1	95
10	65	2.5	8.7		8.8	0.66	0.98	0.65 [3/]	2.9	3.3	0.56	96
14	57	2.6	7.6	1.2 [4/]	10	0.96	1.2	0.97 [5/]	5.1	4.2	1.3	93
28	46	3.5	1.9	4.8 [6/]	11	1.6	0.89	1.4 [7/]	6.4	8.2	3.8	90
54	26	1.2	3.0	3.0 [6/]					11	19	3.7	78
122	0	4.9	2.4	1.3 [6/]					14	29	7.7	64

Aceph = acephate.
Meth = methamidophos.
[1/] 0.41% probably OMAPAA, 0.43% dimethyl sulfide, 1.9% unknowns.
[2/] 0.5% SMPT, 0.35% unknowns.
[3/] 0.5% SMPT 0.15%, unknowns.
[4/] 0.81% SMPT, 0.43%, unknowns.
[5/] 0.72% SMPT, 0.25% unknowns.
[6/] SMPT.
[7/] 0.88% SMPT, 0.54% unknowns.

Table 20. Mean distribution of the applied ^{14}C in the Ongar aerobic aquatic test system (as % of the applied [*O*-methyl-^{14}C]acephate (McMillan-Staff and Knight, 2001).

Day	Water				Sediment					Volatiles traps		
	Aceph	Meth	DMPT	Other	Aceph	Meth	DMPT	Other	Unextracted	CO_2	CH_4	Total
0	101			1.7								103
1	89		2.0	2.0 [1/]					0.37	0.06		98
3	90		5.2						0.75	0.49		102
7	67	2.0	6.9	0.48	7.2	1.1	0.75	1.0	1.7	5.0		94
10	66	1.2	4.2	1.3	4.9	0.77	0.58	0.83	1.3	7.0		85
14	54	1.8	4.2	3.9	5.9	0.85	0.33	0.78	2.1	14		88
28	33	3.2	13		4.3	0.98	0.61	2.4	4.0	28		90
54	19	2.7	15		5.2	0.74	0.15		6.3	38	0.05	87
122		1.5	11		1.0	0.23	0.16	5.5	11	50	0.2	79

Aceph = acephate.
Meth = methamidophos.
[1/] 1.8% possible OMAPAA, 0.19% unknowns (<5%).

Table 21. Mean distribution of the applied ^{14}C in the Ongar aerobic aquatic test system (as % of the applied [*S*-methyl-^{14}C]acephate (McMillan-Staff and Knight, 2001).

Day	Water				Sediment					Volatiles traps		
	Aceph	Meth	DMPT	Other	Aceph	Meth	DMPT	Other	Unextracted	CO_2	CH_4	Total
0	101		2.5									104
1	92		2.6	0.49 [1/]					0.67	0.24	0.09	99
3	89								2.3	1.5	0.22	101
7	70	1.1		0.69	5.3	0.74	0.39	1.5 [2/]	4.6	4.2		89
10	61	2.7	2.7		4.8	0.83	0.68	2.0 [3/]	2.8	6.3	0.89	86
14	58	3.0	0.22	1.2 [4/]	6.8	1.2	0.49	1.4 [5/]	7.7	9.4	0.85	91
28	33	2.6		2.9 [3/]	5.1	1.3	0.71	1.1 [6/]	12	23	1.8	83
54	12	1.3		2.6 [3/]	2.0	0.38	0.15	1.3	13	42	3.5	78
122									17	46	3.0	71

Aceph = acephate.
Meth = methamidophos.
[1/] 0.19% possible OMAPAA, 0.30% unknowns.
[2/] 1.4% SMPT, 0.11% unknown.
[3/] SMPT.
[4/] 0.47% SMPT, 0.59% possible OMAPAA, 0.12% unknown.
[5/] 1.3% SMPT, 0.11% other.
[6/] 0.79% SMPT, 0.28% other.

Anaerobic degradation and metabolism

Esser (1996) tested the anaerobic degradation and metabolism of acephate in a water/sediment system. The sediment was classified as a clay (Deer Creek, Greenville, MS: sand 22%, silt 28%, clay 50%, %OC 4.1, CEC 34 meq/100 g, pH 6.7). The test system with sediment and water was maintained under anaerobic conditions for *ca.* 2 months at 25°C in the dark, prior to introduction of [*S*-methyl-^{14}C]acephate to the water at 2 mg/l. At intervals, the water and acidified acetonitrile extracts of the sediment were analyzed by HPLC and/or TLC for acephate and metabolites (Table 22). [*S*-methyl-^{14}C]acephate degraded with a first-order half-life of 6.6 days in the anaerobic water/sediment system. The initial pH of the system was 7.0, increasing to pH 7.9 at the conclusion of the experiment. The major degradation products were ^{14}C-containing volatile compounds, which accounted for 65% of the applied ^{14}C at 20 days incubation, with $^{14}CO_2$ accounting for 18% and $^{14}CH_4$ accounting for 47% of the applied ^{14}C at 20 days incubation. In the water phase, the parent compound accounted for 85% of the applied radioactivity at 0 days, decreasing to 39% by 7 days incubation and 10% at 20 days incubation. A minor degradation product, methamidophos was present in the water phase at 0.5% of the applied radioactivity at 0 days, increasing to a maximum of 5.0% by 7 days incubation and was 1.8% at 20 days incubation. Other minor degradation products, DMPT and SMPT, were present in the water at a combined maximum of 2.9% of the applied ^{14}C at 7 days incubation. In extracts of the sediment, parent compound was initially present at 8.4% of the applied radioactivity; it increased to a maximum of 9.6% at 3 days incubation and then decreased to 1.8% at

20 days incubation. The individual degradation products, methamidophos, DMPT, and SMPT, never exceeded 10% of the applied ^{14}C in the sediment. Unextracted ^{14}C accounted for a maximum of 16% of the applied radioactivity at 10 days incubation. Further characterization of the unextracted radioactivity in the sediment was conducted following 10 days incubation. Based on the solubility of the radioactivity following extraction with 0.1 M NaOH, the solubilized solids isolated by centrifugation were attributed to the humic acid fraction (1.2%) and the remaining soluble ^{14}C to the fulvic acid fraction (0.7%).

Table 22. Mean distribution of the applied ^{14}C in the anaerobic aquatic test system (as % of the applied [*S*-methyl-^{14}C]acephate (Esser, 1996).

Day	Water				Sediment					Volatile Traps		Total
	Aceph	Meth	SMPT/ DMPT	Other	Aceph	Meth	SMPT/ DMPT	Other	Unextracted	CO_2	CH_4	
0	85	0.5	0.1	0.5	8.4	0.3	0.1	0.5	2.5	NA	NA	97
1	77	2.2	1.1	0.5	8.7	0.3	0.3	0.5	4.3	0.1	NA	97
3	59	4.8	2.5	3.0	9.6	0.9	0.6	0.7	8.8	3.7	1.1	95
7	39	5.0	2.9	0.3	6.5	0.8	0.5	0.1	9.4	9.9	19	92
10	28	3.5	2.4	0.1	3.4	0.4	0.4	0.0	16	33	13	100
20	10	1.8	1.4	1.1	1.8	0.3	0.2	0.1	6.7	18	47	88

Aceph = acephate.
Meth = methamidophos.

METHODS OF RESIDUE ANALYSIS

Analytical methods

Several different analytical methods have been reported for the analysis of acephate and its metabolite methamidophos in plant materials, animal tissues, milk, eggs, soils and water (TMN-0239, TMN-0497, TMN-0502, TMN-0502A, TMN-0502B, TMN-0504B, TMN-0505, TMN-0508, TMN-0509, TMN-510, TMN-0512B, TMN-0515A, TMN-0515B). All are based upon similar principles, with variations derived from the introduction of minor refinements, improved techniques and technologies over the years; for example, clean-up using silica gel column versus gel permeation chromatography.

In a typical method, the sample is macerated and the residue extracted with ethyl acetate (crops, eggs, tissues, water, milk) or acetonitrile:hexane (oily crops). The extract is dried over anhydrous sodium sulfate and the residue solvent mixture evaporated to dryness using a vacuum rotary evaporator. If an oily residue is obtained, the sample should be cleaned up using an acetonitrile:hexane partition. The main clean-up is by silica gel column chromatography: the residue is eluted with 10% methanol in ether, the eluate evaporated to dryness and redissolved in acetone or methyl isobutyl ketone for GC-FPD (phosphorus mode) analysis. An alternative to clean-up by silica gel chromatography is gel permeation chromatography. Alternative detection modes for gas chromatography include NPD in nitrogen mode and ion selective MS. The limit of quantification was reported to be 0.01-0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos.

In several studies of the metabolism of acephate, the results obtained using radiometric methods (TLC and HPLC) were compared with those obtained with analytical method RM-12A-9 (TMN-0497). Although the analyses using method RM-12-9A were conducted after an additional period of frozen storage, there was general agreement between the two sets of results, confirming the utility of the method for determining residues of acephate and its metabolite methamidophos (Table 23).

Table 23. Comparison of residues in animal tissues, milk and crops dosed/or treated with [*S*-methyl-^{14}C]acephate and determined by method RM-12A-9 and TLC radiometry.

Tissue	Analyte	Residue (mg/kg)		Reference
		GC (RM-12A-9)	Radiometric results	
Egg white	Acephate	0.12	0.14	Lai, 1996a
	Methamidophos	0.009	0.025	
Chicken muscle	Acephate	0.010, 0.015 [1/]	0.010	Lai, 1996a
	Methamidophos	0.002, 0.003 [1/]	0.010	

Tissue	Analyte	Residue (mg/kg)		Reference
		GC (RM-12A-9)	Radiometric results	
Goats milk	Acephate	0.068	0.076	Lai, 1996b
	Methamidophos	0.002	0.004	
Goats liver	Acephate	0.042	0.046	Lai, 1996b
	Methamidophos	0.003	<0.01	
Lettuce	Acephate	0.95	1.2	Lai, 1996c
	Methamidophos	0.17	0.27	
Cottonseed	Acephate	0.013	0.025	Lai, 1996d
	Methamidophos	<0.005	0.000	

[1/] Note results were below the LOQ of 0.02 mg/kg.

The analytical methods utilized in the residue trials were suitably validated. From cattle muscle, kidney, milk and hens eggs, fortified with acephate at 0.1-0.4 mg/kg and methamidophos at 0.01-0.1 mg/kg, recoveries were 78-106% for acephate and 65-105% for methamidophos, using analytical Method RM-12A. Recoveries reported in residue trials, from crop samples fortified at 0.025-0.4 mg/kg acephate and 0.01-0.1 mg/kg methamidophos, were 64-123% and 62-118% respectively for acephate and methamidophos.

Stability of residues in stored analytical samples

The Meeting received information on the stability of acephate residues during storage of analytical samples at freezer temperatures. Test data were provided on the following substrates: apples (fruit, sauce, juice and wet pomace), beans (snap), beans (pinto), Brussels sprouts, celery, cottonseed, grass, grass (fresh), grass (hay), lettuce, mint hay and mint spent hay, peas (pigeon), peppers (bell), rice grain and rice straw, as well as cattle milk, kidney and muscle.

Lai (1995b) reported the freezer storage stability of field-incurred acephate residues in apples and apple processed products (sauce, wet pomace and juice) fortified with acephate and methamidophos, as part of a study on the fate of residues during processing (Table 24). Macerated apple samples with field-incurred residues were stored in polyethylene bags at approximately -20°C for intervals up to 14 months. Fortified samples of sauce and juice were stored in plastic containers, wet pomace in plastic bags and the samples stored for intervals of up to 55 days. At each analysis interval, residues of acephate and methamidophos were measured in stored samples, in parallel with determination of procedural recovery.

Table 24. Freezer storage data for fortified samples of apple sauce, juice and wet pomace and macerated samples of apples with field incurred residues (Lai, 1995b).

Matrix	Storage interval (day	Analyte	Residue (mg/kg)	Procedural recovery (%)
Sauce	0	Acephate	0.24, 0.26	106, 96
		Methamidophos	0.068, 0.090	90, 68
	55	Acephate	0.33, 0.30	120
		Methamidophos	0.10, 0.089	90
Wet pomace	0	Acephate	0.33, 0.32	126, 133
		Methamidophos	0.12, 0.12	119, 117
	57	Acephate	0.22, 0.18	83
		Methamidophos	0.074, 0.064	67
Juice	0	Acephate	0.31, 0.33	132, 123
		Methamidophos	0.11, 0.12	116, 112
	55	Acephate	0.33, 0.35	135
		Methamidophos	0.088, 0.10	98

Matrix	Storage interval (day	Analyte	Residue (mg/kg)	Procedural recovery (%)
Apple (macerate, field incurred residue)	0	Acephate	0.75, 1.32	96
		Methamidophos	0.02, 0.04	94
	32	Acephate	0.70, 1.2	107
		Methamidophos	0.02, 0.04	97
	95	Acephate	0.68, 1.2	95
		Methamidophos	0.01, 0.03	94
	251	Acephate	0.45, 1.0	81
		Methamidophos	<0.01, 0.02	72
	328	Acephate	0.69, 1.2	94
		Methamidophos	0.02, 0.04	91
	474	Acephate	0.74, 1.4	102
		Methamidophos	0.02, 0.04	97

Lai (1987e) tested the freezer storage stability of field-incurred acephate residues in beans (snap), Brussels sprouts, celery, corn (grain, silage, meal, germ, flour and press cake), cottonseed, grass, grass (fresh), grass (hay), lettuce, mint hay and mint spent hay, peas (pigeon), peppers (bell), rice grain and rice straw (Table 26), as well as cattle milk, kidney and muscle (Table 25). Samples of eggs fortified with acephate were also studied (Table 25). The crop and cattle tissue samples were macerated and stored in polyethylene bags at approximately -20°C for intervals of up to 119 days. Milk samples were stored in glass jars. At each analysis interval, residues of acephate and methamidophos were measured in stored samples, in parallel with determination of procedural recovery, using analytical method RM-12A-6. Due to interferences in the analysis of the cottonseed samples, the freezer storage was not continued past 48 days, the last interval for which samples were analyzed. The acephate residue remaining after 48 days frozen storage was ca. 80% of the initial level.

Lai reported results for frozen storage of celery samples (Lai, 1988b) and for snap beans, as well as additional results for spiked pinto bean samples (Lai, 1989) (Table 26).

Table 25. Freezer storage stability data for incurred acephate residues in macerated cattle tissues and milk, and for spiked egg samples, stored at approximately -20°C for intervals of up to 202 days (Lai, 1987e).

Storage interval (days)	Acephate	Proc rec (%)	Methamido-phos	Proc rec (%)	Storage interval (days)	Acephate	Proc rec (%)	Methamido-phos	Proc rec (%)
Eggs					Cattle milk				
0	0.15, 0.15	80	0.07, 0.08	75	0	0.04, 0.14, 0.27, 0.79	95	0.0, 0.0, 0.02, 0.12	86
22	0.18, 0.16	95	0.08, 0.08	68	36	0.05, 0.20, 0.29, 0.82	103	0.0, 0.01, 0.02, 0.07	89
175	0.16, 0.15	84	0.07, 0.07	78	103	0.01, 0.15, 0.25, 0.66	90	0.0, 0.02, 0.02, 0.07	86
					202	0.06, 0.19, 0.27, 0.78	104	0.0, 0.02, 0.02, 0.07	88
Cattle kidney					Cattle muscle (pectoral)				
0	0.26, 0.73, 0.63	91	0.02, 0.05, 0.07	65	0	0.11, 0.21, 0.37, 0.40	96	0.0, 0.01, 0.02, 0.03	81
32	0.22, 0.48, 0.60	85	0.01, 0.04, 0.05	84	34	0.12, 0.18, 0.33, 0.41	90	0.01, 0.01, 0.02 0.03	91
131	0.21, 0.48, 0.57	106	0.01, 0.03, 0.05	100	71	0.10, 0.17, 0.33, 0.43	91	0.01, 0.01, 0.02, 0.03	96
172	0.19, 0.46, 0.52	102	0.01, 0.03, 0.04	90	193	0.12, 0.19, 0.33, 0.45	97	0.01, 0.01, 0.02, 0.03	92

Proc rec = procedural recovery.

Table 26. Freezer storage stability data for field-incurred acephate residues in macerated crop samples stored at approximately -20°C for intervals of up to 548 days (Lai, 1987e, 1988b, 1989).

Storage interval (days)	Acephate	Proc rec (%)	Methamido-phos	Proc rec (%)	Storage interval (days)	Acephate	Proc rec (%)	Methamido-phos	Proc rec (%)
Beans (snap)					Beans (pinto) spiked				
0	0.30, 0.39	97	0.12, 0.15	92	0	0.24, 0.23	106	0.10, 0.09	90
69	0.22, 0.33	97	0.09, 0.13	82	65	0.19, 0.19	94	0.08, 0.08	77
175	0.28, 0.40	104	0.12, 0.17	102	107	0.22, 0.23	102	0.08, 0.09	92
217	0.20, 0.34	89	0.08, 0.13	83	166	0.22, 0.21	98	0.05, 0.04	90
394	0.28, 0.40	120	0.11, 0.15	119	380	0.19, 0.22	90	0.08, 0.05	77
548	0.24, 0.37	105	0.09, 0.14	100	461	0.19, 0.19	94	0.08, 0.09	89
Peppers (bell)					Brussels sprouts				
0	3.8, 3.7	109	0.51, 0.53	70	0	2.1, 1.6	98	0.03, 0.03	92
239	3.3, 3.6	93	0.55, 0.63	88	117	1.7, 1.8	88	0.03, 0.03	89
288	3.8, 3.5	93	0.63, 0.60	91	182	2.1, 1.6	88	0.03, 0.03	84
386	3.9, 4.1	105	0.67, 0.72	101	272	1.7, 1.4	110	0.03, 0.03	101
Celery					Pigeon peas				
0	4.2, 4.4, 0.26	96	0.23, 0.29, 0.02	87	0	9.7, 8.1	102	1.1, 0.94	92
14	4.4, 4.0, 0.24	65	0.25, 0.33, 0.01	86	9	8.5, 8.8	94	0.79, 0.89	87
94	4.4, 5.1, 0.31	72	0.36, 0.27, 0.03	85	102	9.6, 9.3	82	1.1, 1.0	71
167	3.6, 4.9, 0.25	88	0.32, 0.47, 0.03	81	195	9.6, 8.9	83	0.88, 0.88	62
273	4.4, 4.6, 0.28	101	0.43, 0.52, 0.03	95	280	10, 9.0	94	1.2, 1.1	91
364	3.6, 4.3, 0.23	104	0.56, 0.66, 0.06	70	418	10, 8.9	108	1.2, 1.0	91
Lettuce					Pasture grass				
0	0.29, 0.31	80	0.02, 0.02	77	0	0.52, 0.70	78	0.10, 0.14	77
95	0.22, 0.25	90	0.01, 0.0	63	25	0.60, 0.66	107	0.11, 0.13	99
270	0.19, 0.21	80	0.0, 0.01	77	110	0.55, 0.56	113	0.10, 0.12	106
341	0.19, 0.25	98	0.01, 0.01	96	175	0.65, 0.85	88	0.11, 0.14	79
504	0.27, 0.26	102	0.01, 0.02	105	269	0.52, 0.55	78	0.09, 0.11	68
Bermuda grass (fresh)					Bermuda grass (hay)				
0	0.62, 0.72	85	0.11, 0.12	77	0	2.9, 1.9	108	0.44, 0.31	99
33	0.53, 0.64	94	0.09, 0.10	90	32	2.2, 1.8	94	0.41, 0.33	90
61	0.67,0.88	107	0.12, 0.14	101	60	2.8, 1.9	101	0.45, 0.33	93
Spearmint (fresh hay)					Spearmint (spent hay)				
0	7.4, 6.9	112	0.49, 0.54	109	0	2.9, 2.8	108	0.33, 0.36	109
28	6.5, 6.6	101	0.43, 0.52	96	28	2.3, 2.1	102	0.29, 0.30	96
58	5.3, 5.8	96	0.37, 0.45	94	58	2.8, 2.7	107	0.30, 0.33	85
Rice grain					Rice straw				
0	1.2, 1.1	85	0.23, 0.21	80	0	0.21, 0.17	93	0.06, 0.06	93
35	1.1, 1.2	99	0.20, 0.21	93	34	0.18, 0.18	95	0.06, 0.03	88
92	0.72, 0.95	88	0.14, 0.15	84	91	0.17, 0.14	107	0.05, 0.04	93
190	1.5, 1.2	98	0.26, 0.27	95	189	0.19, 0.15	97	0.05, 0.05	94
506	0.96, 1.4	97	0.22, 0.26	99	507	0.19, 0.16	101	0.05, 0.05	96

Proc rec = procedural recovery.

Lai (1988c) reported on the freezer storage stability of field-incurred acephate residues in corn grain, silage and processed products (germ, meal, flour and press-cake), as part of a study on the fate of residues on processing. Samples were stored in polyethylene bags at approximately -20°C for intervals of up to 220 days. At each analysis interval, residues of acephate and methamidophos were measured in stored samples, in parallel with determination of procedural recovery (Table 27).

Table 27. Freezer storage data for corn, silage and corn processed commodities with field-incurred residues (Lai, 1988c).

Matrix	Storage interval (day	Analyte	Residue (mg/kg)	Procedural recovery (%)
Grain	0	Acephate	0.10, 0.10	98
		Methamidophos	0.04, 0.04	89
	213	Acephate	0.10, 0.10	105
		Methamidophos	0.04, 0.05	111
Silage	0	Acephate	6.0, 3.8	106
		Methamidophos	0.91, 0.60	98
	220	Acephate	6.7, 4.2	100
		Methamidophos	0.81, 0.60	79
Germ	0	Acephate	0.07	112
		Methamidophos	0.04	93
	83	Acephate	0.04	87
		Methamidophos	0.03	73
Meal	0	Acephate	0.12	116
		Methamidophos	0.05	103
	78	Acephate	0.14	116
		Methamidophos	0.07	79
Flour	0	Acephate	0.11	102
		Methamidophos	0.05	88
	73	Acephate	0.11	98
		Methamidophos	0.05	93
Presscake	0	Acephate	0.03	97
		Methamidophos	0.04	91
	70	Acephate	0.04	79
		Methamidophos	0.04	133

The stability of residues in samples of goat milk and liver stored in a freezer was assessed as part of a metabolism study (Huhtanen and Turck 1996). Residues ^{14}C-acephate in liver were 0.044 and 0.055 mg/kg (duplicate analyses) after *ca.* 5 months frozen storage and 0.043, 0.050, 0.054 mg/kg (triplicate analyses) after 8 months frozen storage. In milk, residues of acephate and methamidophos were 0.074 and 0.005 mg/kg, respectively, after *ca.* 2 months storage and 0.077 and 0.005 mg/kg, respectively, after *ca.* 6 months.

Leary (1972b) tested the freezer storage stability of field-incurred acephate residues in processed Brussels sprouts (Table 28) and also the ambient temperature storage of tomato products (Table 29). Brussels sprouts were treated with 8 applications of acephate at 1.1 kg ai/ha and harvested 3 days after the last spray. Processing was by cooking for 5 minutes in a pressure cooker at 10 lb pressure. Freezer storage samples were transferred to plastic containers and stored in a freezer at –20°C. Tomatoes were treated with 8 applications of acephate at 1.1 kg ai/ha at weekly intervals. Harvest of the tomatoes was 3 days after the last spray and samples were processed to obtain canned tomatoes, tomato purée and tomato juice. Tomato product samples were stored in glass jars at ambient temperature. Additional samples of spiked canned tomatoes were prepared by fortifying commercially canned tomatoes with acephate/methamidophos, cooking the fortified samples in a pressure cooker for 8 minutes at 5 lbs pressure and storing the jars at ambient temperature. The analytical method used was RM-12A.

Table 28. Freezer storage data for processed Brussels sprouts with field-incurred residues (Leary, 1972b).

Storage interval (months)	Field trial 2275/10		Field trial 2275/11	
	Acephate	Methamidophos	Acephate	Methamidophos
0	0.83, 0.90	0.07, 0.08	1.0, 0.92	0.08, 0.08
1	0.84	0.07	1.4	0.08
3	1.3	0.09	1.2	0.08

Table 29. Ambient temperature storage data for processed tomato products with field-incurred residues and spiked residues (Leary, 1972b).

Storage interval, months	Canned		Purée		Juice		Canned spiked A[1]	Canned Spiked B[2]
	Acephate	Meth	Acephate	Meth	Acephate	Meth	Acephate	Meth
0	0.61, 0.50	0.28, 0.25	0.65, 0.55	0.25, 0.24	0.41, 0.38	0.22, 0.21	0.37, 0.32	0.21, 0.19
1	0.54, 0.49	0.25, 0.19	0.45, 0.52	0.18, 0.22	0.52, 0.42	0.24, 0.23	0.19, 0.21	0.14, 0.15
2							0.27, 0.13	0.14, 0.15
3	0.50, 0.51	0.25, 0.24	0.74, 0.78	0.27, 0.27	0.81, 0.57	0.28, 0.25	0.17, 0.19	
4								0.27, 0.24
6								
7							0.16, 0.10	

Meth = methamidophos.
[1] Canned tomatoes spiked with acephate at a nominal level of 0.5 mg/kg.
[2] Canned tomatoes spiked with methamidophos at a nominal level of 0.25 mg/kg.

The available storage stability data indicate that the combined residues of acephate and methamidophos are stable under frozen storage conditions (-20 °C) in/on the following commodities (storage interval in parentheses): eggs (6 months); cattle milk (7 months); cattle kidney (6 months); cattle meat (7 months); goat liver (3 months); apple (16 months); apple sauce and juice (55 days); beans, pinto (15 months); beans, snap (15 months); Brussels sprouts (9 months); celery (12 months); corn grain (7 months); corn silage (7 months); corn meal, flour and press cake (2 months); cottonseed (48 days); Bermuda grass, forage and hay (2 months); pasture grass and forage (9 months); lettuce (17 months); peas, pigeon (14 months); peppers, bell (13 months); rice grain and straw (17 months); spearmint, fresh and spent hay (2 months).

Field-incurred residues in were stable in tomato juice, purée and canned tomatoes when stored at ambient temperature (not specified) for up to 3 months.

USE PATTERN

Acephate has registrations in many countries as a broad-spectrum organophosphate insecticide on a range of crops. It has uses on fruit, vines, cotton, soya beans, potatoes, brassicas and other vegetables for control of a wide range of chewing and sucking insects.

Information on registered uses was made available to the Meeting and those uses of relevance to this evaluation, based on label information, are summarized in Table 30.

Table 30. Registered uses of acephate.

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Alfalfa	Argentina	750 gai/kg SP	foliar	0.30-1.1			15
Alfalfa	Cyprus	750 gai/kg SP	foliar	1.0	0.056-0.075		15
Apples	Chile	750 gai/kg SP	foliar		0.053-0.075		21
Apples	France	500 gai/kg SP	foliar		0.06		21
Apples	Greece	750 gai/kg SP	foliar		0.075		15
Apples	Italy	425 gai/kg SP	foliar		0.034-0.064		30
Apples	Korea	500 gai/kg WP	foliar		0.05-0.06		14
Apples	Lebanon	970 gai/kg WG	foliar		0.12-0.15		21
Apples	Mozambique	750 gai/kg SP	foliar		0.038	2	30
Apples	Portugal	750 gai/kg SP	foliar	1.13	0.075		21
Apples	South Africa	750 gai/kg SP	foliar		0.038	2	30
Apples	Spain	750 gai/kg SP	foliar	1.130	0.075		14
Apricots	Italy	422 gai/kg SP	foliar		0.034-0.05	pre-flower	60
Apricots	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Artichokes	France	500 gai/kg SP	foliar		0.075		14
Artichokes	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Artichokes	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Beans	Argentina	800 gai/kg SP	seed treatment	0.4-0.8 kg/100kg			
Beans	Brazil	750 gai/kg SP	foliar	0.15-0.38			14

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Beans	Brazil	750 gai/kg SP	foliar	0.38-0.75			14
Beans	Chile	750 gai/kg SP	foliar	0.53-0.75			21
Beans	Chile	800 gai/kg SP	seed treatment	0.6-0.8 kg/100kg			
Beans	Colombia	750 gai/kg SP	foliar	0.53-0.75			3
Beans	Cyprus	750 gai/kg SP	foliar		0.056-0.075		15
Beans	Greece	750 gai/kg SP	foliar		0.075		15
Beans	Guatemala	750 gai/kg SP	foliar	0.54 - 0.8	0.05-0.15		14
Beans	Jordan	750 gai/kg SP	foliar		0.056-0.11		14
Beans	Jordan	750 gai/kg SP	foliar		0.028-0.056		7
Beans	Lebanon	970 gai/kg WG	foliar		0.12-0.15		14
Beans	Mexico	500 gai/kg SP	foliar	0.5			14
Beans	Mexico	800 gai/kg SP	seed treatment	0.48-0.8 kgai/100kg			
Beans	Paraguay	800 gai/kg SP	seed treatment	0.6 kgai/100kg			
Beans	Spain	750 gai/kg SP	foliar	1.130	0.11	2	14
Beans	Uruguay	750 gai/kg SP	foliar	0.68-0.98			20
Beans	USA	750 gai/kg SP	foliar	0.28-1.3		(2.24 total)	14
Beans (broad)	Uruguay	750 gai/kg SP	foliar	0.68-0.98			20
Beans (dry, fava)	Poland	750 gai/kg SP	foliar	0.75			14
Beans (fine)	Spain	750 gai/kg SP	foliar		0.038-0.11		14
Beans (green)	Benin	750 gai/kg SP	foliar	0.19-0.75			
Beans (green)	Ghana	750 gai/Kg SP	foliar	0.38-0.75			7
Beans (green)	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Beans (green)	Ivory Coast	750 gai/kg SP	foliar	0.38-0.75			
Beans (string)	Philippines	750 gai/kg SP	foliar		0.09-0.14		14
Beans (vulgaris)	Panama	750 gai/kg SP	foliar		0.05-0.10		10
Beet	Chile	750 gai/kg SP	foliar	0.53-0.75			14
Beet	Lebanon	970 gai/kg WG	foliar		0.12-0.15		30
Beet	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Brassicas	Guatemala	750 gai/kg SP	foliar		0.06-0.15		14-21
Brassicas	Lebanon	970 gai/kg WG	foliar		0.12-0.15		14
Brassicas	Mozambique	750 gai/kg SP	foliar	0.26-0.38			3
Brassicas	South Africa	750 gai/kg SP	foliar	0.23-0.38			3
Broccoli	Australia	750 gai/kg SP	foliar	0.75-0.98	0.075-0.098		14
Broccoli	Australia	970 gai/kg GR	foliar	0.78-0.98	0.078-0.097		14
Broccoli	Brazil	750 gai/kg SP	foliar		0.075		14
Broccoli	Costa Rica	750 gai/kg SP	foliar	0.38-1.13			15
Broccoli	Costa Rica	950 gai/kg SP	foliar	0.48-1.05			
Broccoli	Japan	50 gai/kg GR	soil, foliar	1.4 - 2.7	0.05-0.1 gai/plant		14
Broccoli	Japan	500 gai/kg WP	foliar	0.5	0.05		14
Broccoli	Spain	750 gai/kg SP	foliar	1.13	0.11	3	14
Brussels sprouts	Australia	750 gai/kg SP	foliar	0.75-0.98	0.075-0.098		3
Brussels sprouts	Australia	970 gai/kg GR	foliar	0.78-0.98	0.078-0.097		3
Brussels sprouts	Canada	750 gai/kg SP	foliar	0.56-0.83		4	28
Brussels sprouts	Chile	750 gai/kg SP	foliar	0.38-0.75			7
Brussels sprouts	Costa Rica	750 gai/kg SP	foliar	0.38-1.13			15
Brussels sprouts	Costa Rica	950 gai/kg SP	foliar	0.48-1.05			
Brussels sprouts	Mexico	500 gai/kg SP	foliar	0.5-0.75			7
Brussels sprouts	Mexico	750 gai/kg SP	foliar	0.75-1.13			7

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Brussels sprouts	Netherlands	750 gai/kg SP	foliar	0.75			14
Brussels sprouts	USA	750 gai/kg SP	foliar	0.56-1.3		(2.24 total)	14
Cabbages	Australia	750 gai/kg SP	foliar	0.75-0.98	0.075-0.098		3
Cabbages	Australia	970 gai/kg GR	foliar	0.78-0.98	0.078-0.097		3
Cabbages	Belgium	500 gai/kg SP	foliar		0.05		14
Cabbages	Benin	750 gai/kg SP	foliar	0.56-0.75			
Cabbages	Brazil	750 gai/kg SP	foliar		0.075		14
Cabbages	Brazil	970 gai/kg SP	foliar		0.073		14
Cabbages	Bulgaria	750 gai/kg SP	foliar	1.13			7
Cabbages	Canada	750 gai/kg SP	foliar	0.56-0.83		4	28
Cabbages	Chile	750 gai/kg SP	foliar	0.38-0.75			7
Cabbages	Colombia	750 gai/kg SP	foliar	0.38			3
Cabbages	Cyprus	750 gai/kg SP	foliar		0.056-0.075		15
Cabbages	France	500 gai/kg SP	foliar		0.075		7
Cabbages	Ghana	750 gai/kg SP	foliar	0.56-0.75			7
Cabbages	Greece	750 gai/kg SP	foliar	0.45	0.075		15
Cabbages	Hungary	750 gai/kg SP	foliar	0.98			30
Cabbages	Indonesia	750 gai/kg SP	foliar		0.038-0.075		
Cabbages	Israel	750 gai/kg SP	foliar	1.5			14
Cabbages	Italy	422 gai/kg SP	foliar	0.42-0.63			21
Cabbages	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Cabbages	Ivory Coast	750 gai/kg SP	foliar	0.56-0.75			7
Cabbages	Japan	50 gai/kg GR	soil, foliar	1.4 - 2.7	0.05-0.1 gai/plant	3	21
Cabbages	Japan	500 gai/kg WP	foliar	0.5-1.0	0.025 - 0.05	3	7
Cabbages	Jordan	750 gai/kg SP	foliar		0.056-0.11		14
Cabbages	Jordan	750 gai/kg SP	foliar		0.028-0.056		7
Cabbages	Netherlands	750 gai/kg SP	foliar	0.75			14
Cabbages	New Zealand	970 gai/kg WG	foliar	0.78-1.07	0.078		7
Cabbages	Panama	750 gai/kg SP	foliar		0.06-0.13		10
Cabbages	Peru	750 gai/kg SP	foliar	0.38-0.75			7
Cabbages	Poland	750 gai/kg SP	foliar	0.5630.75		2	14
Cabbages	Portugal	750 gai/kg SP	foliar		0.038		21
Cabbages	Romania	750 gai/kg SP	foliar		0.075		3
Cabbages	Spain	750 gai/kg SP	foliar	1.69	0.11	2	14
Cabbages	Uruguay	750 gai/kg SP	foliar	0.75-0.98			20
Cabbages, Chinese	Indonesia	750 gai/Kg SP	foliar		0.038-0.075		
Cabbages, Chinese	Japan	50 gai/kg GR	soil, foliar	1.4 - 2.7	0.05-0.1 gai/plant	3	21
Cabbages, Chinese	Japan	500 gai/kg WP	foliar	0.5-1.0	0.025 - 0.05	3	14
Cabbages, Chinese	Korea	500 gai/kg WP	foliar		0.05-0.06		14
Capsicums	Benin	750 gai/kg SP	foliar	0.56-0.75			
Cauliflower	Australia	750 gai/kg SP	foliar	0.75-0.98	0.075-0.098		3
Cauliflower	Australia	970 gai/kg GR	foliar	0.78-0.98	0.078-0.097		3
Cauliflower	Brazil	750 gai/kg SP	foliar		0.075		14
Cauliflower	Canada	750 gai/kg SP	foliar	0.56-0.83		4	28
Cauliflower	Chile	750 gai/kg SP	foliar	0.38-0.75			7
Cauliflower	Greece	750 gai/kg SP	foliar		0.075		15
Cauliflower	Italy	422 gai/kg SP	foliar	0.42-0.63			21
Cauliflower	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Cauliflower	Jordan	750 gai/kg SP	foliar		0.056-0.11		14
Cauliflower	Jordan	750 gai/kg SP	foliar		0.028-0.056		7
Cauliflower	Mexico	500 gai/kg SP	foliar	0.5-0.75			7
Cauliflower	Mexico	750 gai/kg SP	foliar	0.75-1.13			7
Cauliflower	Netherlands	750 gai/kg SP	foliar	0.75			14

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Cauliflower	New Zealand	970 gai/kg WG	foliar	0.78-1.07	0.078		7
Cauliflower	Portugal	750 gai/kg SP	foliar	0.5	0.038		21
Cauliflower	Uruguay	750 gai/kg SP	foliar	0.75-0.98			20
Cauliflower	USA	750 gai/kg SP	foliar	0.56-1.3			14
Cherries	Italy	422 gai/kg SP	foliar		0.034-0.05		60
Cherries	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Citrus	Benin	750 gai/kg SP	foliar	1.13-1.5			
Citrus	Brazil	970 gai/kg SP	foliar	6.2 gai/tree	0.039		21
Citrus	Chile	750 gai/kg SP	foliar		0.023-0.06		21
Citrus	Dominica	750 gai/kg SP	foliar	0.75-1.0			2
Citrus	Ghana	750 gai/kg SP	foliar	1.13-1.5			21
Citrus	Italy	422 gai/kg SP	foliar		0.034-0.063		21
Citrus	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Citrus	Ivory Coast	750 gai/kg SP	foliar	1.13-1.5			21
Citrus	Japan	500 gai/kg WP	foliar	0.5-1.0		3	30
Citrus	Malaysia	750 gai/kg SP	foliar		0.05-0.083		21
Citrus	New Zealand	970 gai/kg WG	foliar		0.078		14
Citrus	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Citrus	USA	750 gai/kg SP	foliar	0.56-0.84		non-bearing	1 year
Cotton	Argentina	800 gai/kg SP	seed treatment	0.4-0.56 kg/100kg			
Cotton	Australia	800 gai/kg SP	seed treatment	0.4 kgai/100kg			
Cotton	Brazil	750 gai/kg SP	foliar	0.75-1.13			14
Cotton	Brazil	750 gai/kg SP	foliar	0.38-0.56			14
Cotton	Brazil	750 gai/kg SP	foliar	0.30-0.38			14
Cotton	Brazil	750 gai/kg SP	seed treatment	0.75 kg/100kg			
Cotton	Colombia	750 gai/kg SP	foliar	0.5-1.0			3
Cotton	Colombia	750 gai/kg SP	Seed treatment	0.375 gai/100kg			
Cotton	Guatemala	750 gai/kg SP	foliar	0.25-1.0			10
Cotton	Israel	750 gai/kg SP	foliar	1.13-1.5			21
Cotton	Ivory Coast	750 gai/kg SP	foliar	0.38-0.75			
Cotton	Mexico	500 gai/kg SP	foliar	0.38-1.13			21
Cotton	Mexico	750 gai/kg SP	foliar	0.56-1.7			21
Cotton	Mexico	800 gai/kg SP	seed treatment	0.48-0.8 kgai/100kg			
Cotton	Pakistan	750 gai/kg SP	foliar	0.65-0.93			
Cotton	Paraguay	800 gai/kg SP	seed treatment	0.6 kgai/100kg			
Cotton	Peru	750 gai/kg SP	foliar	0.19-0.38	0.038-0.075		14
Cotton	Turkey	750 gai/kg SP	foliar	0.38-0.75			21
Cotton	USA	750 gai/kg SP	foliar	0.28-1.3		(6.7 total)	21
Cotton	USA	750 gai/kg SP	foliar	0.16-0.21		(6.7 total)	21
Cotton	USA	750 gai/kg SP	in furrow	0.56-1.3		band spray	21
Cotton	USA	750 gai/kg SP	in furrow	0.16-0.21		with seed	21
Cotton	USA	800 gai/kg ST	seed treatment	0.5 kgai/100kg			
Cotton	Argentina	750 gai/kg SP	foliar	0.27-0.45			15
Cucumbers	Ghana	750 gai/Kg SP	foliar	0.56-0.75			7
Cucumbers	Ivory Coast	750 gai/kg SP	foliar	0.56-0.75			7
Cucumbers	Japan	50 gai/kg GR	soil, side	1.4-2.7	0.05-0.1 gai/plant	3	1
Cucumbers	Lebanon	970 gai/kg WG	foliar		0.12-0.15		14
Cucumbers	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Cucumbers	Spain	750 gai/kg SP	foliar	1.69	0.11	2	21
Cucumbers	Uruguay	750 gai/kg SP	foliar	0.49-0.98			20
Cucumbers (glass)	Bulgaria	750 gai/kg SP	foliar		0.075		7
Cucumbers (glass)	Poland	750 gai/kg SP	foliar		0.075		14
Cucurbits	Guatemala	750 gai/kg SP	foliar	0.56-1.13			10
Cucurbits	Guatemala	750 gai/kg SP	foliar	0.54 - 1.13	0.13-0.25		15
Cucurbits	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Cucurbits	Panama	750 gai/kg SP	foliar	0.56-1.13			10
Egg plants	Benin	750 gai/kg SP	foliar	0.56-0.75			

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Egg plants	Cyprus	750 gai/kg SP	foliar		0.056-0.075		15
Egg plants	Ghana	750 gai/kg SP	foliar	0.56-0.75			7
Egg plants	Greece	750 gai/kg SP	foliar		0.075		15
Egg plants	Italy	422 gai/kg SP	foliar		0.034-0.063		21
Egg plants	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Egg plants	Ivory Coast	750 gai/kg SP	foliar	0.56-0.75			7
Egg plants	Japan	50 gai/kg GR	soil, side	1.4-2.7	0.05-0.1 gai/plant	3	1
Egg plants	Japan	500 gai/kg WP	foliar	0.5-1.0	0.025 - 0.05	3	7
Egg plants	Philippines	750 gai/kg SP	foliar	0.47-0.70	0.09-0.14		14
Egg plants	Spain	750 gai/kg SP	foliar		0.038-0.11	3	14
Egg plants	Uruguay	750 gai/kg SP	foliar	0.49-0.98			20
Egg plants (glass)	Poland	750 gai/kg SP	foliar		0.075		14
Hops	Belgium	500 gai/kg SP	foliar		0.05	2	
Hops	Bulgaria	750 gai/kg SP	foliar		0.038		35
Hops	Poland	750 gai/kg SP	drench	0.75 gai/plant	0.11	1	14
Hops	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Leeks	Poland	750 gai/kg SP	foliar	0.75			14
Leeks	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Legumes	Italy	422 gai/kg SP	foliar		0.034-0.063		21
Legumes	Romania	750 gai/kg SP	foliar		0.075		3
Lemons	Indonesia	750 gai/kg SP	foliar		0.038-0.075		
Lettuce	Cyprus	750 gai/kg SP	foliar		0.056-0.075		15
Lettuce	France	500 gai/kg SP	foliar		0.075		14
Lettuce	Italy	422 gai/kg SP	foliar	0.42-0.63			21
Lettuce	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Lettuce	Japan	500 gai/kg WP	foliar	0.5-0.75	0.038-0.05		14
Lettuce	Jordan	750 gai/kg SP	foliar		0.056-0.11		21
Lettuce	Jordan	750 gai/kg SP	foliar		0.028-0.056		21
Lettuce	Lebanon	970 gai/kg WG	foliar		0.12-0.15		14
Lettuce	Mexico	500 gai/kg SP	foliar	0.5-0.75			14
Lettuce	Mexico	750 gai/kg SP	foliar	0.75-1.13			14
Lettuce	New Zealand	970 gai/kg WG	foliar	0.78	0.078		3
Lettuce	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Lettuce	Uruguay	750 gai/kg SP	foliar	0.75-0.98			20
Lettuce (head)	Canada	750 gai/kg SP	foliar	0.56-0.83		4	7
Lettuce (head)	USA	750 gai/kg SP	foliar	0.56-1.3		(2.2 total)	21
Mandarins	Japan	500 gai/kg WP	foliar	0.5-1.0	0.025 - 0.05	3	30
Oranges	Indonesia	750 gai/kg SP	foliar		0.038-0.075		
Peaches	France	500 gai/kg SP	foliar		0.06		21
Peaches	Italy	422 gai/kg SP	foliar		0.034-0.063		21
Peaches	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Peaches	Mozambique	750 gai/kg SP	foliar		0.019-0.038	2	28
Peaches	Portugal	750 gai/kg SP	foliar	0.5	0.038		21
Peaches	South Africa	750 gai/kg SP	foliar		0.018-0.038	2	28
Peaches	Spain	750 gai/kg SP	foliar	2.8	0.075	2	21
Pears	Chile	750 gai/kg SP	foliar		0.053-0.075		21
Pears	Greece	750 gai/kg SP	foliar		0.075		15
Pears	Italy	425 gai/kg SP	foliar		0.034-0.064		30
Pears	Lebanon	970 gai/kg WG	foliar		0.12-0.15		21
Pears	Mozambique	750 gai/kg SP	foliar		0.038	2	30
Pears	Portugal	750 gai/kg SP	foliar	1.13	0.056		21
Pears	South Africa	750 gai/kg SP	foliar		0.038	2	30
Pears	Spain	750 gai/kg SP	foliar	1.2	0.075	3	21
Pears (incl Nashi)	France	500 gai/kg SP	foliar		0.06		21
Peppers	Brazil	750 gai/kg SP	foliar		0.075		14

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Peppers	Cyprus	750 gai/kg SP	foliar		0.056-0.075		15
Peppers	Ghana	750 gai/kg SP	foliar	0.56-0.75			7
Peppers	Israel	750 gai/kg SP	foliar	1.13-1.5			14
Peppers	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Peppers	Japan	50 gai/kg GR	soil, side		0.1 gai/plant	3	1
Peppers	Jordan	750 gai/kg SP	foliar		0.056-0.11		14
Peppers	Jordan	750 gai/kg SP	foliar		0.028-0.056		14
Peppers	Lebanon	970 gai/kg WG	foliar		0.12-0.15		14
Peppers	Mexico	500 gai/kg SP	foliar	0.5-0.75			7
Peppers	Mexico	750 gai/kg SP	foliar	0.75-1.13			7
Peppers	Spain	750 gai/kg SP	foliar	2.25	0.038-0.11	2	14
Peppers	Uruguay	750 gai/kg SP	foliar	0.49-0.98			7
Peppers	Venezuela	750 gai/kg SP	foliar	0.38-0.75			15
Peppers (bell)	USA	750 gai/kg SP	foliar	0.28-1.3		(2.2 total)	7
Peppers (glass)	Bulgaria	750 gai/kg SP	foliar		0.11		7
Peppers (glass)	Poland	750 gai/kg SP	foliar		0.075		14
Peppers (non-bell)	USA	750 gai/kg SP	foliar	0.56		(1.1 total)	7
Peppers (pimento)	Ivory Coast	750 gai/kg SP	foliar	0.56-0.75			7
Peppers (sweet)	Canada	750 gai/kg SP	foliar	0.83		4	7
Peppers (sweet)	Guatemala	750 gai/kg SP	foliar	0.56-1.13			10
Peppers (sweet)	Panama	750 gai/kg SP	foliar	0.56-1.13			10
Plums	Greece	750 gai/kg SP	foliar		0.075		21
Plums	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Plums	Mozambique	750 gai/kg SP	foliar		0.038	2	28
Plums	Portugal	750 gai/kg SP	foliar	0.5	0.05		21
Plums	South Africa	750 gai/kg SP	foliar		0.038	2	28
Plums	Spain	750 gai/kg SP	foliar	1.13	0.075	3	14
Pome fruit	Italy	422 gai/kg SP	foliar		0.034-0.05	2	30
Pome fruit	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Potatoes	Argentina	750 gai/kg SP	foliar	0.53			15
Potatoes	Australia	750 gai/kg SP	foliar	0.5	0.056		3
Potatoes	Australia	970 gai/kg WG	foliar	0.49	0.049		3
Potatoes	Brazil	750 gai/kg SP	foliar	0.29-0.44	0.075		14
Potatoes	Brazil	970 gai/kg SP	foliar		0.075		14
Potatoes	Canada	750 gai/kg SP	foliar	0.56-0.83		4	21
Potatoes	Chile	750 gai/kg SP	foliar	0.38-0.75			15
Potatoes	Cyprus	750 gai/kg SP	foliar		0.056-0.075		15
Potatoes	Guatemala	750 gai/kg SP	foliar	0.5-1.5			10
Potatoes	Guatemala	750 gai/kg SP	foliar		0.13		14
Potatoes	Indonesia	750 gai/kg SP	foliar		0.038-0.075		
Potatoes	Italy	422 gai/kg SP	foliar	0.42-0.63			21
Potatoes	Italy	425 gai/kg SP	foliar	0.34-0.51			21
Potatoes	Ivory Coast	750 gai/kg SP	foliar	0.56-0.75			7
Potatoes	Japan	50 gai/kg GR	soil, side	1.5-3.0	0.038-0.05	5	
Potatoes	Japan	500 gai/kg WP	foliar	0.5-0.75		5	7
Potatoes	Mozambique	750 gai/kg SP	foliar	0.38-0.56			14
Potatoes	New Zealand	970 gai/kg WG	foliar	0.19-0.58			7
Potatoes	New Zealand	970 gai/kg WG	foliar	0.78			7
Potatoes	Pakistan	750 gai/kg SP	foliar	0.46-0.93			
Potatoes	Panama	750 gai/kg SP	foliar	0.5-1.5			10
Potatoes	Peru	750 gai/kg SP	foliar	0.38-0.75	0.075-0.15		7
Potatoes	Poland	750 gai/kg SP	foliar	0.38			35
Potatoes	Portugal	750 gai/kg SP	foliar	0.53			21

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Potatoes	South Africa	750 gai/kg SP	foliar	0.38-0.56			14
Potatoes	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Potatoes	Uruguay	750 gai/kg SP	foliar	0.49-0.98			20
Soya beans	Benin	750 gai/kg SP	foliar	0.19-0.75			
Soya beans	Brazil	750 gai/kg SP	foliar	0.15-0.75			14
Soya beans	Ghana	750 gai/kg SP	foliar	0.38-0.75	0.38-1.5		7
Soya beans	Guatemala	750 gai/kg SP	foliar	0.5-0.75			10
Soya beans	Indonesia	750 gai/kg SP	seed treatment	0.38-0.8 kgai/100kg			
Soya beans	Ivory Coast	750 gai/kg SP	foliar	0.17-0.75			
Soya beans	Japan	500 gai/kg WP	foliar	0.5	0.05		21
Soya beans	Mexico	500 gai/kg SP	foliar	0.5-0.75			14
Soya beans	Mexico	750 gai/kg SP	foliar	0.75-1.13			14
Soya beans	Mexico	800 gai/kg SP	seed treatment	0.48-0.8 kgai/100kg			
Soya beans	Panama	750 gai/kg SP	foliar	0.5-0.75			10
Stone fruit	Greece	750 gai/kg SP	foliar		0.038-0.075		15
Stone fruit	Spain	750 gai/kg SP	foliar		0.038-0.11		21
Sugar beet	Bulgaria	750 gai/kg SP	foliar	0.75	0.075		7
Sugar beet	France	500 gai/kg SP	foliar	0.5			21
Sugar beet	Hungary	750 gai/kg SP	foliar	0.98	0.33-0.4		30
Sugar beet	Italy	422 gai/kg SP	foliar	0.42-0.63			21
Sugar beet	Italy	425 gai/kg SP	foliar	0.34-0.63			21
Sugar beet	Japan	500 gai/kg WP	foliar	0.5-0.75	0.038-0.05		45
Sugar beet	Poland	750 gai/kg SP	foliar	0.38			14
Sugar beet	Portugal	750 gai/kg SP	foliar		0.056		21
Sugar beet	Switzerland	500 gai/kg SP	foliar	0.5			42
Tomatoes	Argentina	750 gai/kg SP	foliar		0.23		21
Tomatoes	Argentina	750 gai/kg SP	seedling drench	20ml/plant	0.075-0.15	pre-plant dip	
Tomatoes	Australia	750 gai/kg SP	foliar	0.75-0.98	0.075-0.098		3
Tomatoes	Australia	970 gai/kg GR	foliar	0.78-0.98	0.078-0.097		3
Tomatoes	Benin	750 gai/kg SP	foliar	0.56-0.75			
Tomatoes	Brazil	750 gai/kg SP	foliar		0.075		7
Tomatoes	Brazil	970 gai/kg SP	foliar		0.073		7
Tomatoes	Canada	750 gai/kg SP	seedling drench	0.9			
Tomatoes	Chile	750 gai/kg SP	foliar	0.38-0.9			7
Tomatoes	Costa Rica	750 gai/kg SP	foliar	0.38-1.13			15
Tomatoes	Costa Rica	950 gai/kg SP	foliar	1.0-1.9			
Tomatoes	Cyprus	750 gai/kg SP	foliar		0.056-0.075		15
Tomatoes	Dominican Republic	750 gai/kg SP	foliar	0.5-1.7			2
Tomatoes	France	500 gai/kg SP	foliar		0.075		3
Tomatoes	Ghana	750 gai/kg SP	foliar	0.56-0.75			7
Tomatoes	Guatemala	750 gai/kg SP	foliar	0.25-1.0	0.1-0.15		3-10
Tomatoes	Indonesia	750 gai/kg SP	foliar		0.038-0.075		
Tomatoes	Israel	750 gai/kg SP	foliar	1.13-1.5			14
Tomatoes	Italy	422 gai/kg SP	foliar		0.034-0.05		21
Tomatoes	Italy	425 gai/kg SP	foliar		0.034-0.064		21
Tomatoes	Ivory Coast	750 gai/kg SP	foliar	0.56-0.75			7
Tomatoes	Japan	50 gai/kg GR	soil, side	1.5-3.0	0.05-0.1 gai/plant	3	1
Tomatoes	Japan	500 gai/kg WP	foliar	0.5-1.0	0.025-0.05	3	1
Tomatoes	Lebanon	970 gai/kg WG	foliar		0.12-0.15		14
Tomatoes	Mozambique	750 gai/kg SP	foliar		0.056-0.075		3
Tomatoes	New Zealand	970 gai/kg WG	foliar	0.78	0.078		3
Tomatoes	Panama	750 gai/kg SP	foliar	0.25-1.0			10
Tomatoes	Philippines	750 gai/kg SP	foliar		0.09-0.14		14
Tomatoes	Poland	750 gai/kg SP	foliar	0.75			14
Tomatoes	Portugal	750 gai/kg SP	foliar		0.075		21
Tomatoes	South Africa	750 gai/kg SP	foliar	0.56-0.75			3
Tomatoes	Spain	750 gai/kg SP	foliar		0.038-0.11		14
Tomatoes	Uruguay	750 gai/kg SP	foliar	0.49-0.98			7

Crop	Country	Form	Application				PHI
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No. (note 1)	days
Tomatoes	Venezuela	750 gai/kg SP	foliar	0.38-0.75			15
Tomatoes (glass)	Poland	750 gai/kg SP	foliar		0.075		14
Zucchini	Italy	422 gai/kg SP	foliar		0.034-0.063		21

Note 1. Rates in brackets are maximum rates per crop-season.

RESIDUES RESULTING FROM SUPERVISED TRIALS

The Meeting received information on supervised field trials for the following crops.

Table 32	Natsudaidai, grapefruit, lemons	Japan, USA
Table 33	Mandarins	Japan, New Zealand
Table 34	Oranges	Brazil, Greece, South Africa, USA
Table 35	Apples	Denmark, France, Greece, Italy, Netherlands, Spain, Switzerland, Yugoslavia
Table 36	Apples	Germany
Table 37	Apples	USA
Table 38	Pears	France, Italy, South Africa, Spain
Table 39	Peaches	France, Greece, Italy and Spain
Table 40	Plums	France, Germany, Italy, South Africa, UK
Table 41	Leeks	France, Germany, Netherlands
Table 42	Broccoli	Canada, USA
Table 43	Broccoli	Australia, Brazil, France, Japan, Spain
Table 44	Brussels sprouts	Australia, Belgium, Germany, Netherlands, South Africa, UK, USA
Table 45	Cabbages	Australia, Brazil, Canada, France, Germany, Japan, Netherlands, South Africa, UK, USA.
Table 46	Cauliflowers	Australia, Brazil, France, Germany, Italy, Netherlands
Table 47	Cucumbers	France, Italy, Puerto Rico, Spain, USA
Table 48	Egg plants	France, Italy, Spain
Table 49	Peppers	Canada, France, Italy, Spain, USA.
Table 50	Tomatoes	Australia, Brazil, Canada, France, Italy, Japan, Spain, USA
Table 51	Lettuce	Belgium, Canada, France, Germany
Table 52	Common beans	Canada, France, Germany, Italy, Spain and USA
Table 53	Beans (dry)	USA
Table 54	Soya beans	Brazil, USA
Table 55	Sugar beet	France, Italy, UK
Table 56	Artichokes	France, Italy
Table 57	Potatoes	Canada, France, Italy, UK, USA
Table 58	Alfalfa	USA
Table 59	Hops	France, Germany, UK, USA

Recent trials were generally well documented, with full laboratory and field reports. Laboratory reports generally included method validation, including batch recoveries with spiking at residue levels similar to those occurring in samples from the supervised trials, together with dates of analyses or duration of residue sample storage. Although trials included control plots, no control data are recorded in the tables, except where residues in control samples exceeded the LOQ (or in the earlier trials, the LOD). ,Residue data from the trials are recorded unadjusted for recovery.

Where residues were not detected, they are shown as below the LOQ or, in the case of the early trials, below the LOD (e.g. <0.1 mg/kg). Residues, application rates and spray concentrations have generally been rounded to two significant figures or, for residues near the LOQ, to one significant figure. Residue values from the trials conducted according to maximum GAP have been used for the estimation of maximum residue levels. These results are <u>double underlined</u>.

Conditions of the supervised residue trials are summarized in Table 31. Most trial designs, particularly in the earlier studies, used non-replicated plots. Multiple results are recorded in the data tables where the trial design included replicate plots and where separate samples have been identified

as being from these replicate plots.

Intervals of freezer storage between sampling and analysis were recorded for trials and were within the acceptable proven storage stability duration.

Table 31. Summary of sprayers, plot sizes and field sample sizes in supervised trials.

Crop	Country	Year	Sprayer	Plot size	Sample size
alfalfa	USA	1984	hand lance knapsack	36-56 m^2	
alfalfa	USA	1984	3m hand boom gas backpack	45 m^2	
apples	Denmark	1976			
apples	France	1971	hand lance, electric pump	3-5 trees	10 fruit
apples	France	1972, 1973			10 fruit
apples	Germany	1972	hand lance knapsack		
apples	Germany	1976, 1988		3 ha, 9-12 trees	0.5-1 kg
apples	Germany	1973, 1975			1.5 kg
apples	Germany	1984, 1985			10-30 fruit
apples	Greece	1995, 1996	hand lance, electric pump	75 m^2	
apples	Italy	1995	hand lance knapsack	8 trees	6 fruit
apples	Netherlands	1972	hand lance, gas powered		1 kg
apples	Spain	1994-98	hand lance, electric pump	5-12 trees	12 fruit
apples	Switzerland	1971	motorised pump sprayer		5 fruit
apples	USA	1983-1985	commercial sprayer,	3-12 trees	
apples	USA	1983		8 trees	1 kg fruit
apples	USA	1982, 1983	hand lance, motorised pump	2-4 trees	
apples	Yugoslavia	1973			
artichokes	France	1976	hand lance knapsack		8 units
artichokes	Italy	1991			
artichokes	Italy	1995, 1996	motorised knapsack	60-100 m^2	12 units
beans (seed)	USA	1972	tractor 2-row boom	2-6 x 12-122m rows	
beans (seed)	USA	1973	helicopter, aircraft	28 x 91m rows, 0.3 ha	
beans (seed)	USA	1974	tractor 4-row boom	4 x 30m rows	
beans (seed)	USA	1976, 1981			
beans (seed)	USA	1982, 1983	hand, tractor plot sprayers	3-36 m^2	1 kg
broccoli	Australia	1995	1m mini-boom	20 plants	5 kg
broccoli	Brazil	1995		5 m^2	4 kg
broccoli	Canada	1976			
broccoli	France	1992, 1995		20-30 m^2	12 heads
broccoli	France	1996	hand lance knapsack	15-20 m^2	12 heads, 1 kg
broccoli	Japan	1993	hand lance knapsack		
broccoli	Spain	1995	2m hand boom	25 m^2	
broccoli	Spain	1995	hand lance knapsack	32 m^2	12 heads
broccoli	USA	1971-1973			
broccoli	USA	1970	tractor mini-boom	2 x 30m rows	
Brussels sprouts	Australia	1995	1m mini-boom knapsack	20 plants	
Brussels sprouts	Belgium	1972			
Brussels sprouts	Germany	1976			
Brussels sprouts	Netherlands	1975			
Brussels sprouts	South Africa	1972			
Brussels sprouts	UK	1975			1.5 kg
Brussels sprouts	USA	1971	mini-boom knapsack		
Brussels sprouts	USA	1972	mini-boom knapsack	4 x 15-30m rows	
cabbages	Australia	1995	1m mini-boom gas backpack	20 plants	
cabbages	Brazil	1994			
cabbages	Canada	1976			4 part-heads
cabbages	France	1974	hand lance knapsack	10 m^2	
cabbages	France	1973, 1976			8 part-heads
cabbages	Germany	1976	hand lance knapsack	80 m^2	8 half-heads
cabbages	Germany	1976			8 part-heads
cabbages	Japan	1988-1992			
cabbages	Netherlands	1972	hand lance gas backpack		5 heads
cabbages	South Africa	1972	hand lance knapsack		1.5 kg
cabbages	UK	1975			10 heads
cabbages	USA	1972			

Crop	Country	Year	Sprayer	Plot size	Sample size
cabbages	USA	1977	tractor boom, hand lance knapsack	3 x 15m rows	10 heads
cabbages	USA	1977	tractor 2-row boom	2 x 13-16m rows	3 part-heads
cauliflowers	Australia	1995	1m mini-boom gas backpack	24 m^2	
cauliflowers	Brazil	1995			4 kg
cauliflowers	France	1975			8 part-heads
cauliflowers	France	1988			
cauliflowers	France	1995, 1996		12-150 m^2	12 part-heads
cauliflowers	Germany	1976			7 part-heads
cauliflowers	Italy	1991			
cauliflowers	Netherlands	1972	gas-powered sprayer		5 heads
cauliflowers	Netherlands	1995, 1996	gas-powered sprayer	4-6 x 15m rows	12 part-heads
common beans	Canada	1978			
common beans	Canada	1980	tractor boom	4 x 30m rows	
common beans	France	1973	hand lance knapsack		1.5 kg
common beans	France	1986, 1987			0.5-1 kg
common beans	Germany	1976			
common beans	Italy	1990			
common beans	Italy	1995, 1996	hand lance knapsack	70-378 m^2	2 kg
common beans	Spain	1995, 1996	hand lance knapsack	20-42 m^2	0.5 kg
common beans	USA	1973		26 m^2	
common beans	USA	1973	tractor boom	1 x 6m row	0.5 kg
common beans	USA	1979	aircraft		
common beans	USA	1987	tractor 6m boom	500 m^2	
common beans	USA	1973-1979			
cucumbers	France	1973, 1974	hand lance knapsack		10 units
cucumbers	Italy	1990			
cucumbers	Italy	1995	motorised knapsack	20-21 m^2	
cucumbers	Puerto Rico	1979	hand lance knapsack	1 x 7.5m row	10 units
cucumbers	Spain	1994	hand lance knapsack	35 m^2	
cucumbers	USA	1981	tractor 2 row boom	2 x 15m rows	
cucumbers	USA	1979, 1980	hand lance knapsack	1 x 3-9m row	10 units
cucumbers	USA	1979, 1980	tractor boom		10 units
eggplant	France	1973-1975			
eggplant	France	1995	hand lance knapsack	18-24 m^2	12 units
eggplant	Italy	1990			
eggplant	Spain	1994		72 m^2	12 units
eggplant	Spain	1995	hand lance knapsack	40 m^2	12 units
grapefruit	USA	1973	knapsack, orchard sprayers	4 trees	24 fruit min
hops	France	1974			
hops	Germany	1972			
hops	UK	1973, 1974			
hops	USA	1977-1981			
leeks	France	1972	hand lance knapsack		
leeks	France	1974, 1975		30 m^2	12 plants
leeks	Germany	1976			10 plants
lemons	Argentina	1995	hand lance knapsack, gas powered	3 trees	1 kg fruit
lemons	USA	1973	orchard sprayer		
lettuce	Belgium	1972			
lettuce	Canada	1976, 1977			3-4 part-heads
lettuce	France	1973-1976			8-10 heads
lettuce	France	1986	hand lance knapsack	3 x 5m rows	4 half-heads
lettuce	Germany	1976			0.5 kg
mandarins	Japan	1971-1992			
mandarins	New Zealand	1995		1 tree	1kg min
oranges	Brazil	1994	motorised knapsack		20 fruit
oranges	Greece	1995	hand lance knapsack	84 m^2	1 kg fruit
oranges	South Africa	1973			
oranges	USA	1973	knapsack, orchard sprayers	4 trees	
peaches	France	1972		6 trees	10 fruit
peaches	France	1973	knapsack mistblower, hand lance		10-20 fruit

Crop	Country	Year	Sprayer	Plot size	Sample size
peaches	France	1996		70 m^2	1 kg fruit
peaches	Greece	1995, 1996	hand lance, electric pump	75 m^2	20 fruit, 1 kg
peaches	Italy	1990			
peaches	Italy	1996	hand lance motorised knapsack	6 trees	
peaches	Spain	1999	knapsack mistblower	6-8 trees	12 fruit
pears	France	1972, 1973	knapsack, airblast sprayers		20 fruit
pears	Italy	1990			
pears	Italy	1995, 1996	knapsack mistblower	90 m^2	12 fruit, 2 kg
pears	South Africa	1974, 1975	hand lance, motorised pump		30 fruit 1.5 kg
pears	Spain	1995, 1996	commercial airblast sprayer	42 m^2	12 fruit
peppers	Canada	1976-1978			
peppers	Canada	1980	tractor boom	4 x 30m rows	
peppers	France	1986			1 kg
peppers	France	1988	hand lance knapsack	10 plants	1 kg
peppers	France	1973, 1974	hand lance knapsack	55 plants, 10 m^2	
peppers	France	1995, 1996	hand lance knapsack	12-14 m^2	24 units, 2 kg
peppers	Italy	1990			
peppers	Italy	1996	motorised knapsack	21 m^2	
peppers	Spain	1985			
peppers	Spain	1994	motorised knapsack	30-36 m^2	12 units
peppers	USA	1972	2-row boom	2 x 6m rows	
peppers	USA	1978	mini-boom gas backpack	1 x 6m row	
peppers	USA	1974, 1977			
plums	France	1995, 1996	hand lance knapsack	30-72 m^2	20 fruit, 1 kg
plums	Germany	1976	hand lance, motorised pump	2500 m^2	0.5-2 kg
plums	Italy	1976	hand lance, motorised pump		
plums	South Africa	1979	hand lance knapsack	1 tree	
plums	UK	1974	hand lance knapsack		
potatoes	Canada	1977, 1978			
potatoes	France	1973	hand lance knapsack		
potatoes	Italy	1996, 1997	hand lance knapsack	20-162 m^2	24 tubers
potatoes	UK	1977, 1978			10 tubers
potatoes	USA	1973	aircraft	4 ha	
potatoes	USA	1977			
potatoes	USA	1977	mini-boom knapsack		
potatoes	USA	1983	2m boom gas backpack	740 m^2	
potatoes	USA	1971, 1976	tractor boom	2-5 x 9-12m rows	
potatoes	USA	1980, 1981	hand plot sprayer	55 m^2	
soya beans	USA	1974			
soya beans	USA	1977	tractor boom		
soya beans	USA	1978	boom gas plot sprayer	0.13 ha	
soya beans	USA	1978	tractor 4-row boom, aircraft	4 x 90m rows	
soya beans	USA	1981	tractor boom, hand boom backpack	4 x 18m rows	
sugar beet	France				5 half-roots
sugar beet	Italy	1996, 1997	hand lance knapsack	20-24 m^2	12 plants
sugar beet	UK	1977			8 plants
sugar beet	UK	1975, 1979	mini-boom knapsack	3-4 x 10-12m rows	5-10 plants
tomatoes	Brazil	1994			
tomatoes	Canada	1980	tractor boom	4 x 30m rows	
tomatoes	Canada	1977, 1978			
tomatoes	France	1973- 1976	hand lance knapsack	28 plants, 10-30 m^2	10 units
tomatoes	France	1986	hand lance knapsack	1 x 7.5m row, 4.5 m^2	10 units, 1 kg
tomatoes	Italy	1999	2.5 m hand boom	180-240 plants	40 units, 2 kg
tomatoes	Japan	1977-1985			
tomatoes	Spain	1995, 1999	hand lance knapsack	75 plants, 50 m^2	24 units, 2 kg
tomatoes	USA	1977	hand plot sprayer, helicopter	1-6 x 3-120m rows	10 units
tomatoes	USA	1993	tractor gas powered sprayer		
tomatoes	USA	1993	tractor 2-row gas powered boom	2-8 x 15-23m rows	16 units
tomatoes	USA	1987, 1993	2m boom knapsack		

Table 32. Acephate residues in natsudaidai (Japan), grapefruit and lemons (the USA) resulting from supervised trials.

CITRUS Location, year (variety), reference	Application Form	kg ai/ha	kg ai/hl	water, l/ha	no.	PHI days	Residues, mg/kg acephate	methamidophos
NATSUDAIDAI								
Japan, Shizuoka, 1992 (Natsudaidai), TMN-0624	WP	3.3	0.066	5000	3	30	0.13 flesh 0.12 peel 0.17	0.01 flesh 0.01 peel 0.02
						45	0.10 flesh 0.11 peel 0.08	0.008 flesh 0.007 peel 0.01
						60	0.04 flesh 0.04 peel 0.04	<0.005 flesh <0.005 peel <0.005
Japan, Shizuoka, 1992 (Natsudaidai), TMN-0624	WP	5.0	0.1	5000	3	30	0.30 flesh 0.22 peel 0.59	0.03 flesh 0.02 peel 0.09
						45	0.14 flesh 0.14 peel 0.14	0.01 flesh 0.01 peel 0.03
						60	0.18 flesh 0.17 peel 0.19	0.02 flesh 0.01 peel 0.03
Japan, Wakayama, 1992 (Natsudaidai), TMN-0624	WP	3.3	0.066	5000	3	30	3.0 flesh 0.48 peel 8.4	0.33 flesh 0.05 peel 0.97
						45	1.8 flesh 0.27 peel 5.2	0.19 flesh 0.03 peel 0.53
						60	1.6 flesh 0.34 peel 4.5	0.18 flesh 0.03 peel 0.53
Japan, Wakayama, 1992 (Natsudaidai), TMN-0624	WP	5.0	0.1	5000	3	30	1.9 flesh 0.27 peel 5.4	0.23 flesh 0.03 peel 0.68
						45	2.3 flesh 0.61 peel 6.5	0.27 flesh 0.05 peel 0.78
						60	2.6 flesh 0.55 peel 7.2	0.32 flesh 0.05 peel 0.92
GRAPEFRUIT								
USA, California, 1973 (White Marsh), TMN-0565A, T-2436	SP	2.8	0.06	4714	2	10	1.4 press liquor 0.22 juice 0.21 juice 0.08 [1/] dried pulp 0.26 peel oil <0.02	0.05 press liquor 0.01 juice <0.01 juice <0.01 [1/] dried pulp 0.09 peel oil <0.01
						25	0.66 juice 0.19	0.03 juice 0.01
USA, California, 1973 (White Marsh), TMN-0565A, T-2436	SP	5.6	0.12	4714	2	10	2.0 juice 0.36	0.05 juice 0.02
						25	0.85 juice 0.31	0.03 juice 0.01
LEMONS								
Argentina, Lujan, 1995 (Eureka), TMN-0564A	SP	0.12	0.017	700	3	5 15	<0.1 <0.1	-
USA, Arizona, 1973 (Lisbon), TMN-0565A, T-2437	SP	1.7	0.06	2800	3	20	0.08 press liquor 0.04 juice 0.04 juice 0.02 [1/] wet pulp <0.05 dried pulp 0.07 peel oil <0.02	0.02 press liquor <0.01 juice <0.01 juice 0.01 [1/] wet pulp 0.01 dried pulp 0.02 peel oil <0.01

[1/] Commercially prepared juice.

Table 33. Acephate residues in mandarins resulting from supervised trials in Japan and New Zealand.

MANDARINS	Application					PHI	Residues, mg/kg	
Location, year (variety), reference	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Japan, Aichi, TMN-0564	WP		0.05		2	21	1.0	0.098
						28	0.57	0.049
						35	0.78	0.05
Japan, Aichi, TMN-0564	WP		0.05		3	21	1.7	0.14
						28	1.7	0.09
						35	1.4	0.07
Japan, Aichi, TMN-0564	WP		0.05		4	21	1.2	0.09
						28	0.98	0.08
						35	0.61	0.03
Japan, Ehime, TMN-0564	WP		0.05		2	21	0.93	0.09
						28	0.79	0.07
						35	0.88	0.09
Japan, Ehime, TMN-0564	WP		0.05		3	21	1.4	0.16
						28	1.7	0.14
						35	1.8	0.15
Japan, Ehime, TMN-0564	WP		0.05		4	21	1.5	0.14
						28	1.7	0.14
						35	1.3	0.12
Japan, Hiroshima, TMN-0564	WP		0.05		2	21	0.75	0.08
						28	0.85	0.08
						35	0.71	0.07
Japan, Hiroshima, TMN-0564	WP		0.05		3	21	2.5	0.30
						28	2.3	0.20
						35	2.6	0.25
Japan, Hiroshima, TMN-0564	WP		0.05		4	21	3.4	0.33
						28	2.6	0.25
						35	5.2	0.26
Japan, Ehime, 1971, TMN-0564 1971-2	WP		0.05		3	95	0.27 peel 0.02	0.01 peel 0.01
Japan, Ehime, 1971, TMN-0564 1971-2	WP		0.05		5	37	0.4 peel 0.41	0.03 peel 0.04
Japan, Shizuoka, 1971, TMN-0564 1971-1	WP	2.5	0.05	5000	3	8	0.28 peel 1.9	0.07 peel 0.15
						32	0.49 peel 0.61	0.06 peel 0.05
						50	0.36 peel 0.61	0.07 peel 0.05
Japan, Shizuoka, 1971, TMN-0564 1971-1	WP	2.5	0.05	5000	5	7	0.54 peel 4.5	0.16 peel 0.54
						26	0.38 peel 2.4	0.02 peel 0.18
Japan, Nagasaki, 1986 (Unshu) TMN-0564 1986-2	WP	2.7	0.033	8000	1	197	<0.005 peel <0.005	<0.01 peel <0.01
Japan, Nagasaki, 1986 (Unshu), TMN-0564 1986-2	WP	2.7	0.033	8000	2	168	<0.005 peel <0.005	<0.01 peel <0.01
Japan, Shizuoka, 1986 (Unshu), TMN-0564 1986-1	WP	1.3	0.033	4000	1	200	<0.005 peel <0.005	<0.01 peel <0.01
Japan, Shizuoka, (Unshu), TMN-0564 1986-1	WP	2.5	0.05	4000	2	177	<0.005 peel <0.005	<0.01 peel <0.01
Japan, Chiba, 1987, TMN-0564 1987-1	WP	2.7	0.05	5000	3	30	0.36 peel 33	0.02 peel 0.27
						45	0.68 peel 1.1	0.04 peel 0.1
						60	0.53 peel 0.38	0.03 peel 0.03

MANDARINS Location, year (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Japan, Ehime, 1987, TMN-0564 1987-1	WP	2.7	0.05	5000	3	30	0.98 peel 6.5	0.08 peel 1.1
						45	1.7 peel 5.8	0.13 peel 0.72
						60	1.8 peel 2.9	0.1 peel 0.32
Japan, Kanagawa, 1992 (Satsuma), TMN-0624	WP	5.0	0.1	5000	3	30	1.1 flesh 1.2 peel 0.68	0.11 flesh 0.10 peel 0.14
						45	0.88 flesh 0.99 peel 0.44	0.06 flesh 0.06 peel 0.06
						60	0.46 flesh 0.62 peel 0.17	0.03 flesh 0.03 peel 0.02
Japan, Shizuoka, (Satsuma), TMN-0624	WP	5.0	0.1	5000	3	30	0.60 flesh 0.63 peel 0.50	0.07 flesh 0.07 peel 0.09
						45	0.55 flesh 0.58 peel 0.41	0.05 flesh 0.052 peel 0.05
						60	0.50 flesh 0.56 peel 0.22	0.03 flesh 0.037 peel 0.02
New Zealand, Tauranga, 1995 (Clementine), TMN-0564E 950403	SP	2.7	0.075	3600	7	14	3.3, 2.6	0.29, 0.23

Table 34. Acephate residues in oranges resulting from supervised trials in Brazil, Greece, South Africa and the USA.

ORANGES Location, year (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Brazil, Holambra, 1994 (Pera Coroa), TMN-0564D	SP	1.2	0.56	2200	2	14	0.2	
Brazil, Holambra, 1994 (Pera Coroa), TMN-0564D	SP	1.2	0.56	2200	2	21	0.2	
Brazil, Holambra, 1994 (Pera Coroa), TMN-0564D	SP	1.2	0.56	2200	2	28	0.1	
Brazil, Holambra, 1994 (Pera Coroa), TMN-0564D	SP	2.5	0.11	2200	2	14	0.5	
Brazil, Holambra, 1994 (Pera Coroa), TMN-0564D	SP	2.5	0.11	2200	2	21	0.3	
Brazil, Holambra, 1994 (Pera Coroa), TMN-0564D	SP	2.5	0.11	2200	2	28	0.1	
Greece, Argolis, 1995 (Merlin), TMN-0564B EA950153 GR01	SP	1.2	0.03	3900	2	21	0.23	0.05
South Africa, Rustenburg, 1973 (Valencia) TMN-0565 T-1235	SP	0.38	0.038		1	7	1.26 flesh 0.25 peel 2.47	0.09 flesh 0.03 peel 0.18
						14	0.96 flesh 0.21 peel 2.70	0.09 flesh 0.02 peel 0.22
						21	0.13 flesh 0.05 peel 0.26	0.02 flesh <0.01 peel 0.02
						28	0.13 flesh 0.09 peel 0.26	<0.01 flesh <0.01 peel 0.03
USA, Arizona, 1972 (Navel), TMN-0565A T-2407	SP	0.56	0.06	935	2	104	green fruit <0.02	<0.01

ORANGES Location, year (variety), reference	Application Form	kg ai/ha	kg ai/hl	water, l/ha	no.	PHI days	Residues, mg/kg acephate	methamidophos
USA, California, 1973 (Navel), TMN-0565A T-2323	SP	0.28	0.03	935	2	199	<0.02	<0.01
USA, California, 1973 (Navel), TMN-0565A T-2323	SP	0.56	0.06	935	2	199	<0.02	<0.01
USA, California, 1973 (Navel), TMN-0565A T-2408	SP	0.56	0.06	935	2	103	green fruit <0.02	<0.01
USA, California, 1973 (Navel), TMN-0565A T-2408	SP	0.56	0.06	935	3	22	0.44	0.07
USA, California, 1973 (Navel), TMN-0565A T-2434	SP	1.7	0.06	2760	3	21 43	0.96 1.3	0.09 0.06
USA, California, 1973 (Navel), TMN-0565A T-2434	SP	3.3	0.12	2760	3	43	0.93	0.12
USA, California, 1973 (Valencia), TMN-0565A T-2435	SP	1.3 1.4	0.06	2198 2338	1 +2	20 40	0.6 press liquor 0.16 juice 0.18 juice 0.13 [1/] wet pulp 0.35 dried pulp 0.45 peel oil 0.02 0.2 juice 0.17	0.05 press liquor <0.01 juice 0.03 juice 0.01 [1/] wet pulp 0.04 dried pulp 0.11 peel oil <0.02 0.02
USA, California, 1973 (Valencia), TMN-0565A T-2435	SP	2.1 1.4	0.12	1768 2338	1 +2	20	1.4 juice 0.33	0.08 juice 0.03

[1/] Commercially prepared juice.

Table 35. Acephate residues in apples resulting from supervised trials in Denmark, France, Greece, Italy, the Netherlands, Spain, Switzerland and Yugoslavia.

APPLES Location, year (variety), reference	Application Form	kg ai/ha	kg ai/hl	water, l/ha	no.	PHI days	Residues, mg/kg acephate	methamidophos
Denmark, Amager, 1976 (Spartan), TMN-0534 T-1533	SP	1.9	0.09	2500	1	0 7 14 21 28	0.83 0.29 0.31 0.28 0.30 c=0.022	<0.01 0.01 <0.01 0.01 0.01
France, Gironde, 1971 (Golden Delicious), TMN-0535 T-238	SP	2.5 1.9	0.11 0.11	2220 1670	3 +1	0 6 13 20	6.9 5.3 5.6 4.1	0.26 0.27 0.25 0.26
France, Graveson, 1971 (Golden Delicious), TMN-0535 T-237	SP	1.7			7	7 14 21	5.5 4.8 4.0	0.30 0.30 0.26
France, Graveson, 1971 (Golden Delicious), TMN-0535 T-1024	SP	0.51 0.78 0.69 0.60	0.05 0.075 0.075 0.075	1035 1035 920 800	2 +2 +1 +3	0 7 14 21	6.6 c0.018 3.5 c0.006 4.4 3.7	0.19 0.16 0.19 0.22
France, Gironde, 1972 (Golden Delicious), TMN-0535 T-1025 (a)	SP		0.05 0.075 0.075 0.075	1500 2000 1500 1300	2 +3 +1 +1	1 7 14 20 36	3.2 c0.02 4.3 c0.013 3.6 c0.01 4.2 3.0 c0.035	0.17 0.15 0.22 0.24 0.28
France, Gironde, 1972 (Golden Delicious), TMN-0535 T-1025 (b)	SP		0.038 0.05 0.05 0.05	1500 2000 1500 1300	+2 +3 +1 +1	36	2.0 c0.035	0.20
France, Gometz le Chatel, 1972, (Canada), TMN-0535 T-1043	SP	0.75	0.05	1500	5	51	0.24 c0.01	0.02

APPLES	Application					PHI	Residues, mg/kg	
Location, year (variety), reference	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Gometz le Chatel, 1972 (Golden Delicious), TMN-0535 T-1039	SP	0.75	0.05	1500	5	51	0.91 c0.04	0.08
France, Gometz le Chatel, 1972 (Red Delicious), TMN-0535 T-1040	SP	0.75	0.05	1500	5	51	0.18	0.03
France, Gometz le Chatel, 1972 (Reine des Reinettes), TMN-0535 T-1041	SP	0.75	0.05	1500	5	51	0.74 c0.04	0.05
France, Gometz le Chatel, 1972 (Starking Delicious) TMN-0535 T-1044	SP	0.75	0.05	1500	5	51	0.24 c0.02	0.03
France, Coumont, 1973 (Golden Delicious), TMN-0535 T-1149	SP	0.6	0.056	1060	1	0 7 14 21 28 35 42 49	1.3 c0.02 1.1 c0.024 0.83 0.63 c0.025 0.53 0.53 0.33 0.30	0.06 0.07 0.08 0.05 0.06 0.06 0.05 0.05
France, Gometz le Chatel, 1973 (Golden Delicious), TMN-0535 T-1147	SP	0.56	0.056	1000	2	119	0.18	0.02
France, Gometz le Chatel, 1973 (Golden Delicious), TMN-0535 T-1261	SP	0.56	0.056	1000	1	0 7 14 21 28	0.77 c0.013 0.58 0.92 0.65 0.61	0.05 0.01 0.03 0.02 0.03
France, Langon, 1973 (Golden Delicious), TMN-0535 T-1148	SP	1.1	0.056	2000	3	90	0.77	0.05
Greece, Goumenissa, 1995 (Starking Delicious), TMN-0534A (95709GR1)	SP	1.6	0.075		3	15	0.39, 0.24	0.03 (2)
Greece, Macedonia, 1996 (Stark Crimson), TMN-0534B (96664GR1)	SP	1.3	0.075		3	15	0.33, 0.35	0.03, 0.04
Italy, Modena, 1995 (Neiplings Early Stayman), TMN-0535D, SIP1053	SP	1.3 1.1	0.08 0.07	1500 1500	1 +1	21 30	0.46, 0.52 0.56, 0.54	<0.1 (2) ≤0.1 (2)
Netherlands, Boven-Leeuwen, 1972 (Goud Reinet), TMN-0534 T-1055	SP	1.5	0.075	1950	4	0 7 14 21	3.7, 2.3, 3.7 c=0.038 3.5, 1.9, 2.6 3.6, 2.4, 3.1 3.6, 3.6, 1.9 c=0.014	0.10, 0.07, 0.12 0.11, 0.08, 0.08 0.13, 0.08, 0.11 0.14, 0.12, 0.08
Netherlands, Boven-Leeuwen, 1972 (Goud Reinet), TMN-0534 T-1056	SP	1.5	0.075	1950	4	0 7 14 21	2.3, 2.1, 1.7 c=0.49 4.1, 2.4, 2.0 3.6, 2.0, 2.0 3.2, 2.4, 3.2	0.01, 0.09, 0.05 c=0.018 0.14, 0.08, 0.08 c=0.008 0.14, 0.08, 0.07 0.16, 0.11, 0.11
Spain, Valencia, 1994 (Reinette), TMN-0535A 93-621	SP	2.3	0.11	2035	2	21	0.99	
Spain, Valencia, 1996 (Reinette), TMN-0535C 96-624	WG	1.1	0.12	924	2	0 3 7 14 21	2.7 1.3 1.2 2.0 1.5	0.03 0.02 0.035 0.054 0.045
Spain, Valencia, 1998 (Esperiega), TMN-0535E S98038R	SP	1.1 1.1	0.075	1500 1488	1 +2	21	0.03	<0.02

APPLES Location, year (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Switzerland, Dielsdorf, 1971 (MacIntosh), TMN-0534 T-548	SP	1.5	0.075	2000	1	0	1.6	0.02
						1	2.0	0.02
						10	1.1	0.15
						20	1.5	0.08
						30	1.2	0.11
							c=0.064	c=0.004
Yugoslavia, Beograd, 1973, TMN-0534 T-1259	SP		0.056		1	0	0.52	0.03
						3	0.24	0.02
						7	0.26	0.02

c = result obtained from control sample.

Table 36. Acephate residues in apples resulting from supervised trials in Germany.

APPLES Location, year (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Germany, Immenstaad, 1972 (Golden Delicious), TMN-0536 T-1066 (a)	SP	1.0	0.05	2000	1	0	2.5	0.04
						7	2.5	0.03
						14	2.4	0.06
						21	2.2	0.06
						28	2.1	0.06
Germany, Immenstaad, 1972 (Golden Delicious), TMN-0536 T-1066 (b)	SP	1.5	0.075	2000	1	0	2.5	0.02
						7	2.8	0.05
						14	2.5	0.08
						21	2.1	0.09
						28	2.9	0.10
Germany, Immenstaad, 1972 (James Grieve), TMN-0536 T-1067 (a)	SP	1.0	0.05	2000	1	0	2.6	<0.002
						14	1.5	0.04
							c=0.032	
Germany, Immenstaad, 1972 (Golden Delicious), TMN-0536 T-1067 (b)	SP	1.5	0.075	2000	1	0	1.9	0.01
						7	2.0	0.04
						14	2.3	0.06
						21	2.0	0.06
						28	2.4	0.07
							c=0.032	
Germany, Immenstaad, 1973 (Golden Delicious), TMN-0536 T-1257	SP	1.0	0.05	2000	4	0	2.4	<0.01
						4	2.4	0.02
						7	2.9	0.07
						10	1.7	0.07
						14	2.4	0.10
						21	2.8	0.12
						28	2.7	0.13
Germany, Immenstaad, 1973 (Cox's Orange), TMN-0536 T-1258	SP	1.0	0.05	2000	3	0	2.3	0.03
						4	2.0	0.03
						7	0.9	0.03
						10	1.1	0.04
						14	1.4	0.06
						21	1.5	0.06
						28	1.0	0.06
Germany, Immenstaad, 1975 (Cox's Orange), TMN-0536 T-1464	SP	1.0	0.05	2000	5	0	1.0	<0.01
						7	0.77	0.04
						14	0.76	0.04
						21	0.65	0.04
						28	0.23	0.02
Germany, Frankfurt, 1976 (Lodi), TMN-0536 T-1525	SP	1.0	0.05	2000	3	0	4.3 c0.65	<0.07
						14	0.33	0.02
						28	0.23 c0.03	<0.01
						36	0.34	0.03
Germany, Nordenstaat, 1976, (James Grieve Liret), TMN-0536 T-1526	SP	1.0	0.05	2000	3	0	3.0 c0.2	0.05
						14	0.89	0.05
						28	0.71	0.03
						42	0.43	0.02
						51	0.34 c0.03	0.02

APPLES	Application					PHI	Residues, mg/kg	
Location, year (variety), reference	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Germany, Nordenstaat, 1976 (King of the Pippins), TMN-0536 T-1527	SP	1.0	0.05	2000	3	0 14 28 42 77	3.3 c0.92 0.34 0.18 c0.07 0.32 0.29	0.02 c0.07 0.02 0.01 0.02 0.01
Germany, Neuenhain, 1984 (James Grieve), TMN-0536 T-2070	SP	0.75	0.15	500	4	0 14 21 28 35	5.7 c0.46 4.9 3.4 1.9 2.7	0.13 c0.02 0.17 0.11 0.07 0.11
Germany, Koln-Auweiller, 1984 (James Grieve), TMN-0536 T-2071	SP	0.75	0.1	750	4	0 14 21 28 35	5.3 4.4 3.4 2.8 1.9	0.13 0.15 0.09 0.10 0.08
Germany, Neuenhain, 1985 (James Grieve), TMN-0536 T-2116	SP	0.75	0.15	500	3	0 14 21 28 35 73	4.4 c0.12 2.5 2.2 1.8 2.1 0.9	0.08 0.12 0.08 0.1 0.08 0.03
Germany, Koln-Auweiller, 1985 (James Grieve), TMN-0536 T-2117	SP	0.75	0.15	500	3	0 14 21 28 35 56	2.0 c1.2 0.45 0.12 0.15 c0.99 0.21 0.06	<0.02 c0.064 0.03 <0.02 <0.02 c0.059 <0.02 <0.02
Germany, Weinsberg, 1986 (Gloster), TMN-0536 T-2268	SP	0.75	0.05	1500	4	0 14 28 42	4.7 c0.08 3.4 2.8 2.8 c0.06	0.15 0.10 0.17 0.15
Germany, Weinsberg, 1986 (Gloster), TMN-0536 T-2269	SP	0.42	0.056	750	4	0 14 28 42	3.5 c0.07 2.1 1.7 2.8	0.08 0.05 0.08 0.13
Germany, Jork, 1986 (Gloster), TMN-0536 T-2270	SP	0.75	0.05	1500	4	0 14 28 42	4.1 c0.09 3.9 2.9	0.18 0.13 0.14
Germany, Jork, 1986 (Gloster), TMN-0536 T-2271	SP	0.75	0.25	300	4	0 14 28 42	2.5 c0.12 3.3 3.3 0.97	0.08 0.11 0.15 0.10
Germany, Frankfurt, 1986 (Jonathan), TMN-0536 T-2272	SP	0.75	0.05	1500	4	0 14 28 42	2.3 1.3 1.6 1.5	0.1 0.07 0.06 0.08
Germany, Frankfurt, 1986 (Jonathan), TMN-0536 T-2273	500 SP	0.75	0.2	375	4	0 14 28 42	1.2 0.75 0.66 0.51	0.06 0.03 0.03 <0.02
Germany, Weinsberg, 1987 (Gloster), TMN-0536 T-2337	500 SP	0.75	0.2	375	4	0 14 28 48	7.6 c0.6 4.5 2.6 3.2 c0.34	0.24 0.27 0.21 0.23 c0.05
Germany, Weinsberg, 1987 (Gloster), TMN-0536 T-2338	500 SP	0.75	0.18	420	4	0 14 28 42	4.4 c0.67 3.3 1.7 2.9 c0.34	0.17 0.18 0.11 0.19 c0.05

APPLES Location, year (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Germany, Meckenheim, 1987 (Golden Delicious), TMN-0536 T-2339	500 SP	0.75	0.05	1500	4	0 14 28 42	1.7 1.3 1.3 0.66	0.08 0.08 0.09 0.07
Germany, Meckenheim, 1987 (Golden Delicious), TMN-0536 T-2340	500 SP	0.75	0.05	1500	4	0 14 28 42	7.3 c0.09 6.4 6.6 0.2 c5.0	0.27 0.31 0.35 <0.02 c0.27
Germany, Jork, 1987 (Gloster), TMN-0536 T-2341	500 SP	0.75	0.2	375	4	0 14 28 42	5.3 3.3 3.0 3.9 c0.1	0.20 0.19 0.14 0.19
Germany, Frankfurt, 1987 (Ontario), TMN-0536 T-2342	500 SP	0.75	0.05	1500	4	0 14 28 42	2.7 2.1 1.8 1.7	0.07 0.01 0.08 0.08
Germany, Frankfurt, 1987 (Ontario), TMN-0536 T-2343	500 SP	0.75	0.2	375	4	0 14 28 42	4.0 2.9 2.8 2.4	0.12 0.10 0.10 0.09

c = result obtained from control sample.

Table 37. Acephate residues in apples resulting from supervised trials in the USA.

APPLES Location, year (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
USA, Oregon, 1983 (Red Delicious), TMN-0534 T-5942	SP	1.1	0.03	3740	2	104	0.09	0.02
USA, Missouri, 1982 (Red Delicious), TMN-0537 T-5632	SP	1.1	0.06	1871	3	101	0.41 c0.72	0.06 c0.1
USA, Wisconsin, 1982 (Red Spur), TMN-0537 T-5657	SP	1.1	0.03	3741	3	120	0.14	0.02
USA, Washington, 1982 (Golden Delicious), TMN-0537 T-5751 (a)	SP	1.1	0.06	1871	1	156	<0.02	<0.01
USA, Washington, 1982 (Golden Delicious), TMN-0537 T-5751 (b)	SP	1.1	0.06	1871	1	113	0.1	0.02
USA, Washington, 1982 (Golden Delicious), TMN-0537 T-5751 (c)	SP	1.1	0.06	1871	2	113	0.11	0.02
USA, New York, 1982 (Cortland), TMN-0537 T-5764 A(a)	SP	0.67	0.012	5612	3	122	0.06	<0.01
USA, New York, 1982 (Ben Davis), TMN-0537 T-5764 B(a)	SP	0.67	0.012	5612	3	143	0.12	0.01
USA, New York, 1982 (Cortland), TMN-0537 T-5764 A(b)	SP	0.84	0.015	5612	3	122	0.05	<0.01
USA, New York, 1982 (Ben Davis), TMN-0537 T-5764 B(b)	SP	0.84	0.015	5612	3	143	0.08	0.01
USA, New York, 1982 (Cortland), TMN-0537 T-5765 A	SP	1.7	0.045	3770	3	118	0.15	0.01
USA, New York, 1982 (McIntosh), TMN-0537 T-5765 B	SP	1.7	0.045	3770	3	99	0.33	0.02
USA, New York, 1982 (Red Delicious), TMN-0537 T-5765 C	SP	1.7	0.045	3770	3	106	0.11	0.02
USA, New York, 1982 (Golden Delicious), TMN-0537 T-5765 D	SP	1.7	0.045	3770	3	106	0.1	0.01
USA, New York, 1982 (R.I Greening), TMN-0537 T-5765 E	SP	1.7	0.045	3770	3	118	0.07	0.01
USA, New York, 1982 (Rome Beauty), TMN-0537 T-5765 F	SP	1.7	0.045	3770	3	118	0.53	0.01
USA, New York, 1982 (Empire), TMN-0537 T-5765 G	SP	1.7	0.045	3770	3	112	0.19	0.02

APPLES Location, year (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
USA, Wisconsin, 1983 (Red Spur), TMN-0537 T-5902	SP	1.1	0.03	3742	3	143	fruit 0.02 sauce 0.01 juice 0.02	fruit <0.01 sauce <0.01 juice <0.01
USA, Washington, 1983 Red Delicious), TMN-0537 T-5940 (a)	SP	1.1	0.03	3742	2	114	0.01	<0.01
USA, Washington, 1983 (Red Delicious), TMN-0537 T-5940 (b)	SP	1.1	0.03	3742	1	178	<0.01	<0.01
USA, Wisconsin, 1984 (mixed varieties), TMN-0537 T-6197	SP	1.1	0.3	374	3	114	<0.01	<0.01
USA, Washington, 1984 (Red Delicious), TMN-0537 T-6219	SP	1.1	0.06	1870	2	168	<0.01	<0.01
USA, Washington, 1984 (Yakima), TMN-0537 T-6220	SP	1.1	0.045	234	2	117	0.02	<0.01
USA, Washington, 1984 (Red Delicious), TMN-0537 T-6221	SP	0.84 1.1	0.022 0.03	3742	1 +1	113	0.02	<0.01
USA, Wisconsin, 1985 (MacIntosh), TMN-0537 T-6432	SP	1.1	0.12	935	3	106	fruit 0.46 juice 0.46 wet pomace 0.42 dry pomace 1.0	fruit 0.02 juice 0.02 wet pomace 0.02 dry pomace 0.06 Moisture: dry pomace 23%
USA, Wisconsin, 1985 (MacIntosh), TMN-0537 T-6432	SP	1.1 1.1	0.12 0.05	935 2245	3 +1	9	fruit 1.0 juice 0.99 wet pomace 1.2 dry pomace 2.9	fruit 0.03 juice 0.03 wet pomace 0.05 dry pomace 0.09 Moisture: dry pomace 23%
USA, Washington, 1993 (Red Delicious), TMN-0537A V10674-C (Lai 1995)	SP	1.1	0.12	963	3	118	0.06 washed fruit 0.06 sauce 0.03 juice 0.06 wet pomace 0.05	0.01 washed fruit 0.01 sauce <0.01 juice <0.01 wet pomace <0.01 Moisture: dry pomace 25%

c = result obtained from control sample.

Table 38. Acephate residues in pears resulting from supervised trials in France, Italy, South Africa and Spain.

PEARS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
France, Graveson, 1972, (Williams), TMN-0636 T-1052	SP	0.75	0.075	1000	1	0 6 13 20	1.1 0.69 0.50 0.24	<0.002 0.01 0.02 0.01
France, Chazay d'Azergues, 1973, (Guyot), TMN-0636 T-1179	SP	0.75	0.075	1000	6	0	1.0	0.08
Italy, Cervere, 1990, (Decana del Comizio), TMN-0636A OR 21(a)	WP	0.77	0.047	1622	1	35	0.34	0.02
Italy, Cervere, 1990 (Decana del Comizio), TMN-0636A OR 21(c)	WP	0.77	0.047	1622	1	45	0.44	0.02
Italy, Cervere, 1990 (Decana del Comizio), TMN-0636A OR 21(b)	WP	1.5	0.094	1622	1	35	0.66	0.09
Italy, Cervere, 1990 (Decana del Comizio), TMN-0636A OR 21(d)	WP	1.5	0.094	1622	1	45	0.55	0.03
Italy, Verona, 1990 (Passa Crassana), TMN-0636A OR 22(b)	WP	1.5	0.077	2000	1	36	0.71	0.16
Italy, Verona, 1990 (Passa Crassana), TMN-0636A OR 22(a)	WP	0.77	0.038	2000	1	36	0.17	<0.01
Italy, Verona, 1990 (Passa Crassana), TMN-0636A OR 22(c)	WP	0.77	0.038	2000	1	45	0.17	<0.01

PEARS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Italy, Verona, 1990 (Passa Crassana), TMN-0636A OR 22(d)	WP	1.5	0.077	2000	1	45	0.39	0.02
Italy, Camposanto, 1995 (William Bianco), TMN-0636E SIP1052	WP	1.2 1.0	0.08 0.07	1500 1500	1 +1	21 30	0.36 0.28	<0.10 <0.10
Italy, Corporino, 1996 (Abate Fetel), TMN-0636C SIP1071	WP	0.8 0.74	0.05	1500 1500	1 +1	0 7 14 21 30	0.58 0.29 0.23 0.35 0.13 c=0.03	0.01 0.10 0.01 0.01 0.01
South Africa, Lynedoch – Cape, 1974 (Kieffer), TMN-0636 T-1256	SP	0.75	0.075	1000	2	120	0.20	0.03
South Africa, Lynedoch – Cape, 1975 (Kieffer), TMN-0636 T-1357	SP	1.4	0.056	2470	2	7 21 35 49 63	32 c0.23 11 c0.11 3.1 c0.22 1.9 c0.15 1.6 c0.04	1.4 c0.03 0.93 c0.17 0.40 c0.02 0.29 c0.02 0.20
Spain, Valencia, 1995 (Castell), TMN-0636B 95-719	WG	0.99 0.90	0.058 0.043	1716 2070	1 +1	0 3 7 14 21	1.5 0.70 0.55 0.44 0.26	0.03 0.04 0.04 0.04 0.03
Spain, Valencia, 1996 (Castell), TMN-0636D 96-623	WG	1.1	0.069	1641	2	14 21	0.96 0.55	0.09 0.06

c = result obtained from control sample.
Note. Summary data only were available for reference TMN-0636A, trials OR 21 and OR22.

Table 39. Acephate residues in peaches resulting from supervised trials in France, Greece, Italy and Spain.

PEACHES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Avignon, 1972 (Early Elearta), TMN-0635 T-1027	SP	0.56 0.66 0.75	0.037		1 +3 +2	0 24	3.0 1.2	0.5 0.33
France, Maillane, 1972 (Early Alberta), TMN-0635 T-1026	SP	0.53	0.037		3	0 8 16 19	0.78, 2.0 0.69, 1.5 c0.01 0.34, 0.67 0.32, 0.40	0.11, 0.12 0.13, 0.25 0.10, 0.15 0.07, 0.11
France, Maillane, 1972 (Early Alberta), TMN-0635 T-1026	SP	1.6	0.11		3	0 8 16 19	3.6, 3.6 2.1, 2.2 c0.01 1.6, 1.2 0.88, 1.2	0.27, 0.31 0.38, 0.35 0.44, 0.31 0.17, 0.24
France, Avignon, 1973 (Dixired), TMN-0635 T-1151	SP	0.56 0.70	0.056		2 +1	0 7 14 21	1.3 0.48 0.46 0.24	<0.01 0.07 0.1 0.07
France, Avignon, 1973 (Red Haven), TMN-0635 T-1153	SP	0.56 0.70	0.056		2 +1	34	0.1	0.04
France, Langon, 1973 (Dixired), TMN-0635 T-1152	SP	0.63	0.075		3	0 7 14 21	1.3 0.8 0.46 0.3	0.07 0.09 0.09 0.07
France, Loupiac, (Loring), TMN-0635 T-1154	SP	0.63	0.075		3	44	0.07	0.02
France, Barbentane, 1996 (Silver King), TMN-0635A (96575AV1)	SP	1.1	0.16	714	1	0 3 7 18	2.0, 2.0 2.5, 2.3 1.9, 1.1 1.3, 0.95	0.07, 0.07 0.21, 0.19 1.1, 0.90 0.91, 0.72
Greece, Goumenissa, 1995 (Robodou), TMN-0635AA (95710GR1	SP	1.2	0.075		3	15	1.4, 0.97	0.22, 0.15

PEACHES Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Greece, W Macedonia, 1996 (Andros), TMN-0634E (96665GR1)	SP	1.2	0.075	1600	3	15	0.51, 0.63	0.12, 0.16
Italy, Cunio, 1990 (Crest Haven), TMN-0625 OR23	WP	0.84	0.038		1	59	0.11	0.02
Italy, Cunio, 1990 (Crest Haven), TMN-0625 OR23	WP	1.7	0.076		1	59	0.17	0.08
Italy, Ravenna, 1990 (Fantasia), Nectarine, TMN-0625 OR25	WP	0.77	0.04		1	60	0.04	0.03
Italy, Ravenna, 1990 (Fantasia), Nectarine, TMN-0625 OR25	WP	1.5	0.08		1	60	0.07	0.03
Italy, Verona, TMN-0625 OR25 (Guily Lady), TMN-0625 OR24	WP	0.75	0.038	2000	1	61	0.03	0.03
Italy, Verona, 1990 (Guily Lady), TMN-0625 OR24	WP	1.5	0.075	2000	1	61	0.07	0.05
Italy, Ferrara, 1996 (Suncrest), TMN-0634G (SIP1030)	SP	1.0	0.10	1500	2	21	0.10	0.03
Spain, Valencia, 1994 (May Crest), TMN-0635B (94618SE1)	SP	1.6 1.5	0.075		1 +1	15	0.73, 1.0	0.20, 0.28
Spain, Valencia, 1994 (Spring Crest), TMN-0635B (94618SE2)	SP	1.6 1.7	0.075		1 +1	15	1.4, 0.96 c0.03	0.35, 0.27 c0.017
Spain, Valencia, 1999 (Federica), TMN-634J (99175S1)	SP	0.89	0.075		3	21	<0.02	0.02

c = result obtained from control sample.

Note. Summary data only were available for reference TMN-0625, trials OR23, OR24 and OR25.

Table 40. Acephate residues in plums resulting from supervised trials in France, Germany, Italy, South Africa and the UK.

PLUMS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
France, Fabregues, 1995 (Reine Claude Bavay), TMN-0641A (95545AV2)	SP	1.0	0.15	667		0 2 7 21	0.25, 0.18 0.15, 0.25 0.16, 0.17 0.16, 0.15	<0.01, <0.01 <0.01, <0.01 <0.01, <0.01 0.02, 0.01
France, Saint Loubes, 1995 (Prune d'Ente), TMN-0641A (95545BX1)	SP	1.0	0.33	305	1	0 3 7 21	1.7, 0.91 1.1, 0.58 1.1, 0.94 1.3, 1,59	<0.01, <0.01 0.06, 0.03 0.11, 0.12 0.28, 0.28
France, Vallagregues, 1995 (Reine Claude Doree), TMN-0641A (95545AV1)	SP	1.0	0.15	667		19	0.06, 0.07	<0.01, <0.01
France, Sorgues, 1996 (Stanley), TMN-0641B (96574AV1)	SP	1.1	0.19	597		0 2 7 21 21	0.15, 0.41, 0.31 0.45, 0.39 0.35, 0.42 0.84, 0.86 excl stone 1.2, 1.3	<0.01, <0.01 0.01, 0.18 0.27, 0.54 0.12 excl stone 0.08, 0.07
France, St Loubes, 1996 (d'Ente), TMN-0641B (96574BX1)	SP	1.1	0.37	305		0 2 7 21 21	0.31, 0.19 0.59, 0.15 0.22, 0.74 0.76, 1.1 excl stone 1.0, 0.86	0.01, <0.01 0.04, 0.01 0.09, <0.01 0.01 excl stone 0.11, 0.1
Germany, Neuenhain, 1976 (Ersinger), TMN-0641 T-1528	SP	1.0	0.05	2000	2	0 14 21 28	0.33 0.22 0.14 0.11	0.03 0.03 0.02 0.01
Germany, Neuenhain, 1976 (Fey), TMN-0641 T-1530	SP	1.0	0.05	2000	2	0 14 21 28 42 56	0.75 0.26 0.15 0.12 0.09 0.07	0.10 0.05 0.03 0.01 <0.01 <0.01

PLUMS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Germany, Neuenhain, 1976 (Lutzelsachser), TMN-0641 T-1529	SP	1.0	0.05	2000	2	0 14 21 28	0.38 0.18 0.24 0.18	0.06 0.03 0.04 0.02
Germany, Neuenhain, 1976 (Nonnenhorn), TMN-0641 T-1552	SP	1.0	0.05	2000	2	0 14 21 28 42 56	0.81 0.38 0.28 0.15 0.21 0.35	0.09 0.06 0.04 0.02 0.02 0.03
Italy, Ferrara, 1996 (Angelena), TMN-0641C (SIP1033)	SP	1.0	0.10	1000	1	21	0.24	<0.05
Italy, Ferrara, 1996 (Sungold), TMN-0641D (SIP1067)	SP	1.0	0.10	1000	1	21	0.47	0.02
South Africa, Stellenbosch, 1979 (Golden King), TMN-0641 T-1764	SP		0.038		1	7 16 22 30 37 43 51	0.37 0.12 0.06 0.08 <0.05 <0.05 <0.05	0.02 <0.02 <0.02 <0.02 <0.02 <0.02 <0.02
South Africa, Stellenbosch, 1979 (Golden King), TMN-0641 T-1764	SP		0.075		1	30 43 51	0.25 <0.05 0.07	0.04 <0.02 <0.02
UK, Kent, 1974 (Czar), TMN-0641 T-1285	SP	1.3	0.07		1	15	2.7	0.23
UK, Kent, 1974 (Giant Prune), TMN-0641 T-1287	SP	1.3	0.056	2247	1	37	0.68	0.04
UK, Kent, 1974 (Victoria), TMN-0641 T-1286	SP	1.3	0.056	2247	1	34	1.4	0.09

Table 41. Acephate residues in leeks resulting from supervised trials in France, Germany and the Netherlands.

LEEKS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
France, Gironde, 1972 (Long de Mezieres), TMN-0616 T-1030	SP	1.1	0.11	1000	6	1 11 21 28	1.2 0.40 0.45 0.06	0.05 0.04 0.03 0.01
France, Limas, 1974 (Bleu de Salaise), TMN-0616 T-1297	SP	0.45		600	1	7	0.47	0.04
France, Graveson, 1975 (Long de Liege), TMN-0616 T-1422	SP	0.5		1000	1	13	0.16 cooked <0.02	0.02 cooked <0.01
Germany, Büttelborn, 1976 (Elefant), TMN-0616 T-1518	SP	0.15 0.3 0.15		600	1 +1 +1	0 7 10 14 21	0.23 0.56 0.46 0.02 0.10	<0.01 0.06 0.05 <0.01 0.01
Germany, Büttelborn, 1976 (Malabar), TMN-0616 T-1517	SP	0.15 0.3 0.15		600	1 +1 +1	0 7 10 14 21	0.51 0.32 0.45 c0.06 0.05 0.07	<0.01 0.01 0.03 <0.01 <0.01
Germany, Büttelborn, 1976 (Seigfried), TMN-0616 T-1519	SP	0.15 0.3 0.15		600	1 +1 +1	0 7 10 14 21	0.44 0.25 0.37 0.04 0.22	<0.01 0.03 0.04 <0.01 0.03
Netherlands, Drunen, 1996 (Davina), TMN-0616A 96674NL4	SP	0.82	0.16	520	4	21	0.37	0.03

LEEKS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Netherlands, Etten-Leur, 1996 (Farinto), TMN-0616A 96674NL3	SP	0.79 0.80 0.78 0.80	0.16	502 514 499 510	1 +1 +1 +1	21	0.33	0.04
Netherlands, Etten-Leur, 1996 (Farinto), TMN-0616A 96674NL1	SP	0.78 0.81 0.80 0.78	0.16	490 517 513 500	1 +1 +1 +1	21	0.48	0.07
Netherlands, Haarsteeg, 1996 (Upton), TMN-0616A 96674NL2	SP	0.81 0.78 0.80	0.16	520 500 510	1 +2 +1	21	0.29	0.02

c = result obtained from control sample.

Table 42. Acephate residues in broccoli resulting from supervised trials in Canada and the USA.

BROCCOLI Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Canada, Ontario, 1976 (Atlantic), TMN-0546 T-3752	SP	0.84		600	3	14	0.1	0.06
USA, California, 1970 (Pacifica), TMN-0544 T-2052 (a)	SP	1.1	0.4	280	6	0 3 7 14	5.7 c0.04 5.6 4.8 1.8	0.67 0.63 0.75 0.38
USA, California, 1970 (Pacifica), TMN-0544 T-2052 (b)	SP	2.2	0.8	280	6	0 3 7 14 3 7 14	18 18 13 4.3 washed 12 washed 8.2 washed 3.8	1.7 1.7 1.7 0.83 washed 1.3 washed 1.1 washed 0.75
USA, New Jersey, 1970, TMN-0546 T- 2060 (a)	SP	1.1			9	0 3 7 14	15 17 12 2.5	1.8 1.5 1.3 0.76
USA, New Jersey, 1970, TMN-0546 T- 2060 (b)	SP	2.2			9	0 3 7 14	29 24 23 6.0	3.5 2.4 2.5 1.3
USA, California, 1971 (Hybrid 10), TMN-0544 T-2169 (a)	SP	0.56 1.1			2 +3	14	0.14	0.05
USA, California, (Hybrid 10), TMN- 0546 T-2168 (a)	SP	1.1 0.56			3 +2	14	0.31	0.11
USA, California, 1971 (Hybrid 10), TMN-0544 T-2169 (b)	SP	2.2			1	42	0.05	<0.01
USA, California, 1971 (Hybrid 10), TMN-0546 T-2168 (b)	SP	2.2 0.56			1 +2	14	0.27	0.09
USA, California, 1971 (Hybrid 10), TMN-0544 T-2169 (c)	SP	4.5			1	42	<0.02	<0.01
USA, California, 1971 (Hybrid 10), TMN-0546 T-2168 (c)	SP	4.5 0.56			1 +1	14	0.24	0.07
USA, California, 1971 (Hybrid 10), TMN-0544 T-2169 (d)	SP	6.7			1	42	<0.02	<0.01
USA, California, 1971 (Hybrid 10), TMN-0546 T-2168 (d)	SP	6.7			1	42	0.08	0.04
USA, California, 1971 (Hybrid 10), TMN-0544 T-2169 (e)	SP	9.0			1	42	0.03	0.02
USA, California, 1971 (Hybrid 10), TMN-0546 T-2168 (e)	SP	9.0			1	42	0.1	0.05
USA, New Jersey, 1972 (Atlantic), TMN-0546 T-2271 (a)	SP	0.56		47 (air)	3	7 14	0.09 <0.02	0.02 <0.01

BROCCOLI Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
USA, New Jersey, 1972 (Atlantic), TMN-0546 T-2271 (c)	SP	0.56			3	7 14	0.38 0.04	0.1 <0.01
USA, New Jersey, 1972 (Atlantic), TMN-0546 T-2273 (a)	SP	0.56			6	7 14	0.31 0.04	0.1 0.02
USA, New Jersey, 1972 (Atlantic), TMN-0546 T-2271 (b)	SP	1.1		47 (air)	3	7 14	0.28 0.03	0.05 <0.01
USA, New Jersey, 1972 (Atlantic), TMN-0546 T-2271 (d)	SP	1.1			3	7 14	0.83 0.07	0.22 0.03
USA, New Jersey, 1972 (Atlantic), TMN-0546 T-2273 (b)	SP	1.1			6	7 14	0.58 0.15	0.19 0.05
USA, New Jersey, 1972 (Atlantic), TMN-0546 T-2954	SP	1.1			6	14 21 14 21	0.06 <0.02 with some leaf 0.61 with some leaf 0.23	0.02 <0.01 with some leaf 0.1 with some leaf 0.09
USA, California, 1973 (Var 145), TMN-0544 T-2214	SP	1.1	0.12		13	6 14	3.5 0.86	0.56 0.28

c = result obtained from control sample.

Table 43. Acephate residues in broccoli resulting from supervised trials in Australia, Brazil, France, Japan and Spain.

BROCCOLI Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Australia, South Australia, 1995 (Marathon), TMN-0621B AgrEvo/9510	SP	0.98		475	6	7 14 21 28	<0.02, <0.02 0.02, <0.02 0.02, 0.12 <0.02, <0.02	<0.02, <0.02 0.02, <0.02 0.08, 0.04 <0.02, <0.02
Australia, South Australia, 1995 (Marathon), TMN-0621B AgrEvo/9510	SP	2.0		475	6	7 14 21 28	3.0, 3.1 1.6, 3.4 0.29, 0.58 0.02, 0.02	0.41, 0.52 0.34, 0.52 0.06, 0.17 <0.02, <0.02
Brazil, Colombo-PR, 1995 (Ramos Piracicaba), TMN-0543A T1	SP	0.75	0.075	1000	1	0	7.3	-
Brazil, Colombo-PR, 1995 (Ramos Piracicaba), TMN-0543A T3	SP	0.75	0.075	1000	3	7	2.3	-
Brazil, Colombo-PR, 1995 (Ramos Piracicaba), TMN-0543A T5	SP	0.75	0.075	1000	3	14	0.2	-
Brazil, Colombo-PR, 1995 Ramos Piracicaba), TMN-0543A T7	SP	0.75	0.075	1000	3	21	<0.10	-
Brazil, Colombo-PR, 1995 (Ramos Piracicaba), TMN-0543A T2	SP	1.5	0.15	1000	1	0	12	-
Brazil, Colombo-PR, 1995 (Ramos Piracicaba), TMN-0543A T4	SP	1.5	0.15	1000	3	7	6.5	-
Brazil, Colombo-PR, 1995 (Ramos Piracicaba), TMN-0543A T6	SP	1.5	0.15	1000	3	14	0.3	-
Brazil, Colombo-PR, 1995 (Ramos Piracicaba), TMN-0543A T8	SP	1.5	0.15	1000	3	21	<0.10	-
France, Bretagne, 1992 (Marathon), TMN-0543 35 03 A	SP	0.75		300	3	7	0.32	-
France, Bretagne, 1992 (Marathon), TMN-0543 35 03 B	SP	0.75		300	3	7	0.03	-
France, Fontaine l'Etalon, 1995 (Marathon), TNM-0543C 95-542-AM1	SP	0.75	0.25	300	3	0 (2hr) 3 7 14	0.37 0.06 <0.01 <0.01	<0.01 <0.01 <0.01 <0.01
France, Saint Coulomb, 1995 (Marathon), TMN-0543C 95-542-RN1	SP	0.74	0.22	325	3	0 (2hr) 3 7 14	2.2 0.25 0.15 0.03	0.13 0.08 0.05 0.016

BROCCOLI Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	For m	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
France, Fontaine l'Etalon, 1996 (Marathon), TMN-0543E 96-570RAM1	SP	1.1	0.22		1	14	0.23, 0.34	0.07, 0.10
France, St Malo, 1996 (Marathon), TMN-0543E 96-570RN1	SP	1.1	0.32		3	13	0.21, 0.30	0.09, 0.09
Japan, Aichi, 1993 (Ryokurei), TMN-0545 Aichi	WP	1.3		2500	3	7 14 21	4.2 1.3 1.2	0.96 0.42 0.47
Japan, Nagano, 1993 (Haitsu), TMN-0545 Nagano	WP	1.3		2500	3	7 14 21	0.74 0.16 0.008	0.17 0.04 0.008
Spain, Almusafes, 1995 (Captain F1), TMN-0543B EA950152	SP	1.1 1.1 1.2	0.11	996 974 1022	1 +1 +1	14	0.05	0.03
Spain, Valencia, 1995 (Marathon), TMN-0543D 95-722	SP	1.0 1.0 1.1	0.15 0.059 0.064		1 +1 +1	0 3 7 14 21	4.9, 6.3 4.3, 5.2 2.4, 2.6 1.2, 1.2 0.3, 0.35	0.18, 0.23 0.28, 0.28 0.29, 0.33 0.31, 0.33 0.14, 0.15

Table 44. Acephate residues in Brussels sprouts resulting from supervised trials in Australia, Belgium, Germany, the Netherlands, South Africa, the UK and the USA.

BRUSSELS SPROUTS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Australia, New South Wales, 1995 (Stevens), TMN-0621B AgrEvo/9510	SP	0.98		400	6	1 3 5 7	0.58, 0.78 0.43, 1.3 0.82, 1.0 1.3, 1.5	0.05, 0.09 0.05, 0.12 0.07, 0.09 0.10, 0.11
Australia, New South Wales, 1995 (Stevens), TMN-0621B AgrEvo/9510	SP	2.0		400	6	1 3 5 7	1.4, 1.6 2.1, 2.6 1.7, 3.5 1.7, 2.3	0.13, 0.13 0.15, 0.17 0.13, 0.22 0.12, 0.15
Australia, South Australia, 1995 (Stevens), TMN-0621B AgrEvo/9510	SP	0.98		475	6	1 3 5 7	3.9, 2.8 2.6, 7.1 1.1, 2.2 4.8, 12	0.3, 0.3 0.2, 0.4 0.1, 0.2 0.8, 1.0
Australia, South Australia, 1995 (Stevens), TMN-0621B AgrEvo/9510	SP	2.0		475	6	1 3 5 7	20, 21 13, 15 19, 10 10, 16	1.0, 1.3 0.9, 0.9 0.6, 1.4 0.8, 0.9
Belgium, Wavre St Catherine, 1972, TMN-0621A	SP		0.025		1	3	0.09	0.95
Belgium, Wavre St Catherine, 1972, TMN-0621A	SP		0.05		1	3	0.13	1.4
Germany, Frankfurt am Main, 1976 (Hild's Ideal), TMN-0547 T-1502	SP	0.25 0.50 0.25		1000 1000 1000	1 +1 +1	0 7 10 14 21	0.83 0.52 0.30 0.36 0.14	0.05 0.06 0.05 0.05 0.03
Germany, Frankfurt am Main, 1976 (Huizer Abunda), TMN-0547 T-1503	SP	0.25 0.50 0.25		1000 1000 1000	1 +1 +1	0 7 10 14 21	1.9 2.0 2.0 0.69 0.84	0.13 0.19 0.23 0.13 0.12
Netherlands, Rockanje, 1975 (Perfect Line), TMN-0547 T-1454 (a)	SP	0.75		600	2	14 21 28	0.70 0.43 0.94	0.08 0.05 0.13
Netherlands, Rockanje, 1975 (Perfect Line), TMN-0547 T-1454 (b)	SP	0.75		600	2	14 21 28	0.84 0.83 1.0	0.09 0.07 0.12

BRUSSELS SPROUTS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
South Africa, Stellenbosch, 1972, TMN-0547 T-1021	SP	0.56	0.056		3	1 4 8 14 21	3.0 2.9 1.5 1.3 0.81	0.10 0.14 0.09 0.10 0.06
UK, Levington, 1975 (Gravendeel), TMN-0547 T-1445 (a)	SP	0.68		900	2	117	<0.02	<0.01
UK, Levington, 1975 (Gravendeel), TMN-0547 T-1445 (b)	SP	0.9		900	2	117	<0.02	<0.01
USA, California, 1971, TMN-0547A T-2077	SP	1.1		327	8	0 3 7 14	2.1 c0.03 3.2 c0.04 3.8 c0.13 1.2	0.09 0.1 0.13 0.07
USA, California, 1971, TMN-0547A T-2078	SP	1.1		327	8	0 3 7 14	6.0 2.3 0.83 c0.03 0.68	0.21 0.1 0.05 0.05
USA, California, 1971, TMN-0547A T-2077	SP	2.2		327	8	0 3 7 14	4.4 c0.03 7.4 c0.04 6.4 c0.13 2.6	0.18 0.21 0.21 0.13
USA, California, 1971, TMN-0547A T-2078	SP	2.2		327	8	0 3 7 14	9.0 6.8 3.0 c0.03 1.8	0.36 0.27 0.15 0.1
USA, New Jersey, 1971 (Jade Cross), TMN-0547A T-2079	SP	1.1		327	8	0 3 7 14	5.1 c0.02 0.67 0.29 c0.08 0.17 c0.03	0.23 0.05 0.04 0.04
USA, New Jersey, 1971 (Jade Cross), TMN-0547A T-2079	SP	2.2		468	5	0 3 7 14	3.6 c0.02 0.37 0.5 c0.08 0.07 c0.03	0.1 0.03 0.03 <0.01
USA, California, 1972 (Jade Cross), TMN-0547A T-2274	SP	1.1	0.36		8	0 3 7	2.3 2.5 0.87	0.07 0.09 0.07
USA, California, 1972 (Jade Cross), TMN-0547A T-2275	SP	1.1	0.36		8	0 3 7	0.94 0.7 c0.03 0.61	0.07 0.08 0.05

c = result obtained from control sample.

Table 45. Acephate residues in cabbages resulting from supervised trials in Australia, Brazil, Canada, France, Germany, Japan, the Netherlands, South Africa, the UK and the USA.

CABBAGES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Australia, South Australia, 1995, (Savoy), TMN-0621B AgrEvo/9510	SP	0.98		475	6	1 3 5 7	3.2, 3.8 7.0, 18 10, 17 15, 22	0.2, 0.3 0.3, 0.8 0.8, 1.0 1.2, 1.5
Australia, South Australia, 1995, (Savoy), TMN-0621B AgrEvo/9510	SP	2.0		475	6	1 3 5 7	5.1, 3.6 17, 21 14, 17 7.5, 12	0.3, 2.6 0.9, 1.6 1.0, 1.2 0.7, 1.0
Brazil, 1994, (Capitata) TMN-0548A 21405/94	SP	0.26		350	3	7 14 21	leaves <0.05 leaves <0.05 leaves <0.05	
Brazil, 1994, (Capitata) TMN-0548A 21405/94	SP	0.52		350	3	7 14 21	leaves <0.05 leaves <0.05 leaves <0.05	

CABBAGES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Canada, Quebec, 1976, (Green Storing), TMN-0551 T-3755	SP	0.84		655	5	0 7	0.12 0.08	0.01 <0.01
Canada, Quebec, 1976, (Green Storing), TMN-0551 T-3755	SP	1.1		655	5	0 7	0.11 0.13	0.01 0.02
Canada, Ontario, 1977, (Pennsylvania Ballhead), TMN-0551 T-4223	SP	0.84		673	3	3	0.16	0.03
France, Villefranche, 1973, (Quintal d'Alsace), TMN-0549 T-1170	EC	0.3	0.05		1	0 7 14 21	1.8 2.0 0.22 0.13	0.06 0.17 0.02 0.04
France, Villefranche, 1973, (Quintal d'Alsace), TMN-0549 T-1171	EC	0.5	0.05		1	0 7 14 21	2.6 2.2 0.15 0.06	0.13 0.23 0.03 0.02
France, Villefranche, 1973, (Quintal d'Alsace), TMN-0549 T-1172	SP	0.53	0.052		1	0 7 14 21	1.3 0.16 0.54 0.04	0.10 0.03 0.09 0.02
France, Limas, (Cabus Quintal), TMN-0549 T-1296	SP	0.45		600	1	7	0.06, <0.02 (2)	<0.01 (3)
France, Limas, 1974, (Cabus Quintal), TMN-0549 T-1300	SP	0.53	0.052		3	7	0.05, 0.03, <0.02	<0.01 (3)
France, Rognonas, 1976, (Choux Verts des 4 Saisons), TMN-0549 T-1481	SP	0.75		996	3	0 7 10 14	0.98 0.85 0.80 0.87	0.05 0.07 0.07 0.09
Germany, Frankfurt am Main, 1976, (Langendijker Herbst) White cabbage, TMN-0549 T-1501	SP	0.25 0.5 0.25		1000 1000 1000	1 +1 +1	0 7 10 14 21	0.04 0.03 0.06 0.03 0.03	<0.01 <0.01 <0.01 <0.01 <0.01
Germany, Frankfurt am Main, 1976, (Marner September) Savoy cabbage, TMN-0554 T-1498	SP	0.25 0.5 0.25		1000 1000 1000	1 +1 +1	0 7 10 14 21	1.0 0.03 0.09 0.06 <0.02	0.03 <0.01 <0.01 <0.01 <0.01
Germany, Frankfurt am Main, 1976, (Langendijker Herbst) Savoy cabbage, TMN-0554 T-1499	SP	0.25 0.5 0.25		1000 1000 1000	1 +1 +1	0 7 10 14 21	0.53 0.18 0.02 0.03 0.05	0.03 0.03 <0.01 <0.01 <0.01
Germany, Frankfurt am Main, 1976, (Marner September) White cabbage, TMN-0549 T-1500	SP	0.25 0.5 0.25		1000 1000 1000	1 +1 +1	0 7 10 14 21	0.13 0.03 0.03 0.03 <0.02	<0.01 <0.01 <0.01 <0.01 <0.01
Japan, Ishikawa AES, 1987, (Syutoko), TMN-0624	WP	1.5		1500	3	6 13 19	0.66 0.46 0.14	0.14 0.14 0.06
Japan, Chiba AES, 1988, (Kinkei-201), TMN-0624	WP	1.8		1800	3	6 13 19	0.06 0.03 0.10	0.01 0.008 0.016
Japan, 1992, (Kinkei-201), TMN-0548, 50 g ai/kg formulation	GR	3.0			3	14 21 30	0.99 0.61 0.17	0.23 0.17 0.08
Japan, 1992, (Syosyu), TMN-0548, 50 g ai/kg formulation	GR	3.0			3	14 21 30	0.96 1.9 0.32	0.26 0.33 0.11
Netherlands, Rysoord, 1972, (Vroege Zomerrode) Red cabbage, TMN-0553 T-1057	SP	1.0	0.075		1	14	0.32	0.04

CABBAGES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
South Africa, Stellenbosch, 1972, TMN-0552 T-1023	SP	0.56	0.056		1	1 4 8 14 21	4.0 c0.05 3.1 c0.02 2.4 c0.1 2.0 1.2 c0.06	0.22 0.17 0.18 c0.004 0.18 0.13 c0.003
UK, Levington, 1975, (January King), TMN-0549 T-1444	SP	0.68		900	1	103	<0.02	<0.01
UK, Levington, 1975, (January King), TMN-0549 T-1444	SP	0.9		900	1	103	<0.02	<0.01
USA, Iowa, 1972, (Danish Fallhead), TMN-0549A T-2270	SP	1.1			7	0 3 7	0.23 0.21 0.08	0.03 0.02 0.01
USA, Mississippi, 1972, (Early Jersey Wakefield), TMN-0549A T-2268	SP	1.1			8	0 3 7	2.2 1.6 0.6	0.13 0.13 0.08
USA, Arizona, 1977, (Golden Acre 17000 A1), TMN-0549A T-3812	SP	1.1		187	4	21 28 35	1.5 c0.02 1.0 c0.04 0.72	0.17 0.09 0.08
USA, Florida, 1977, (Market Prize), TMN-0549A T-3864	SP		0.03		5	14	0.23	0.05
USA, Florida, 1977, (Market Prize), TMN-0549A T-3864	SP		0.06		5	14	0.31	0.08
USA, Florida, 1977, (Market Prize), TMN-0549A T-3864	SP		0.12		5	14	0.87	0.12
USA, Florida, 1977, (Market Prize), TMN-0549A T-3864	SP	0.28		2030	5	14	0.04	0.01
USA, Florida, 1977, (Market Prize), TMN-0549A T-3864	SP	0.56		2030	5	14	0.10	0.03
USA, Florida, 1977, (Market Prize), TMN-0549A T-3864	SP	1.1		2030	5	14	0.20	0.05
USA, Florida, 1977, (Market Prize), TMN-0549A T-3864	SP	1.1			5	14	1.5	0.18
USA, New York, 1977, (Roundup), TMN-0551 T-3931	SP	1.1		313	4	21 27 34	0.1 0.06 0.02	0.03 0.02 <0.01
USA, North Carolina, 1977, (Market Prize), TMN-0549A T-4125	SP	1.1		907	5	21 28 35	0.72 0.11 0.10	0.14 0.04 0.03
USA, Texas, 1977, (Rio Verde), TMN-0549A T-3811	SP	1.1		187	9	21 28 35	1.2 1.2 0.52	0.22 0.27 0.17
USA, Texas, 1977, (Rio Verde), TMN-0549A T-3811	SP	1.1		187	9	21 28 35	1.6 1.3 0.71	0.34 0.32 0.28
USA, Wisconsin, 1977, (Globe), TMN-0551 T-3934	SP	1.1		561	4	21 28 35	0.09 0.06 0.02	0.02 0.01 <0.01

c = result obtained from control sample.

Table 46. Acephate residues in cauliflowers resulting from supervised trials in Australia, Brazil, France, Germany, Italy and the Netherlands.

CAULIFLOWERS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Australia, New South Wales, 1995 (Atlantis), TMN-0621B AgrEvo/9510	SP	0.98		400	6	1 3 5 7	1.5, 1.2 0.47, 0.81 0.64, 0.80 0.72, 1.4	0.11, 0.11 0.05, 0.09 0.10, 0.09 0.12, 0.20
Australia, New South Wales, 1995 (Atlantis), TMN-0621B AgrEvo/9510	SP	2.0		400	6	1 3 5 7	3.2, 4.9 2.8, 3.4 1.1, 3.3 2.4, 2.3	0.31, 0.39 0.26, 0.30 0.17, 0.36 0.27, 0.28
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	1.5	0.15	1000	3	21	<0.1	
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	1.5	0.15	1000	2	14	0.3	
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	1.5	0.15	1000	3	7	2.3	
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	1.5	0.15	1000	1	0	7.1	
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	0.75	0.075	1000	3	21	<0.1	
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	0.75	0.075	1000	2	14	0.1	
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	0.75	0.075	1000	3	7	1.2	
Brazil, Colombo, 1995 (Piracicaba Precoce), TMN-0560B	SP	0.75	0.075	1000	1	0	5.3	
France, Graveson, 1975 (Nain Hatif d'Erfurt), TMN-0560 T-1420	SP	0.5		1500	1	14	0.02	<0.01
France, Villandrout, 1988 (Siria), TMN-0560 T-2373	SP	1.3		938	2	21	0.38 c0.31	0.17 c0.1
France, Villandrout, 1988 (Siria), TMN-0560 T-2373	SP	1.3		938	1	14 21	1.5 1.0 c0.31	0.21 0.19 c0.1
France, Saint Coulomb, 1995 (Sirente), TMN-0560E 95-561RN1	SP	0.73 0.75 0.74		321 333 310	1 +1 +1	7	0.15	0.03
France, Saint Coulomb, 1995 (White Ball), TMN-0560D 95-543RN1	SP	0.75		180	3	0 (2 hr) 2 4 7	0.20 0.21 0.14 0.1	0.01 0.02 0.02 0.01
France, Velleron, 1995, TMN-0560D 95-543AV1	SP	0.75 0.73		235 229	2 +1	0 (2 hr) 2 4 7	0.42 0.09 0.06 0.03	0.04 0.02 0.02 0.01
France, Saint Coulomb, 1996 (Castelgrant), TMN-0560F 95-572RN1	SP	1.1 1.1 1.1		291 300 286	1 +1 +1	0 (2 hr) 3 6 13	0.27 0.26 0.19 0.17	0.04 0.04 0.03 0.04
France, St Malo, 1996 (Sirente), TMN-0560G 96-571RN1	SP	1.1 1.1 1.1	0.34	310 325 318	1 +1 +1	13	0.07	<0.01
France, Trizay, 1996 (Fremonte), TMN-0560G 96-571BX1	SP	1.1	0.23	500	3	14	0.08	<0.01
France, Velleron, 1996 (Montford), TMN-0560G 96-571AV1	SP	1.1	0.37	303	3	14	0.18	0.05

CAULIFLOWERS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
Germany, Frankfurt a Main, 1976 (Flora Blanca), TMN-0560 T-1506	SP	0.25 0.50 0.25		1000	1 +1 +1	0 7 10 14 21	0.45 0.12 0.31 0.39 0.04	0.03 0.02 0.06 0.06 0.01
Italy, Latina, 1991 (ASG120), TMN-0625 OR5 Summary	WP	0.47		1000	1	26	<0.01	0.04
Italy, Latina, 1991 (ASG120), TMN-0625 OR5 Summary	WP	0.47		1000	1	33	<0.01	0.064
Italy, Latina, 1991 (ASG120), TMN-0625 OR5 Summary	WP	0.94		1000	1	26	0.01	0.09
Italy, Latina, 1991 (ASG120), TMN-0625 OR5	WP	0.94		1000	1	33	<0.01	0.101
Italy, Latina, 1991 (Gigante di Napoli), TMN-0625 OR6	WP	0.47		1000	1	26	<0.01	0.05
Italy, Latina, 1991 (Gigante di Napoli), TMN-0625 OR6	WP	0.47		1000	1	33	<0.01	0.037
Italy, Latina, 1991 (Gigante di Napoli), TMN-0625 OR6	WP	0.94		1000	1	26	0.17	0.11
Italy, Latina, 1991 (Gigante di Napoli), TMN-0625 OR6	WP	0.94		1000	1	33	0.17	0.016
Netherlands, Rockanje, 1972, TMN-0560 T-1058	SP	1.0	0.075		1	14	0.08	0.01
Netherlands, Goudswaard, 1995 (Freemont), TMN-0560C 95-761NL2	SP	0.76 0.78 0.76	0.094	813 834 803	1 +1 +2	13	0.02	≤0.01
Netherlands, Goudswaard, 1995 (Freemont), TMN-0560C 95-761NL2	SP	0.73 0.77	0.094	779 820	1 +2	28	<0.01	<0.01
Netherlands, Hoogkarspel, 1995 (Freemont), TMN-0560C 95-761NL4	SP	0.79 0.76 0.74	0.094	843 807 793	1 +1 +1	19	0.03	0.01
Netherlands, Hoogkarspel, 1995 (Freemont), TMN-0560C 95-761NL4	SP	0.79 0.75 0.74 0.75	0.094	843 802 790 797	1 +1 +1 +1	11	0.11	0.03
Netherlands, Mijnsheerenland, 1995 (Freemont), TMN-0560C 95-761NL1	SP	0.78 0.76	0.094	836 811	1 +2	28	<0.01	<0.01
Netherlands, Mijnsheerenland, 1995 (Freemont), TMN-0560C 95-761NL1	SP	0.78 0.73 0.76 0.75	0.094	835 783 813 800	1 +1 +1 +1	13	0.03	≤0.01
Netherlands, Goudswaard, 1996 (Freemont), TMN-0560H 96-669NL3	WG	0.74 0.76 0.75	0.094	782 802 791	1 +1 +1	14	0.08	0.01
Netherlands, Heml, 1996 (Freemont), TMN-0560H 96-669NL2	WG	0.77 0.75 0.72	0.094	810 795 763	1 +1 +1	14	0.07	≤0.01
Netherlands, Hoogkarspel, 1996 (Freemont), TMN-0560H 96-669NL1	WG	0.78 0.76 0.78	0.094	825 808 801	1 +1 +1	14	0.06	≤0.01
Netherlands, Hoogkarspel, 1996 (Linday), TMN-0560C 95-761NL3	SP	0.76 0.77 0.74	0.094	812 821 792	1 +1 +1	14	≤0.01	≤0.01
Netherlands, Hoogkarspel, 1996 (Linday), TMN-0560C 95-761NL3	SP	0.76 0.77 0.72	0.094	810 821 770	1 +1 +1	28	<0.01	<0.01
Netherlands, Mijnsheerenland, 1996 (Freemont), TMN-0560H 96-669NL4	WG	0.74 0.76 0.78 0.77	0.094	780 805 829 817	1 +1 +1 +1	14	0.1	0.01

c = result obtained from control sample.

Note. Summary data only were available for reference TMN-0625, trials OR5 and OR6.

Table 47. Acephate residues in cucumbers resulting from supervised trials in France, Italy, Puerto Rico, Spain and the USA.

CUCUMBERS	Application					PHI	Residues, mg/kg	
Location, year, (variety), reference	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Rognonas, 1973 (Admirable), TMN-0575 T-1163	SP	0.75	0.019	4000	1	0 3 6 14	0.5 0.4 0.80 0.24	<0.01 0.01 0.04 0.02
France, Limas, 1974, TMN-0575 T-1292	SP	0.75	0.075	1000	1	7	2.2	0.2
Italy, Brindisi, 1990 (Marketer), TMN-0575B OR 10	WP	0.49		950	1	21	0.67	0.20
Italy, Brindisi, 1990 (Marketer), TMN-0575B OR 10	WP	0.96		950	1	21	2.07	0.33
Italy, Cremona, 1990 (Marketmore), TMN-0575B OR 9	WP	0.47		1000	1	21	0.31	0.05
Italy, Cremona, 1990 (Marketmore), TMN-0575B OR 9	WP	0.94		1000	1	21	0.79	0.18
Italy, Bologna, 1995 (Darina) Indoor crop, TMN-0575D (SIP1034)	WP	1.0		1000	2	14 21	0.86, 0.71 0.14, 0.12	0.06 <0.05 <0.05 <0.05
Italy, Bologna, 1995 (Darina) Indoor crop, TMN-0575E (SIP1068)	WP	1.0		1000	2	0 3 7 14 21	1.9 2.8 2.3 0.76 0.31	0.13 0.14 0.20 0.10 0.07
Puerto Rico, 1979 (Ashley), TMN-0575C T-4674	SP	1.1		935	4	0 7 10	0.12 0.14 0.06	0.01 0.02 <0.01
Puerto Rico, 1979 (Ashley), TMN-0575C T-4674	SP	2.2		935	4	0 7 10	0.18 0.34 0.18	0.02 0.05 0.01
Spain, Almeria, 1994 (Alaska), TMN-0575A (94-621SE1)	SP	1.9 2.2	0.11	1709 1923	2 +1	0 3 7 14 21	3.6, 3.5 3.3, 3.7 3.1, 3.3 2.8, 2.9 1.8, 1.9	0.19, 0.19 0.19, 0.23 0.23, 0.20 0.20, 0.23 0.19, 0.16
USA, Florida, 1979, TMN-0575C T-4726	SP	1.1		935	4	0 7 14	2.6 0.58 0.02	0.31 0.18 0.01
USA, Florida, 1979 (Poinsett), TMN-0575C T-4815	SP	1.1		935	7	0 3 7 14	2.4 2.6 2.5 1.0	0.23 0.26 0.25 0.15
USA, Maryland, 1979 (Poinsett), TMN-0575C T-4792	SP	0.56		468	5	0 3 7 10	0.89 0.67 0.27 0.17	0.10 0.09 0.06 0.05
USA, Maryland, 1979 (Poinsett), TMN-0575C T-4792	SP	0.84		468	5	0 3 7 10	1.8 1.3 0.49 0.26	0.30 0.25 0.12 0.06
USA, Maryland, 1979 (Poinsett), TMN-0575C T-4792	SP	1.1		468	5	0 3 7 10	2.1 1.8 0.51 0.65	0.22 0.27 0.12 0.13
USA, Puerto Rico, 1979 (Ashley), TMN-0575C T-4674	SP	2.2		935	4	0 7 10	0.16, 0.20 0.31, 0.47 0.17, 0.18	0.02, 0.01 0.04, 0.05 0.01, 0.01
USA, Virginia, 1979 (Poinsett), TMN-0575C T-4798	SP	1.1		935	3	3 7	0.76 0.64	0.11 0.09

CUCUMBERS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, Washington, 1979, TMN-0575C T-4840	SP	1.1		1169	5	3 7	1.2 0.84	0.18 0.18
USA, California, 1980 (Ashley), TMN-0575C T-5076	SP	1.1		1356	4	0 3 7	0.84 1.1 1.1	0.07 0.10 0.10
USA, California, 1980 (Salab), TMN-0575C T-5045	SP	0.84		468	4	3 7	1.1 1.5	0.07 0.09
USA, California, 1980 (Salab), TMN-0575C T-5045	SP	1.1		468	4	3	2.8	0.13
USA, Georgia, 1980, TMN-0575C T-4902	SP	1.1		468	3	3 10	1.0 0.51	0.13 0.07
USA, Georgia, 1980, TMN-0575C T-4902	SP	2.2		468	3	3 10	3.4 0.72	0.28 0.08
USA, Mississippi, 1980 (Improved Long Green), TMN-0575C T-510	SP	1.1		187	2	4 7	1.0 0.6	0.16 0.09
USA, New York, 1980 (Marketmore), TMN-0575C T-5058	SP	0.84		337	4	0 3 7	1.1 0.74 1.2	0.12 0.12 0.10
USA, New York, 1980 (Marketmore), TMN-0575C T-5058	SP	1.1		337	4	0 3 7	1.5, 1.5 1.8, 2.1 1.7, 0.9	0.11, 0.16 0.14, 0.14 0.17, 0.11
USA, Texas, 1981 (Poinsett), TMN-0575C T-5187	SP	1.1		393	3	7 14	3.5 1.7	0.24 0.14

Note. Summary data only were available for reference TMN-0575B, trials OR9 and OR10.

Table 48. Acephate residues in eggplants resulting from supervised trials in France, Italy and Spain.

EGGPLANTS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Villefranche, 1973 (Longue Violette), TMN-0576 T-1174	SP	0.53	0.053		1	0 7 14 21	1.4 0.73 0.82 0.54	0.03 0.05 0.1 0.1
France, Limas, 1974, TMN-0576 T-1293	SP	0.45		600	1	7	1.0	0.05
France, Avignon, 1975 (Longue Noire de Barbentane), TMN-0576 T-1419	SP	0.53	0.053		1	14	0.09	0.01
France, Chateau Renard, 1995 (Gignac), TMN-0576C 95-546AV1	SP	0.75	0.12	625	2	0 (2h) 3 7 14	0.86, 2.2 1.0, 1.3 0.64, 0.65 0.17, 0.22	0.04, 0.09 0.12, 0.16 0.09, 0.09 0.03, 0.05
France, Generac, 1995 (Avan), TMN-0576C 95-546BX1	SP	0.75 0.75	0.26 0.24	285 313	1 +1	0 (2h) 3 7 14	0.13, 0.17 0.22, 0.47 0.24, 0.45 0.17, 0.41	0.01, 0.02 0.02, 0.05 0.03, 0.06 0.03, 0.07
Italy, Brindisi, 1990 (Tania), TMN-0576A OR13 bis	WP	0.49		1000	1	21	<0.02	<0.02
Italy, Brindisi, 1990 (Tania), TMN-0576A OR13 bis	WP	0.94		1000	1	21	<0.02	<0.02
Italy, Forli, 1990 (Lunga di Rimini), TMN-0576A OR13	WP	0.45		1000	1	21	0.04	0.03
Italy, Forli, 1990 (Lunga di Rimini), TMN-0576A OR13	WP	0.9		1000	1	21	0.07	0.03
Italy, Latina, 1990 (Prospera), TMN-0576A OR12	WP	0.41		1100	1	21	<0.005	0.011
Italy, Latina, 1990 (Prospera), TMN-0576A OR12	WP	0.60		800	1	21	0.006	0.009

EGGPLANTS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Spain, Valencia, 1994 (Soraya), TMN-0576D 94-620	SP	3.7 4.2 4.6	0.11	3254 3739 4085	1 +1 +1	0 3 7 14 21	2.4, 1.2 1.6, 1.3 1.4, 1.1 0.51, 0.44 0.08, 0.09	0.09, 0.06 0.11, 0.09 0.14, 0.12 0.07, 0.06 0.01, 0.01
Spain, Valencia, 1995 (Soraya), TMN-0576B 95-721	WG	1.0 1.1 1.1	0.11 0.08 0.07	914 1318 1464	3	0 3 7 14 21	0.35, 0.28 0.18, 0.17 0.22, 0.20 0.09, 0.09 0.02, 0.03	0.02, 0.02 0.02, 0.01 0.03, 0.02 0.01, 0.01 <0.01, <0.01

Note. Summary data only were available for reference TMN-0576A, trials OR12 and OR13.

Table 49. Acephate residues in peppers resulting from supervised trials in Canada, France, Italy, Spain and the USA.

PEPPERS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Canada, Ontario, 1976 (Midway), TMN-0639 T-3750	SP	0.84	0.25	327	1	1 3 7	1.7 0.68 0.73	0.09 0.08 0.19
Canada, Wisconsin, 1976 (Stoddans Select), TMN-0639 T-3810	SP	0.84	0.09	888	10	1 3 5 7	1.0 1.2 1.5 0.99	0.34 0.36 0.61 0.43
Canada, Ontario, 1977 (Emerald Giant), TMN-0639 T-4229	SP	0.84	0.14	608	10	3 7	4.7, 4.3, 4.6, 4.2 3.1, 3.1, 2.5, 4.8	1.5, 1.6, 1.6, 1.5 1.4, 1.3, 1.2, 2.2
Canada, Ontario, 1977 (Emerald Giant), TMN-0639 T-4230	SP	0.84		327	7	3 7	1.6, 1.3, 1.6, 1.6 1.2, 1.3, 1.1, 1.5 c0.26, 0.20	0.5, 0.4, 0.5, 0.4 0.4, 0.4, 0.3, 0.5 c0.03, 0.05
Canada, Ontario, 1977 (Staddons Select), TMN-0639 T-4231	SP	0.84	0.15	560	9	1 3 7	3.4, 3.7, 2.9, 2.7 2.9, 3.1, 4.8, 4.7 2.1, 2.4, 1.9, 3.2	1.0, 0.9, 0.7, 0.7 0.9, 0.9, 1.0, 0.9 0.8, 0.9, 0.6, 0.9
Canada, Ontario, 1978 (Californian Wonder), TMN-0639 T-4564	SP	0.84	0.13	666	1	3 7	0.90, 0.65, 0.77, 0.75 0.51, 0.46, 0.35, 0.40	0.08, 0.06, 0.09, 0.11 0.15, 0.14, 0.09, 0.10
Canada, Ontario, 1978 (Keystone), TMN-0639 T-4559	SP	0.84	0.22	374	4	3 7	2.0, 4.7, 4.0, 8.5 3.7, 2.6, 2.4, 3.3	0.66, 1.1, 1.2, 1.8 0.75, 0.80, 1.6, 1.0
Canada, Ontario, 1980 (Californian Wonder), TMN-0639 T-5253	SP	0.84	0.11	800	1	3 7	1.6, 2.1, 1.4, 2.0 1.6, 1.5, 2.1, 1.7	0.35 0.46 0.32 0.41 0.34 0.40 0.47 0.42
France, Avignon, 1973 (Westlandia) Indoor crop, TMN-0633 T-1146	SP	0.55	0.053		3	7 14 21	2.3 1.3 0.34	0.59 0.49 0.22
France, Villefranche, 1973 (Piment Doux Caire), TMN-0633 T-1173	SP	0.53	0.053		1	0 7 13 20	0.82 0.29 0.47 0.37	0.08 0.09 0.16 0.15
France, Limas, 1974 (Piment Doux Caire), TMN-0633 T-1291	SP	0.75	0.08		1	7	2.7	0.41
France, Limas, 1974 (Piment Doux Caire), TMN-0633 T-1309	SP	0.45		600	1	7	0.69	0.14
France, Limas, 1974 (Piment Doux Caire), TMN-0633 T-1310	SP	0.45		600	3	7	1.0	0.2
France, Limas, 1974 (Piment Doux Caire), TMN-0633 T-1290	SP	0.75	0.08		1	7	2.1	0.39
France, Limas, 1974 (Piment Doux Caire), TMN-0633 T-1298	SP	0.75	0.08		3	7	1.5	0.33
France, Limas, 1974 (Piment Doux Caire), TMN-0633 T-1299	SP	0.75	0.08		3	7	1.1	0.22
France, Toulenne, 1986 (Clovis), TMN-0633 T-2174	SP	0.9	0.08	1200	1	14 21 	0.75 washed 0.68 0.21 washed 0.18	0.2 washed 0.2 0.08 washed 0.1

PEPPERS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Villandrout, 1988 (Lamuyn), TMN-0637 T-2355	SP	0.99	0.075	1320	1	14 21	0.67 1.5	0.13 0.21
France, Villandrout, 1988 (Lamuyn), TMN-0637 T-2355	SP	0.99	0.075	1320	2	21	1.0	0.35
France, Generac, 1995 (Lori), TMN-0636J (95-547BX1)	SP	0.75	0.27 0.22	277 347	1 +1	0 3 7 14	0.11 0.26 0.27 0.20	0.02 0.07 0.11 0.09
France, Saint Priest, 1995 (Osir), TMN-0636J (95-547LY1)	SP	0.75	0.23 0.15	333 500	1 +1	0 3 7 14	0.31 0.26 0.13 0.04	0.03 0.04 0.03 0.02
France, Carpentras, 1996 (Doux d'Espagne), TMN-063 (96-573AV1)	SP	1.1	0.32	347	1	14	0.98	0.30
Italy, Cremona, 1990 (Corno Bianco), TMN-0625 OR 19 Summary	WP	0.47		600	1	21	0.38	0.20
Italy, Cremona, 1990 (Corno Bianco), TMN-0625 OR 19 Summary	WP	0.94		600	1	21	0.98	0.42
Italy, Latina, 1990 (Atlantic), TMN-0625 OR 19 Summary	WP	0.43		700	1	21	0.04	0.02
Italy, Latina, 1990 Atlantic), TMN-0625 OR 19 Summary	WP	0.89		700	1	21	0.11	0.04
Italy, Latina, 1990 (Corno di Bue), TMN-0625 OR 19 Summary	WP	0.47		1000	1	21	0.14	0.11
Italy, Latina, 1990 Corno di Bue), TMN-0625 OR 19 Summary	WP	0.85		1000	1	21	0.12	0.14
Italy, Bologna, 1996 (Melody), TMN-0636N (SIP1069)	SP	1.0	0.10	1000	2	14 21	0.84 0.30	0.29 0.13
Italy, Bologna, 1996 (Melody), TMN-0636N (SIP1032)	SP	1.0	0.10	1000	2	14 21	1.1 0.34	0.25 0.13
Spain, Vecindario, 1985 (Gedeon) indoor crop, TMN-0633 T-2115	SP	0.96 0.45		800	3 +2	21	0.03	0.05
Spain, Almeria, 1994 (Espartaco) indoor crop, TMN-0636K (95-720SE1)	SP	1.0 1.1	0.049 0.042	2100 2600	1 +2	0 3 7 14 21	2.3 1.8 1.5 1.5 1.5	0.17 0.15 0.16 0.24 0.24
Spain, Almeria, 1994 (Sendor) indoor crop, TMN-0636K (95-720SE2)	SP	1.1	0.06	1800	3	0 3 7 14 21	1.9 1.9 2.3 2.2 2.2	0.11 0.13 0.21 0.32 0.34
Spain, Almeria, 1994 (Spartico) indoor crop, TMN-0637A (94-619SE1)	SP	2.3 2.6	0.11	2000 2330	2 +1	0 3 7 14 21	3.0, 3.7 2.0, 2.7 2.9, 2.6 2.9, 1.5 0.98, 1.6	0.14, 0.21 0.12, 0.20 0.20, 0.23 0.25, 0.17 0.11, 0.16
USA, Wisconsin, 1972 (Bel Aire), TMN-0639 T-2370	SP	1.1	0.36	309	6	0 3 7	2.1 1.7 1.7	0.37 0.39 0.35
USA, Florida, 1974 (Bell pepper), TMN-0638 T-2373	SP	0.56	0.06		6	0 3 7	1.2 1.7 0.88	0.31 0.31 0.25
USA, Texas, 1974 (Rio Grande), TMN-0638 T-3051	SP	1.1		47	6	0 3 7 14	0.52 0.96 0.61 0.44	0.18 0.21 0.20 0.11
USA, Michigan, 1977 (Cascabella - Hot), TMN-0636H T-4421 D	SP	0.56		748	7	6	0.62	0.23
USA, Michigan, 1977 (Cascabella - Hot), TMN-0636H T-4421 D	SP	1.1 0.56		748	4 +3	6	0.47	0.13

PEPPERS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, Michigan, 1977 (Cascabella - Hot), TMN-0636H T-4421 D	SP	1.1		748	4	29	1.2	0.34
USA, Michigan, 1977 (Hot Serrano), TMN-0636H T-4421 A	SP	0.56		748	7	6	0.55	0.26
USA, Michigan, 1977 (Hot Serrano), TMN-0636H T-4421 A	SP	1.1 0.56		748	4 +3	6	0.69	0.35
USA, Michigan, 1977 (Hungarian Wax - Hot), TMN-0636H T-4421 F	SP	0.56		748	7	7	1.2	0.27
USA, Michigan, 1977 (Hungarian Wax - Hot), TMN-0636H T-4421 F	SP	1.1 0.56		748	4 +3	7	1.3	0.35
USA, Michigan, 1977 (Hungarian Wax - Hot), TMN-0636H T-4421 F	SP	1.1		748	4	23	2.5	0.49
USA, Michigan, 1977 (Jalapeno - Hot), TMN-0636H T-4421 E	SP	0.56		748	7	6	0.43	0.17
USA, Michigan, 1977 (Jalapeno - Hot), TMN-0636H T-4421 E	SP	1.1 0.56		748	4 +3	6	0.67	0.39
USA, Michigan, 1977 (Jalapeno - Hot), TMN-0636H T-4421 E	SP	1.1		748	4	29	0.79	0.28
USA, Michigan, 1977 (Long Yellow - Sweet), TMN-0636H T-4421 H	SP	0.56		748	7	7	0.11	<0.01
USA, Michigan, 1977 (Long Yellow - Sweet), TMN-0636H T-4421 G	SP	1.1 0.56		748	6	7	0.36	<0.01
USA, Michigan, 1977 (Long Yellow - Sweet), TMN-0636H T-4421 G	SP	1.1 0.56		748	4 +2	7	0.76	<0.01
USA, Michigan, 1977, (Long Yellow - Sweet), TMN-0636H T-4421 G	SP	1.1		748	4	23	1.3	0.05
USA, Michigan, 1977 (Long Yellow - Sweet), TMN-0636H T-4421 H	SP	1.1 0.56		748	4 +3	7	0.15	<0.01
USA, Michigan, 1977(Mississippi Sport - Hot), TMN-0636H T-4421 C	SP	0.56		748	7	6	0.43	0.15
USA, Michigan, 1977 (Mississippi Sport - Hot), TMN-0636H T-4421 C	SP	1.1 0.56		748	4 +3	6	0.50	0.17
USA, Michigan, 1977 (Mississippi Sport - Hot), TMN-0636H T-4421 C	SP	1.1		748	4	29	1.2	0.3
USA, Michigan, 1977 (Sweet Cherry), TMN-0636H T-4421 B	SP	1.1 0.56		748	4 +3	6	1.1	0.43
USA, Michigan, 1977 (Sweet Cherry), TMN-0636H T-4421 B	SP	0.56		748	7	6	1.3	0.56
USA, Michigan, 1977 (Sweet Cherry), TMN-0636H T-4421 B	SP	1.1		748	4	29	1.7	0.65
USA, New Jersey, 1978 (Hot Cherry), TMN-0636H T-4634	SP	0.56		673	6	7 14	2.0 c0.1 1.2 c0.09	0.49 c0.1 0.47 c0.09
USA, New Jersey, 1978 (Hot Cherry), TMN-0636H T-4634	SP	1.1		673	6	7 14	4.8 c0.1 3.3 c0.13	1.2 c0.08 1.2 c0.13
USA, New Jersey, 1978 (Hot Cherry), TMN-0636H T-4634	SP	1.7		673	6	7 14	4.8 c0.87 3.3 c0.16	2.0 c0.3 1.3 c0.11
USA, North Carolina, 1978 (Hot Banana), TMN-0636H T-4832	SP	0.56		935	3	6	1.7	0.46
USA, North Carolina, 1978 (Hot Banana), TMN-0636H T-4832	SP	0.56		935	6	7	0.82	0.36
USA, North Carolina, 1978 (Hot Banana), TMN-0636H T-4832	SP	1.1		935	3	6	4.0	0.85
USA, North Carolina, 1978 (Hot Banana), TMN-0636H T-4832	SP	1.1		935	6	7	1.3	0.45
USA, North Carolina, 1978 (Hot Banana), TMN-0636H T-4832	SP	1.7		935	3	6	7.6	1.7
USA, North Carolina, 1978 (Hot Banana), TMN-0636H T-4832	SP	1.7		935	6	7	2.5	1.1
USA, North Carolina, 1978 (Sweet Banana), TMN-0636H T-4831	SP	0.56		935	3	6	2.4 c0.07	0.53 c0.02

PEPPERS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, North Carolina, 1978 (Sweet Banana), TMN-0636H T-4831	SP	0.56		935	6	7	1.3 c0.01	0.56 c0.01
USA, North Carolina, 1978 (Sweet Banana), TMN-0636H T-4831	SP	1.1		935	3	6	5.8 c0.07	0.98 c0.02
USA, North Carolina, 1978 (Sweet Banana), TMN-0636H T-4831	SP	1.1		935	6	7	2.2 c0.01	0.86 c0.01
USA, North Carolina, 1978 (Sweet Banana), TMN-0636H T-4831	SP	1.7		935	3	6	8.0 c0.07	1.4 c0.02
USA, North Carolina, 1978 (Sweet Banana), TMN-0636H T-4831	SP	1.7		935	6	7	4.3 c0.01	1.6 c0.01

c = result obtained from control sample.
Note. Summary data only were available for reference TMN-0625, trials OR19.

Table 50. Acephate residues in tomatoes resulting from supervised trials in Australia, Brazil, Canada, France, Italy, Japan, Spain and the USA.

TOMATOES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Australia, Queensland, 1995 (Tornado), TMN-0621B AgrEvo 9510	SP	0.98		278	6	1 3 5 7	1.6 0.88 1.8 1.6	0.43 0.26 0.5 0.3
Australia, Queensland, 1995 (Tornado), TMN-0621B AgrEvo 9510	SP	2.0		278	6	1 3 5 7	2.2 2.6 0.77 2.8	0.54 0.55 0.23 0.58
Brazil, Quarto Barras, 1994 (Angela Hyper), TMN-0672E 21257/94	SP	0.3	0.075	400	3	3 7 14	<0.05 <0.05 <0.05	
Canada, Ontario, 1977 (New Yorker), TMN-0673A T-4221	SP	0.84		374	4	3 7	0.32 0.34	0.14 0.18
Canada, Ontario, 1978 (Campbell 28), TMN-0673A T-4566	SP	0.84	0.13	666	1	3 7	0.24 0.11	0.08 0.04
Canada, Ontario, 1980 (1630 Heinz), TMN-0673A T-5251	SP	0.84	0.1	800	4	3 7	0.53 0.4	0.17 0.15
France, Villefranche, 1973 (H63-5) Indoor crop, TMN-0672 T-1265	SP	0.79 0.83	0.05	1000	1 +1	16 22	0.29 0.19	0.04 0.06
France, Villefranche, 1973 (H63-5) Indoor crop, TMN-0672 T-1280	SP	0.79 0.83	0.05	1000	1 +1	1 7	0.59 0.13	0.04 0.03
France, Villefranche, 1973 (Marmande), TMN-0672 T-1176 experimental formulation	EC	0.5			1	0 7 13 20	0.93 0.06 0.05 0.07	0.03 <0.02 <0.02 0.03
France, Villefranche, 1973 (Marmande), TMN-0672 T-1177 experimental formulation	EC	0.53	0.053	1000	1	0 7 13 20	0.49 0.15 0.10 0.05	0.02 0.02 0.04 0.03
France, Limas, 1974 (Montfavat H36-5), TMN-0672 T-1295	SP	0.9	0.075	1200	1	7	0.54	0.05
France, Limas, 1974 (Montfavat H36-5), TMN-0672 T-1301	SP	0.9	0.075	1200	3	7	1.3	0.24
France, Limas, 1974 (Montfavat), TMN-0672 T-1311	SP	0.45	0.075	600	1	7	0.36	0.07
France, Limas, 1974 (Montfavat), TMN-0672 T-1312	SP	0.45	0.075	600	3	7	0.28	0.09
France, Chateaux Renard, 1975 (Picos), TMN-0672 T-1418	SP	0.5	0.05	995	1	14 14	0.09 cooked 0.09	0.03 cooked 0.02
France, Chateaux Renard, 1976 (A.C.E 55 Y.F), TMN-0672 T-1484	SP	0.76	0.075	1000	3	0 7 10 14	0.73 0.40 0.37 0.33	0.1 0.13 0.15 0.15

TOMATOES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, St Croix du Mont, 1986 (Rio Grande), TMN-0672 T-2377	SP	0.55	0.075	733	1	13 20	<0.05 0.08	<0.02 <0.02
France, St Croix du Mont, 1986 (Rio Grande), TMN-0672 T-2377	SP	0.55	0.075	733	2	20	0.16	0.04
France, St Croix du Mont, 1986 (Roma), TMN-0672 T-2184	SP	0.62	0.075	830	1	15 22	0.18 0.07	0.03 0.03
France, Toulenne, 1986 (Bellotte), TMN-0672 T-2173	SP	0.75	0.075	1000	1	14 14 21 21	0.42 washed 0.46 0.19 washed 0.26	0.14 washed 0.14 0.04 washed 0.07
France, Villandrout, 1986 (St Pierre), TMN-0672 T-2391	SP	1.6	0.075	2187	2	21	0.75	0.38
France, Villandrout, 1986 (St Pierre), TMN-0672 T-2391	SP	1.6	0.075	2187	1	14 21	0.42 0.07	0.06 0.06
Italy, Emilia Romagna, 1999 (Alican), TMN-0673C 99176/I1 I99011R	SP	1.0	0.1	1000	2	14 21	0.14 0.11	0.05 0.04
Italy, Venito, 1999 (Red Setter), TMN-0673C 99176/I1 I99018R	SP	1.0	0.1	1000	2	14 21	0.08 0.07	0.03 0.03
Japan, Koibuchi Gakuen, 1977 (Hikari), TMN-0624 Koibuchi Gakuen	GR	3.0	2 g ai per plant		3	1 3 7	<0.02 0.11 0.02	0.007 0.03 0.008
Japan, Nagano, 1977 (Kyoryoku-Syuko), TMN-0624 Nagano	GR	3.0	2 g ai per plant		3	1 3 7	0.15 0.37 0.02	0.006 0.015 <0.005
Japan, Kagoshima, 1984 (Kyoryoku-Syuko), TMN-0624 Kagoshima	WP	1.5	0.1	1500	2	1 3 7	0.43 0.67 0.38	0.03 0.05 0.06
Japan, Kagoshima, 1984 (Kyoryoku-Syuko), TMN-0624 Kagoshima	WP	1.5	0.1	1500	3	1 3 7	0.70 0.85 0.65	0.06 0.08 0.12
Japan, Japan Plant Protection Association, 1985 (Yuyake-A), TMN-0624 JPP Assoc	WP	1.5	0.1	1500	2	1 3 7	0.76 0.57 0.65	0.04 0.03 0.06
Japan, Japan Plant Protection Association, 1985 (Yuyake-A), TMN-0624 JPP Assoc	WP	1.5	0.1	1500	3	1 3 7	1.0 0.89 0.74	0.08 0.06 0.07
Spain, Villena, 1995 (Roma), TMN-0672F EA950154SP01	SP	1.1	0.13	1000	3	14	0.05	0.03
Spain, Valencia, 1999 (Valenciano), TMN-0673B 99175/S1 S99036R	SP	1.0	0.1	1000	2	14 21	0.18 0.12	0.11 0.06
Spain, Valencia, 1999 (Valentine), TMN-0673B 99175/S1 S99047R	SP	1.0	0.1	1000	2	14 21	0.08 0.04	0.05 0.02
USA, California, 1977 (13 L 34), TMN-0673 T-4119	SP	1.1		94 air	5	3	0.31	0.09
USA, California, 1977 (Cal Ace 6718), TMN-0673 T-4118	SP	1.1		94 air	5	3	0.08	0.02
USA, California, 1977 (VF 145-B-7879), TMN-0673 T-4120	SP	1.1		94 air	5	3	0.19	0.05
USA, Florida, 1977 (Big Boy), TMN-0673 T-3870	SP	0.28			4	3	0.16, 0.1	0.06, 0.02
USA, Florida, 1977 (Big Boy), TMN-0673 T-3870	SP	0.56			4	3	0.26, 0.11	0.08, 0.04
USA, Florida, 1977 (Big Boy), TMN-0673 T-3870	SP	1.1			4	3	0.46, 0.19	0.16, 0.07

TOMATOES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, California, 1987 (204C), TMN-0672A P73T-7112 (Lai, 1988)	SP	1.1	0.4	280	8	3	fruit 1.4 washed fruit 1.8 canned fruit 0.54 paste 5.6 canned purée 2.5 canned juice 1.3 wet pomace 0.84 dry pomace 1.4	fruit 0.08 washed fruit 0.1 canned fruit 0.04 paste 0.43 canned purée 0.17 canned juice 0.08 wet pomace 0.04 dry pomace 0.09 (paste c0.03) Moisture: 64% wet pomace 5% dry pomace
USA, California, 1993 (UC 82B), TMN-0672D V10677-C (Lai, 1995)	SP	1.1	0.4	280	6	3	1.37 washed fruit 0.29 paste 1.23 paste 1.22 purée 0.73 juice 0.33 wet pomace 0.24 dry pomace 0.43 dry pomace 0.32	0.08 washed fruit 0.06 paste 0.39 paste 0.35 purée 0.26 juice 0.09 wet pomace 0.06 dry pomace 0.05 Moisture: 77% wet pomace 7% dry pomace
USA, South Carolina, 1993 (Celebrity), TMN-0672C V10760-A	SP	1.1	0.4	280	6	3	0.28, 0.22	0.09, 0.06
USA, Ohio, 1993 (Heinz 903S), TMN-0672D V10677-A	SP	1.1	0.4	285	6	3	0.45, 0.47	0.09, 0.09
USA, California, 1993 (UC 82B), TMN-0672D V10677-B	SP	1.1	0.4	280	6	3	0.51, 0.33	0.13, 0.07

c = result obtained from control sample.

Table 51. Acephate residues in lettuce resulting from supervised trials in Belgium, Canada, France, Germany.

LETTUCE Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Belgium, Wavre St Catherine, 1972, TMN-0621A	SP		0.25		1	3	whole plant 0.59 upper leaves 0.47 lower leaves 1.1	whole plant 0.01 upper leaves 0.01 lower leaves 0.02
Belgium, Wavre St Catherine, 1972, TMN-0621A	SP		0.05		1	3	whole plant 1.2 upper leaves 1.2 lower leaves 2.1	whole plant 0.03 upper leaves 0.03 lower leaves 0.04
Canada, Ontario, 1976, Head lettuce, TMN-0618 T-3747	SP	1.1		327	3	7	5.3	0.22
Canada, Ontario, 1976 (Minetta) Head lettuce, TMN-0618 T-3748	SP	1.1		327	5	7	9.3	0.32
Canada, Ontario, 1976 (Minetta) Head lettuce, TMN-0618 T-4219	SP	1.1		374	5	7	0.80	0.15
Canada, Ontario, 1977 (Minetta) Head lettuce, TMN-0618 T-4220	SP	1.1		374	4	7	0.50	0.10
Canada, Ontario, 1979 (Minetta) Head lettuce, TMN-0618 T-4825	SP	0.75		550	3	3 7 14	0.19 <u>0.28</u> 0.07	0.03 <u>0.03</u> 0.01
France, Villefranche, 1973 (Batavia Blonde) Head lettuce, TMN-0617 T-1169	SP	0.53	0.053	1000	1	0 7 14 21	42 10 1.0 0.16 c0.21	0.75 0.49 0.09 0.03

LETTUCE Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Chateaux-Renard, 1974 (Noran) Head lettuce, indoor crop, TMN-0617 T-1264	SP	0.15	0.025	600	2	0 1 4 7 10 14 21	4.1 3.3 1.5 0.95 0.79 0.66 0.2	0.1 0.11 0.08 0.05 0.05 0.04 0.02
France, Chateaux-Renard, 1974 (Noran) Head lettuce, indoor crop, TMN-0617 T-1269	SP	0.15	0.025	600	2	0 7	5.9 1.2	0.09 0.06
France, Rognonas, 1976 (America) Head lettuce, TMN-0617 T-1483	SP	0.75	0.075	1000	2	0 7 11 15	30 7.5 1.7 1.1	0.20 0.24 0.11 0.09
France, Bazas, 1986 (America) Head lettuce, TMN-0617 T-2169	SP	0.75	0.075	1000	1	21	<0.05	<0.02
France, Bazas, 1986 (America) Head lettuce, TMN-0617 T-2169	SP	1.5	0.075	2000	1	14	0.67	0.06
Germany, Frankfurt a Main, 1976 (Blondine) Butterhead, TMN-0617 T-1497	SP	0.15 0.30 0.15		600	1 +1 +1	0 7 14 21	1.6 0.05 0.03 0.03	0.05 0.01 <0.01 <0.01
Germany, Frankfurt a Main, 1976 (Silvester) Butterhead, TMN-0617 T-1561	SP	0.15 0.30 0.15		600	1 +1 +1	0 7 10 14 21	2.9 0.37 0.27 0.16 0.06	0.12 0.04 0.04 0.02 <0.01

Table 52. Acephate residues in common beans resulting from supervised trials in Canada, France, Germany, Italy, Spain and the USA.

BEANS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Canada, Ontario, 1978 (Tender Crop - Stokes) Green beans, TMN-0540B T-4563	SP	0.84		666	1	3 7	0.86 0.72	0.2 0.22
Canada, Ontario, 1980 (Tender Crop) Green beans, TMN-0540B T-5252	SP	0.84	0.11	800	3	3 7	2.6 2.0	0.59 0.54
France, Grange Rouge, 1973 (Nain Contender), TMN-0540 T-1168, TMN-0540C T-1168	SP	0.53	0.053	1000	1	0 7 14 21	3.8 1.4 0.21 0.03	0.20 0.34 0.09 0.01
France, Villandraut, 1986 (Delinyl) French beans, TMN-0540C T-2180	SP	0.9	0.075	1200	1	14 14 21 21	1.6 washed 1.5 0.87 washed 0.96	0.35 washed 0.34 0.16 washed 0.19
France, Villandraut, 1986 (Triomphe de Farcy) French beans, TMN-0540C T-2172	SP	0.64	0.075	852	1	21 21	0.20 washed 0.14	0.05 washed 0.03
France, Villandraut, 1986 (Triomphe de Farcy) French beans, TMN-0540C T-2172	SP	1.1	0.075	1482	1	14 14	1.3 washed 0.98	0.35 washed 0.20
France, Bieujac-Langon, 1987 (Cabri) French beans, TMN-0540C T-2299	SP	0.47	0.075	625	1	21	<0.05	<0.02
France, Bieujac-Langon, 1987 (Cabri) French beans, TMN-0540C T-2299	SP	0.56	0.075	750	1	14	0.18	<0.02
France, Villandraut, 1987 (Triomphe de Farcy) French beans, TMN-0540C T-2274	SP	0.75	0.075	1000	1	17	0.15 c0.05	<0.02

BEANS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Villandraut, 1987 (Triomphe de Farcy) French beans, TMN-0540C T-2274	SP	0.9	0.075	1200	1	23	0.07 c0.05	<0.02
Germany, München-Perlach, 1976 (Favorit) French bean, TMN-0540 T-1509	SP	0.15 0.3 0.15	0.025 0.05 0.025	600	1 +1 +1	0 7 14 21	0.38 c0.03 0.16 0.08 0.09	0.03 0.04 <0.01 <0.01
Italy, Cremona, 1990 (Mondrapone) French beans, TMN-0541B OR 11	WP	0.47		1000	1	21	0.15	0.07
Italy, Cremona, 1990 (Mondrapone) French beans, TMN-0541B OR 11	WP	0.99		1000	1	21	0.26	0.18
Italy, Modena, 1995 (Etna), TMN-0541C (SIP1044)	SP	1.0	0.17	600	2	14 21	beans <0.1 beans <0.1	beans <0.1 beans <0.1
Italy, Modena, 1995 (Etna), TMN-0541D (SIP1045)	SP	1.0	0.17	600	2	14 21	straw 1.0, 0.89 straw 0.55, 0.57	0.11, 0.11 <0.10 (2)
Italy, Modena, 1995 (Etna), TMN-0541E (SIP1046)	SP	1.0	0.17	600	2	14 21	0.96, 0.73 0.72, 0.61	0.18, 0.16 0.19, 0.15
Italy, Modena, 1995 (Etna), TMN-0541F (SIP1047)	SP	1.0	0.17	600	2	14 21	shoots - pod 5.5, 9.3 shoots - pod 1.6, 1.3	0.39, 0.64 0.13 (2)
Italy, Lombardia, 1996 (Taylor's Horticultural), TMN-0540E (SIP1073)	SP	1.0	0.10	1000	2	14 21	0.92 0.81	0.13 0.15
Spain, Valencia, 1995 (Iluro) French beans, TMN-0540D (95-717SE2)	SP	1.1 1.1 1.1	0.11 0.06 0.04	960 1700 3100	1 +1 +1	0 3 7 14 21	0.70, 1.0 0.56, 0.62 0.35, 0.21 0.06, 0.03 <0.01, <0.01	0.09, 0.12 0.14, 0.14 0.13, 0.08 0.02, <0.01 0.04, <0.01
Spain, Valencia, 1995 (Musica) French beans, TMN-0540D (95-717SE1)	SP	1.0 1.1 1.1	0.05	2000 2300 2200	1 +1 +1	0 3 7 14 21	1.8, 1.3 0.79, 0.78 0.30, 0.32 0.06, 0.07 0.02, 0.02	0.25, 0.20 0.15, 0.16 0.07, 0.07 <0.01, 0.01 <0.01, <0.01
Spain, Almeria, 1996 (Semilarga) French beans, TMN-0540D (96-622A1)	SP	1.1 1.1 1.1	0.18 0.15 0.12	570 733 900	1 +1 +1	14 21	2.9, 1.8 1.0, 1.0	0.54, 0.39 0.35, 0.27
Spain, Sevilla, 1996(Contender) French beans, TMN-0540F (96-622SE1)	SP	1.1	0.09	1190	2	14 21	0.57, 0.72 0.11, 0.21	0.34, 0.45 0.07, 0.14
Spain, Valencia, 1996 (Emerite) French beans, TMN-0540D (96-622V1)	SP	1.1 1.1	0.11 0.068	416 1600	1 +2	14 21	1.2, 1.0 0.56, 0.55	0.34, 0.27 0.14, 0.14
USA, Florida, 1973 (Contender) Snap beans, TMN-0540A T-2483	SP	1.1	0.32		6	0 7 7 7 14	3.4 2.0 canned 0.26 can water 0.26 1.3	1.1 0.76 canned 0.25 can water 0.27 0.66
USA, Florida, 1973 (Contender) Snap beans, TMN-0540A T-2483	SP	2.2	0.64		3	0 7 14	6.5 6.8 5.8	1.8 2.0 2.0
USA, Florida, 1973 (Kentucky) Pole beans, TMN-0540A T-2446	SP	1.1	0.4		3	0 7	5.2 0.89	0.44 0.38
USA, Iowa, 1973 (Tender Crop) Snap beans, TMN-0540A T-2482	SP	1.1	0.24		6	0 7 14	1.4 0.55 0.11	0.19 0.14 0.02
USA, New Jersey, 1973 Snap beans, TMN-0541 T-2444	SP	1.1		47 air	4	0 7 14 	3.2 vines 90 1.6 vines 16 0.51 vines 7.7	0.33 vines 1.6 0.37 vines 1.2 0.17 vines 1.1

BEANS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, New Jersey, 1973 Snap beans, TMN-0541 T-2444	SP	1.1 1.1		47 234	4 air +1	9	1.6 canned 0.56 can water 0.61	0.55 canned 0.30 can water 0.29
USA, Oregon, 1973 (290) Snap beans, TMN-0540A T-2441	SP	1.1	0.4		3	0 7 14	3.1 vines 55 2.0 vines 13 <0.02 vines 0.03	0.46 vines 1.2 0.42 vines 1.4 <0.01 vines <0.01
USA, Oregon, 1973 (290) Snap beans, TMN-0540A T-2441	SP	2.2	0.8		3	0 7 14	7.0 5.3 0.69	0.92 1.0 0.18
USA, Florida, 1976 Snap beans, TMN-0541 T-3675	SP	0.56		56 air	8	14	0.06	0.02
USA, Illinois, 1976 Snap beans, TMN-0541 T-3743	SP	0.56		37 air	4	14	0.44	0.10
USA, Illinois, 1976 Snap beans, TMN-0541 T-3743	SP	0.56		75 air	4	14	0.79	0.15
USA, Illinois, 1976 Snap beans, TMN-0541 T-3801	SP	0.56		37 air	4	14	0.62	0.1
USA, Illinois, 1976 Snap beans, TMN-0541 T-3801	SP	0.56		75 air	4	14	1.2	0.16
USA, Wisconsin, 1976 Snap beans, TMN-0541 T-3743	SP	0.56		37 air	1	14	0.39	0.08
USA, Wisconsin, 1976 Snap beans, TMN-0541 T-3743	SP	0.56		75 air	1	14	0.91	0.19
USA, Michigan, 1979 (Tender Giant) Snap beans, TMN-0540A T-4878	SP	1.1		47 air	2	14	whole plant 0.44	whole plant 0.07
USA, Tennessee, 1979 (Early Gallatin) Snap beans, TMN-0540A T-4909	SP	1.1	0.3	374	1	14	whole plant 0.81	whole plant 0.38
USA, Tennessee, 1979 (Early Gallatin) Snap beans, TMN-0540A T-4909	SP	2.2	0.6	374	1	14	whole plant 1.5	whole plant 0.36
USA, Illinois, 1987 (Del Monte 04-21) Snap beans, TMN-0540A T-7116, TMN-0541A	SP	0.84		28 air	4	22	0.43, 0.42 washed 0.39 cooked 0.20 canned 0.03 wash water 0.07 cooking water 0.19 can water 0.02	0.12, 0.13 washed 0.12 cooked 0.07 canned 0.03 wash water 0.01 cooking water 0.07 can water 0.02
USA, Wisconsin, 1987 (Hy Style) Snap beans, TMN-0540A T-7017	SP	1.1		290	2	14	0.39, 0.32 washed 0.23 cooked 0.17 canned 0.08 wash water <0.01 cooking water 0.09 can water 0.08	0.15, 0.13 washed 0.11 cooked 0.09 canned 0.05 wash water <0.005 cooking water 0.05 can water 0.05
USA, California, 1973 Lima beans, TMN-0540A T-2481	SP	1.1		94 air	3	0 7 14	1.1 fresh beans 0.16 empty pods 1.2, 0.66 fresh beans 0.12 empty pods 0.74, 1.0 dry beans 0.22 fresh beans 0.07 empty pods 2.5	0.14 fresh beans 0.05 empty pods 0.18, 0.13 fresh beans 0.04 empty pods 0.18, 0.23 dry beans 0.13 fresh beans 0.1 empty pods 0.39

BEANS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
USA, Iowa, 1973 (Fordhook 242) Lima beans, TMN-0540A T-2480	SP	1.1		467	8	0 7 14 62	fresh beans 0.2 empty pods 0.6 vines 29 fresh beans 0.19 empty pods 0.35 vines 2.9 fresh beans 0.12 empty pods 0.38 dry beans <0.02 vines 0.33	fresh beans 0.05 empty pods 0.11 vines 1.9 fresh beans 0.06 empty pods 0.11 vines 0.68 fresh beans 0.06 empty pods 0.12 dry beans <0.01 vines 0.60
USA, California, 1973 (Henderson Bush) Lima beans, TMN-0541 T-2439	SP	1.1		94 air	4	1 7 14	beans 1.0 beans 1.9 beans 0.94	beans 0.05 beans 0.13 beans 0.28
USA, New Jersey, 1973 (Fordhook 242) Lima beans, TMN-0540A T-2443	SP	1.1		47 air	5	0 7 14 28	beans 0.54 empty pods 2.8 beans 0.62 empty pods 1.8 beans 0.31 empty pods 0.62 dry beans 0.08	beans 0.17 empty pods 0.43 beans 0.20 empty pods 0.41 beans 0.15 empty pods 0.28 dry beans 0.18
USA, New Jersey, 1973 (Fordhook 242) Lima beans, TMN-0540A T-2443	SP	2.2		47 air	5	0 7 14 28	beans 1.0 empty pods 5.4 beans 1.2 empty pods 3.7 beans 0.76 empty pods 1.7 dry beans 0.21	beans 0.31 empty pods 0.75 beans 0.37 empty pods 0.74 beans 0.29 empty pods 0.57 dry beans 0.35
USA, Florida, 1981 (Ford Hook) Lima beans, TMN-0540A T-5208	SP	1.1			4	0	5.3	0.45
USA, Florida, 1981 (Ford Hook) Lima beans, TMN-0540A T-5208, technical grade product		1.1			4	0	3.5	0.34
USA, New Jersey, 1982 (Ford Hook) Lima beans, TMN-0540A T-5513	SP	1.1			11	0	2.4	1.1

c = result obtained from control sample.

Note. Summary data only were available for reference TMN-0625, trials OR5 and OR6.

Note. The term “beans” means analysis of the beans without pods. Where not specified, the analysis was of the fresh bean with pod.

Table 53. Acephate residues in beans (dry) resulting from supervised trials in the USA.

BEANS, DRY Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
USA, California, 1972 (Pinto) dry beans, TMN-0540 T-2325	SP	1.1	0.53		3	0 7 14	dried pods 4.6 vines 126 dried pods 1.8 vines 43 dried pods 0.50 vines 20	dried pods 0.24 vines 1.6 dried pods 0.17 vines 0.80 dried pods 0.07 vines 0.37
USA, New Jersey, 1972 (Red Kidney), TMN-0540 T-2363	SP	1.1	0.39	290	10	0 7 14	0.9, 0.9 0.57, 0.47 0.1, 0.15	0.26, 0.3 0.34, 0.23 0.07, 0.09
USA, Colorado, 1973 (Pinto), TMN-0540 T-2830	SP	1.1	0.4		3	41	0.19 hay 1.7	0.1 hay 0.5
USA, California, 1974 (Pinto), TMN-0540 T-2440	SP	1.1		187	3	30	<0.02	0.02
USA, California, 1976 Dry beans, TMN-0541 T-3681	SP	0.56		94 air	1	22	0.23	0.03
USA, California, 1976 Dry beans, TMN-0541 T-3682	SP	0.56		94 air	1	9 +7 drying	0.04	0.0

BEANS, DRY Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, California, 1976 Lima beans, TMN-0541 T-3683	SP	0.56		47 air 94 air	1 +1	6	0.0	0.0
USA, California, Dry beans, TMN-0541 T-3756	SP	0.56		94 air	1	16	0.0	0.0
USA, North Dakota, 1982 (Fleetwood), Navy beans, TMN-0540A T-5639	SP	0.56		183	1	66	<0.01 c0.02 hay <0.01	<0.01 hay <0.01
USA, North Dakota, 1982 (Fleetwood) Navy beans, TMN-0540A T-5639	SP	0.56		183	2	56	<0.01 c0.02 hay <0.01	<0.01 hay <0.01
USA, Florida, 1983 (Henderson) Lima beans, TMN-0540A T-5735	SP	1.1		234	7	0 15	fresh pods 4.8 0.04	fresh pods 0.75 0.14

c = result obtained from control sample.

Note. Where not specified, the analysis is of the dry bean without the pod. The term 'pod' means beans with pod.

Table 54. Acephate residues in soya beans resulting from supervised trials in Brazil and the USA.

SOYA BEANS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Brazil, Granja Canjica, 1979 (Prata), TMN-0654B T-4854	SP	0.84		3269	1	14 21 28	<0.02 <0.02 <0.02	<0.01 <0.01 <0.01 beans dried for 179 days at ambient temp.
Brazil, Granja Canjica, 1979 (Prata), TMN-0654B T-4854	SP	1.1		3269	1	14 21 28	<0.02 <0.02 <0.02	<0.01 <0.01 <0.01
USA, Georgia, 1974 (Coker 136), TMN-0654 T-3166	SP	1.1		234	3	14	0.14	0.06
USA, Iowa, 1974 (Corsoy), TMN-0654 T-3076	SP	1.1		374	3	16	0.17	0.06
USA, New Jersey, 1974 (Kent), TMN-0654 T-3074	SP	1.1		234	3	14	≤0.02	≤0.01
USA, Virginia, 1974 (York), TMN-0654 T-3075	SP	1.1		935	3	14	≤0.02	≤0.01
USA, Virginia, 1974 (York), TMN-0654 T-3197	SP	1.1		19 air	2	14	0.03	≤0.01
USA, Massachusetts, 1977 (Forrest), TMN-0654A T-4238	SP	1.1		94 air	3	14 28	<0.02 0.03	<0.01 <0.01
USA, Iowa, 1978 (Hark, Crosby, Amsoy 71), TMN-0654A T-4406	SP	1.1		196	3	14 22	beans 0.03 meal 0.03 crude oil <0.02 hulls 0.26 beans 0.02 meal <0.02 crude oil <0.02 hulls <0.02	beans 0.02 meal 0.03 crude oil <0.01 hulls 0.05 beans 0.01 meal <0.01 crude oil <0.01 hulls <0.01
USA, Iowa, 1978 (Hark, Crosby, Amsoy 71), TMN-0654A T-4406	SP	2.2		196	3	14 22	beans 0.11 meal 0.04 crude oil <0.02 hulls 0.62 beans 0.06 meal 0.04 crude oil 0.03 hulls 0.19	beans 0.02 meal 0.05 crude oil <0.01 hulls 0.13 beans 0.03 meal 0.05 crude oil <0.01 hulls 0.05
USA, Mississippi, 1978 (Bragg), TMN-0654A T-4407	SP	1.1		94 air	3	13+30 drying 21	0.04 <0.02	<0.01 <0.01

SOYA BEANS Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
USA, Mississippi, 1978 (Bragg), TMN-0654A T-4592	SP	1.1		47 air	3	15+30 drying	bean 0.11 whole plant 0.53	bean 0.02 whole plant 0.06
USA, Mississippi, 1978 (Bragg), TMN-0654A T-4407	SP	2.2		94 air	3	13+30 drying 21	0.15 <0.02	<0.01 <0.01
USA, Mississippi, 1981 (Bedford), TMN-0654A T-5375	ST SP	1.1 0.36kg per 100kg seed			1 +1	26	<0.02	<0.01
USA, Mississippi, 1981 (Bedford), TMN-0654A T-5375	ST	0.36kg per 100kg seed			1	112	<0.02	<0.01
USA, Mississippi, 1979 (Bragg), TMN-0654A T-4592		1.1		47 air	3	15+30 drying 23+23 drying	<0.02, 0.09 whole plant 0.71, 0.53 <0.02 whole plant 0.04	<0.01, 0.01 whole plant 0.08, 0.07 <0.01 whole plant <0.01

Table 55. Acephate residues in sugar beet resulting from supervised trials in France, Italy and the UK.

SUGAR BEET Location, year, (variety), reference	Application					PHI days	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.		acephate	methamidophos
France, Bris sous Forge, 1972 (Polybeta Desprez), TMN-0542F T-1037	SP	0.5	0.1	500	2	98	roots 0.016 tops <0.005	roots <0.002 tops <0.002
France, Janvry, 1972 (Metapoly Desprez), TMN-0542F T-1038	SP	0.5	0.1	500	3	102	roots 0.01 tops 0.01	roots <0.002 tops 0.003
Italy, Marmorta, 1996 (Bushell), TMN-0542G & TMN-0542H (SIP1080/1081)	SP	0.69		300	1	30	roots <0.01 tops 0.61	roots <0.01 tops 0.11
Italy, Marmorta, 1996 (Monodoro), TMN-0542G & TMN-0542H (SIP1080/1081)	SP	0.69		300	1	30	roots <0.01 tops 0.95	roots <0.01 tops 0.10
Italy, Bologna, 1997 (Nubia), TMN-0542J & TMN-0542K (SIP1122/1123)	SP	0.66		310	1	30	roots <0.01 tops 0.59	roots <0.01 tops 0.11
Italy, Modena, 1997 (Puma), TMN-0542J & TMN-0542K (SIP1122/1123)	SP	0.64		300	1	27	roots <0.01 tops 0.25 c0.12	roots <0.01 tops 0.04 c0.03
UK, Chatteris, 1975 (Amono), TMN-0542F T-1441	SP	0.45	0.1	450	4	95	roots <0.02 tops <0.02	roots <0.01 tops <0.01
UK, Chatteris, 1975 (Amono), TMN-0542F T-1441	SP	0.90	0.2	450	4	95	roots <0.02 tops 0.07	roots <0.01 tops <0.01
UK, Downham Market, 1975 (Amono), TMN-0542F T-1443	SP	0.45	0.1	450	2	107	roots <0.02 tops <0.02	roots <0.01 tops <0.01
UK, Downham Market, 1975 (Amono), TMN-0542F T-1443	SP	0.90	0.2	450	2	107	roots <0.02 tops <0.02	roots <0.01 tops <0.01
UK, Linton, 1975 (Sharps Klein Mono), TMN-0542F T-1442	SP	0.45	0.1	450	3	69	roots <0.02 tops 0.06	roots <0.01 tops 0.02
UK, Linton, 1975 (Sharps Klein Mono), TMN-0542F T-1442	SP	0.90	0.2	450	3	69	roots <0.02 tops 0.1	roots <0.01 tops <0.01
UK, Bury St Edmunds, 1977 (M36 Nomo), TMN-0542F T-1632	SP	0.45	0.09	500	1	107	roots <0.05 tops<0.05	roots <0.02 tops <0.02
UK, Ipswich, 1977 (Nomo), TMN-0542F T-1631	SP	0.49	0.1	500	1	108	roots <0.05 tops <0.05	roots <0.02 tops <0.02
UK, Kidderminster, 1977 (Sharpes Monobeet), TMN-0542F T-1629	SP	0.45	0.09	500	1	104	roots <0.05 tops <0.05	roots <0.02 tops <0.02
UK, Newark, 1977 (M36 Nomo), TMN-0542F T-1634	SP	0.45	0.09	500	1	97	roots <0.05 tops 0.12	roots <0.02 tops <0.02
UK, Radcliffe, 1977 (Nomo), TMN-0542F T-1630	SP	0.45	0.09	500	1	99	roots <0.05 tops <0.05	roots <0.02 tops <0.02
UK, Wissington, 1977 (M36 Mono), TMN-0542F T-1633	SP	0.45	0.09	500	1	100	roots <0.05 tops 0.2	roots <0.02 tops <0.02
UK, Conyers Green, 1979, TMN-0542F T-1880	SP	0.45	0.11	400	1	52	roots <0.05 tops 1.5	roots <0.05 tops 0.24

SUGAR BEET Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
UK, Conyers Green, 1979, TMN-0542F T-1880	SP	0.90	0.11	400	1	52	roots <0.05 tops 3.0	roots <0.05 tops 0.32
UK, Rougham, 1979, TMN-0542F T-1881	SP	0.45	0.11	400	1	56	roots <0.05 tops 3.2	roots <0.05 tops 0.33
UK, Rougham, 1979, TMN-0542F T-1882	SP	0.45	0.11	400	1	53	roots <0.05 tops 0.86	roots <0.05 tops 0.23
UK, Rougham, 1979, TMN-0542F T-1881	SP	0.9	0.23	400	1	56	roots <0.05 tops 3.3	roots <0.05 tops 0.45
UK, Rougham, 1979, TMN-0542F T-1882	SP	0.90	0.23	400	1	53	roots <0.05 tops 2.0	roots <0.05 tops 0.28

c = result obtained from control sample.

Table 56. Acephate residues in artichokes (globe) resulting from supervised trials in France and Italy.

ARTICHOKES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Graveson, 1973 (Violet Chrysantheme), TMN-0538 T-1145	SP	0.42 0.53	0.053 0.053	800 1000	1 +1	7 14 21	8.3, 10 1.3, 1.6 0.51, 0.77	0.49, 0.54 0.12, 0.12 0.08, 0.10
France, St Etienne du Gres, 1974 (Violet Hatif), TMN-0538 T-1274, analysis of upper and lower halves of heads	SP	0.5	0.05	950	1	7	1.8, 1.9 upper 4.2, 4.2 lower 1.3, 0.95	0.13, 0.14 upper 0.26, 0.25 lower 0.11, 0.08
France, Graveson, 1975 (Violet Chrysantheme), TMN-0538 T-1416	SP	0.5	0.05	950	1	15	0.54 cooked 0.07	0.08 cooked 0.02
France, Eyrargues, 1976 (Maco), TMN-0538 T-1482	SP	0.79	0.075	1053	3	0 7 10 15	3.1, 4.1 3.3, 3.4 2.4, 2.4 0.85, 1.3	0.12, 0.17 0.22, 0.24 0.19, 0.19 0.11, 0.13
Italy, Foggias, 1991 (Francescina), TMN-0538AA OR7(a)	WP	0.47	0.05	1000	1	28	0.68	0.16
Italy, Foggias, 1991 (Francescina), TMN-0538AA	WP	0.47	0.05	1000	1	35	0.06	0.02
Italy, Foggias, 1991 (Francescina), TMN-0538AA OR7(b)	WP	0.94	0.09	1000	1	28	4.2	0.94
Italy, Foggias, 1991 (Francescina), TMN-0538AA OR7(d)	WP	0.94	0.09	1000	1	35	1.1	0.21
Italy, Lantina, 1991, TMN-0538AA OR8(a)	WP	0.47	0.05	1000	1	26	0.21	1.0
IItaly, Lantina, 1991, TMN-0538AA OR8(c)	WP	0.47	0.05	1000	1	33	0.26	0.08
Italy, Lantina, 1991, TMN-0538AA OR8(b)	WP	0.94	0.09	1000	1	26	0.95	0.29
Italy, Lantina, 1991, TMN-0538AA OR8(d)	WP	0.94	0.09	1000	1	33	0.12	0.06
Italy, Tarquinia, 1995 (Violetta), TMN-0538D SIP1031	WP	0.63	0.06	1000	1	21	0.08	0.04
Italy, Cecina Mare, 1996 (Morello di Toscana), TMN-0538C SIP1074	WP	0.67	0.06	1000	1	21	0.08	0.02
Italy, Roma, 1996 (Romanesco), TMN-0538BB SIP1065	WP	0.63	0.063	1000	1	21	0.08	0.02
Italy, Venturina, 1996 (Terom), TMN-0538B SIP1054	WP	0.62	0.06	1000	1	0 3 7 14 21	1.5 1.2 0.59 <0.1 <0.1	0.44 0.32 0.2 0.04 0.08

Note. Summary data only were available for reference TMN-538AA, trials OR7 and OR8.

Table 57. Acephate residues in potatoes resulting from supervised trials in Canada, France, Italy, the UK and the USA.

POTATOES	Application					PHI	Residues, mg/kg	
Location, year, (variety), reference	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
Canada, Ontario, 1977 (Kennebec), TMN-0644 T-4821	SP	0.75		800	8	3 7	0.08 0.07	<0.01 <0.01
Canada, Ontario, 1977 (Kennebec), TMN-0644 T-4228	SP	0.84		673	9	3 7	0.19 0.18	<0.01 <0.01
Canada, Ontario, 1977 (Kennebec), TMN-0644 T-4565	SP	0.84		666	10	4 8	0.20 0.25	<0.01 <0.01
Canada, Ontario, 1977 (Superior), TMN-0644 T-4226	SP	0.84		281	4	3 7	0.18 0.14	0.01 0.01
Canada, Ontario, 1977 (Superior), TMN-0644 T-4557	SP	0.84		374	6	7	0.07	<0.01
France, Villefranche, 1973 (Bintge), TMN-0643 T-1165	SP	0.53		1000	1	0 7 13 20	<0.02 <0.02 <0.02 <0.02	<0.01 <0.01 <0.01 <0.01
Italy, Serivia, 1990 (Spunta), TMN-0625 OR 18	SP	0.45		600	1	21	<0.02	<0.02
Italy, Serivia, 1990 (Spunta), TMN-0625 OR 18	SP	0.90		600	1	21	<0.02	<0.02
Italy, Emilia Romagna, 1996 (Agata), TMN-0642A (SIP1082)	SP	0.50		500	1	30	0.02	<0.01
Italy, Lombardia, 1996 (Kennebec), TMN-0642A (SIP1082)	SP	0.53		500	1	30	<0.01	<0.01
Italy, Emilia romagna, 1997 (Primura), TMN-0642B (SIP1124)	SP	0.55		540	1	30	0.02	<0.01
Italy, Veneto, 1997 (Jarla), TMN-0642B (SIP1124)	SP	0.53		520	1	30	0.02	<0.01
UK, Wales, 1977, TMN-0643 T-1626	SP	0.25		300	1	68	<0.05	<0.02
UK, Debden, 1978 (Desiree), TMN-0643 T-1653	SP	0.45		450	3	35 47	0.1 0.04	<0.02 <0.02
UK, Debden, 1978 (Desiree), TMN-0643 T-1653	SP	0.90		450	3	35 47	0.18 0.18	<0.02 <0.02
UK, Shelford, 1978 (Desiree), TMN-0643 T-1652	SP	0.45		450	3	35 47	0.06 <0.05	<0.02 <0.02
UK, Shelford, 1978 (Desiree), TMN-0643 T-1652	SP	0.90		450	3	35 47	0.11 0.11	<0.02 <0.02
USA, Idaho, 1971 (Russet Burbank), TMN-0644 T-2082	SP	1.1		280	5	0 3 7 14 49	0.08 0.03 0.07 0.05 0.04	<0.01 <0.01 <0.01 <0.01 <0.01
USA, Idaho, 1971 (Russet Burbank), TMN-0644 T-2082	SP	2.2		280	5	0 3 7 14 49	0.08 0.05 0.08 0.10 0.11	<0.01 <0.01 <0.01 <0.01 <0.01
USA, New York, 1973 (Katahdin), TMN-0644 T-2535	SP	1.1		247 (air)	6	0 3 7 14	0.10 0.11 0.10 0.08	0.01 0.01 0.02 0.01
USA, New York, 1976 (Katahdin), TMN-0644 T-3901	SP	1.1		935	6	14	0.03	<0.01
USA, California, 1977 (White Rose), TMN-0644 T-3994	SP	0.56		505	4	14	0.63	0.02
USA, Florida, 1977 (Sebago), TMN-0643A T-3945	SP	1.1		468	6	7 21	0.19 0.14	0.01 <0.01
USA, Idaho, 1977 (Russet Burbank), TMN-0644 T-3939	SP	0.56		374	6	21 28	0.19 c0.07 0.14 c0.04	<0.01

POTATOES Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, Idaho, 1977 (Russet Burbank), TMN-0644 T-3939	SP	1.1		374	6	21 28	0.20 c0.07 0.18 c0.04	<0.01 <0.01
USA, Maine, 1977, TMN-0644 T-3944	SP	1.1		1170	6	7 21	0.70 c0.11 0.43 c0.11	0.02 0.02
USA, Colorado, 1980 (Russet Burbank), TMN-0643A T-5226	SP	1.1		450	1	60	<0.02	<0.01
USA, Colorado, 1981 (Centennial), TMN-0643A T-5478	SP	1.1		450	1	13	<0.02	<0.01
USA, Oregon, 1983 (Russet Gem), TMN-0643A T-5941	SP	1.1		187	1	18	0.11	<0.01

c = result obtained from control sample.

Note. Summary data only were available for reference TMN-065, trials OR18.

Table 58. Acephate residues in alfalfa resulting from supervised trials in the USA.

ALFALFA Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
USA, New York, 1983 (Iroquois), TMN-0533 T-6095 (a)	SP	0.56	0.12	468	1	21 21+1	forage 5.6 hay 14	forage 0.77 hay 2.1
USA, New York, 1983 (Iroquois), TMN-0533 T-6095 (b)	SP	0.84	0.18	468	1	21 21+1	forage 6.4 hay 16	forage 0.63 hay 2.3
USA, Missouri, 1984 (Vernal), TMN-0533 T-6018	SP	0.56	0.3	187	1	29 29+2	forage 0.07 hay 0.13	forage 0.02 hay 0.04
USA, New York, 1984 (Iroquois), TMN-0533 T-6100 (a)	SP	0.56	0.2	468	1	25 25+3	forage 0.08 hay 0.17	forage 0.02 hay 0.05
USA, New York, 1984 (Iroquois), TMN-0533 T-6100 (b)	SP	0.84	0.18	468	1	25 25+3	forage 0.18 hay 0.31	forage 0.05 hay 0.08
USA, South Dakota, 1984 (Saranak), TMN-0533 T-6097	SP	0.56	0.6	94	1	21 21+8	forage 0.2 hay 0.15	forage 0.05 hay 0.03

Table 59. Acephate residues in hops resulting from supervised trials in France, Germany, the UK and the USA.

HOPS Location, year, (variety), reference	Application					PHI	Residues, mg/kg	
	Form	kg ai/ha	kg ai/hl	water, l/ha	no.	days	acephate	methamidophos
France, Boeschepe, 1974 (Northern Brewer), TMN-0613 T-1756	SP	0.75		1000	2	69	dry cones 1.2 c0.99	dry cones 0.19 c0.14
France, Boeschepe, 1974 (Northern Brewer), TMN-0613 T-1757	SP	0.75 2.1		1000 0.75gai per plant	1 +1	56	dry cones 3.9 c0.99	dry cones 0.58 c0.14
Germany, Pischlsdorf, 1972 (Spalt), TMN-0613 T-1089	SP		0.05		1	9+108 storage	dry cones 1.8 beer 0.007 c0.01	dry cones 0.41 beer <0.002
Germany, Spalt, 1972 (Spalt), TMN-0613 T-1095	SP		0.10		1	35+115 storage	dry cones 3.7 beer 0.007 c0.01	dry cones 0.90 beer <0.002
UK, Kent, 1973 (OT 48), TMN-0613 T-1204, 1cc extract from 10g dried cones	SP	1.4			1	111 (before extraction)	hops extract 45 (<0.25 in isomerised extract)	hops extract 8.8 (<0.1 in isomerised extract)
UK, Kent, 1973 (OT 48), TMN-0613 T-1210, 1cc extract from 10g dried cones	SP	1.4			1	111 (before extraction)	hops extract 65 (<0.25 in isomerised extract)	hops extract 5.9 (<0.1 in isomerised extract)
UK, Kent, 1974 (1147), TMN-0613 T-1315	SP	0.7 0.93 1.4	0.12 0.08 0.12	563 1126 1126	2 +2 +1	53	dry cones 1.8	dry cones 0.55

HOPS Location, year, (variety), reference	Application Form	kg ai/ha	kg ai/hl	water, l/ha	no.	PHI days	Residues, mg/kg acephate	methamidophos
UK, Kent, 1974 (1147), TMN-0613 T-1315	SP	0.7 0.93 1.4 3.7	0.12 0.08 0.12	563 1126 1126 1.5gai per hill	2 +2 +1 +1	42	dry cones 5.3	dry cones 1.6
UK, Kent, 1974 (Bullion), TMN-0613 T-1316	SP	0.7 0.93 1.4	0.12 0.08 0.12	563 1126 1126	2 +2 +1	52	dry cones 2.2	dry cones 0.68
UK, Kent, 1974 (Bullion), TMN-0613 T-1319	SP	0.7 0.93 1.4	0.12 0.08 0.12	563 1126 1126	2 +2 +1	48	dry cones 1.1	dry cones 0.32
UK, Kent, 1974 (Bullion), TMN-0613 T-1316	SP	0.7 0.93 1.4 3.7	0.12 0.08 0.12	563 1126 1126 1.5gai per hill	2 +2 +1 +1	44	dry cones 4.3	dry cones 0.87
UK, Kent, 1974 (Bullion), TMN-0613 T-1319	SP	0.7 0.93 1.4 3.7	0.12 0.08 0.12	563 1126 1126 1.5gai per plant	+1 +1	32	dry cones 6.8	dry cones 4.1
USA, Idaho, 1977, TMN-0614 T-4273		1.1		70	1	7 7	green cones 6.4 dry cones 43	green cones 0.55 dry cones 0.93
USA, Washington, 1977, TMN-0614 T-4210		0.56			3	0 0 7 7 14 14 21 21	green cones 14 dry cones 59 green cones 5.9 dry cones 31 green cones 2.3 dry cones 15 green cones 0.91 dry cones 5.4	green cones 0.91 dry cones 1.4 green cones 0.46 dry cones 1.2 green cones 0.23 dry cones 6.5 green cones 0.9 dry cones 0.15
USA, Washington, 1977, TMN-0614 T-4210		1.1			3	0 0 7 14 21 21	green cones 43 dry cones 147 green cones 22 green cones 401 green cones 1.9 dry cones 8.2	green cones 2.0 dry cones 3.8 green cones 1.4 green cones 0.33 green cones 0.16 dry cones 0.45
USA, Idaho, 1978, TMN-0614 T-4510		1.1			1	7 7 21 21	green cones 2.1 dry cones 5.8 green cones 1.3 dry cones 2.0	green cones 0.2 dry cones 0.6 green cones 0.2 dry cones 0.3
USA, Washington, 1978, TMN-0614 T-4414		0.9		1403	3	7 7 13 13 20	green cones 11 dry cones 44 green cones 15 dry cones 43 green cones 10.0	green cones 0.54 dry cones 2.2 green cones 0.68 dry cones 2.0 green cones 0.65
USA, Washington, 1978, TMN-0614 T-4414		1.8		1403	3	7 13 20	green cones 28 green cones 27 green cones 28	green cones 1.3 green cones 1.4 green cones 1.2
USA, Idaho, 1979, TMN-0614 T-4907		0.84			3	2 2 10 10	green cones 4.8 dry cones 19 green cones 0.22 dry cones 1.2	green cones 0.32 dry cones 0.89 green cones 0.02 dry cones 0.13
USA, Idaho, 1979, TMN-0614 T-4942		1.1		468	1	66 66 67 67 70 70	green cones 0.0 dry cones 0.0 green cones 0.0 dry cones 0.0 green cones 0.0 dry cones 0.0	green cones 0.0 dry cones 0.0 green cones 0.0 dry cones 0.0 green cones 0.0 dry cones 0.0

HOPS Location, year, (variety), reference	Application Form	kg ai/ha	kg ai/hl	water, l/ha	no.	PHI days	Residues, mg/kg acephate	methamidophos
USA, Oregon, 1979, TMN-0614 T-4906		0.56	0.027	2104	3	7 7 14 14	green cones 13 dry cones 31 green cones 3.1 dry cones 6.7	green cones 1.3 dry cones 2.1 green cones 0.41 dry cones 0.84
USA, Oregon, 1979, TMN-0614 T-4415		0.56			3	7 7 14 14	green cones 6.9 dry cones 21 green cones 5.3 dry cones 19	green cones 0.15 dry cones 0.87 green cones 0.2 dry cones 0.6
USA, Oregon, 1979, TMN-0614 T-4906		1.1	0.053	2104	3	7 7 14 14	green cones 22 dry cones 48 green cones 4.9 dry cones 14	green cones 1.8 dry cones 2.6 green cones 0.7 dry cones 1.4
USA, Oregon, 1979, TMN-0614 T-4415		1.1			3	7 7 14 14	green cones 84 dry cones 34 green cones 14 dry cones 28	green cones 0.32 dry cones 1.2 green cones 0.37 dry cones 0.96
USA, Idaho, 1980, TMN-0614 T-5089		0.56	0.08	468	1	7 14 14	green cones 7.0 green cones 0.97 dry cones 4.1	green cones 0.02 green cones 0.06 dry cones 0.22
USA, Idaho, 1980, TMN-0614 T-5089		0.84	0.18	468	1	7 14 14	green cones 2.9 green cones 1.8 dry cones 9.0	green cones 0.18 green cones 0.11 dry cones 0.35
USA, Oregon, 1980, TMN-0614 T-5046		0.56	0.08	1403	1	7 7 14 14 21 21	green cones 14 dry cones 20 green cones 6.9 dry cones 14 green cones 3.0 dry cones 4.1	green cones 1.3 dry cones 2.1 green cones 0.59 dry cones 1.3 green cones 0.32 dry cones 0.47
USA, Oregon, 1980, TMN-0614 T-5046		0.84	0.18	1403	1	7 7 14 14 21 21	green cones 28 dry cones 51 green cones 13 dry cones 14 green cones 4.8 dry cones 7.9	green cones 1.9 dry cones 4.1 green cones 0.88 dry cones 14 green cones 0.39 dry cones 0.81
USA, Washington, 1981, TMN-0614 T-5182		1.1	0.08	1403	3	39	dry cones 2.0	dry cones 0.08

c = result obtained from control sample.

FATE OF RESIDUE IN STORAGE AND PROCESSING

Four citrus studies from USA (oranges, lemons and grapefruit) were conducted to assess the residue levels of acephate and methamidophos in citrus juice, pulp and peel oil. Although no details are available on the processing methods used in these studies, the field application details and the residue results and processing factors are summarised in Table 60.

Fruit from three field trials on apples in USA (1983, 1985 and 1993) were sampled for use in processing studies, to investigate the effect of washing and processing on residues of acephate and methamidophos. In the 1993 study, apples taken from a field trial involving 3 early season applications (PHI 118 days) in California were processed in a manner that reflected commercial practice (Lai, 1995b). The fruit were tub-washed, crushed and pressed in a hydraulic fruit press (through cloth) and the resulting juice strained through a standard milk filter before being analyzed. The wet pomace was dried in a laboratory bin dryer to less than 10% moisture and milled to a uniform size, before being frozen and stored for analysis. Washed apples were peeled, cored and trimmed before being sliced and cooked with water and sugar in a steam-jacketed kettle, at about 93 °C for 30 minutes, strained through a 0.3 mm screen to produce apple sauce which, after reheating to 93 °C for 4 minutes, was canned and cooled before being frozen for analysis. The results of these studies are summarised in Table 61, together with the processing factors associated with washing, juicing, canning and the production sauce/purée.

One study on tomatoes, from France, and two from USA are summarised in Table 62. In the

earlier of the two USA studies (Lai, 1988d), field-treated tomatoes were processed in a laboratory according to commercial practice. Tomatoes were washed to remove dirt and debris, then passed through a chlorinated water dip and rinsed with potable water, before being crushed through a 4mm screen, flash-heated to 107 °C for about 40 seconds and then the crushed tomatoes were passed through a fine screen (0.033) to remove the skins and seeds. The resultant juice was canned, sealed and cooked for 10 minutes in boiling water before being cooled and analyzed. The canned fruit were prepared from whole washed tomatoes by blanching in boiling water, removing the skins and rinsing before being vacuum sealed in cans (topped up with added juice) and cooked for 30 minutes in a rotary cooker. Tomato concentrates were prepared by concentrating the juice using a single pass, wiped surface evaporator, with the paste (at about 30° Brix) and purée (concentrated to a solids level of 8-10%) being canned and cooked for 30 minutes in boiling water.

In the later tomato study (Lai, 1995c), a similar process reflecting commercial practice was used, but the field-treated tomatoes were first soaked in 0.5% caustic soda for 3 minutes at 54 °C and rinsed for 30 seconds before being steam blanched for 30 seconds, crushed, flash-heated to 85 °C for about 15 seconds in a steam jacketed kettle. The resulting 'hot break' juice was then strained through a 0.5-0.8mm mesh screen to remove the seeds, stems and skins. In this study, the juice was concentrated using a batch vacuum pan evaporator, to produce “unfinished” purée (at about 11° Brix). This was then heated to about 90 °C after adding 1% salt, sealed in cans and cooked in a water bath kettle for 15-20 minutes at 98-100 °C. Further concentration of the 'unfinished' purée, using a scrape surface vacuum evaporator, resulted in the production of tomato paste (at 22-24° Brix). Salt (1%) was then added to the paste and it was heated to about 90 °C before being canned and cooked in a water bath kettle for 15-20 minutes at 98-100 °C.

The effects of washing and of cooking and/or canning on residues in beans were investigated in three washing studies conducted in France and three canning studies in the USA; the latter also measuring residues of acephate and methamidophos in the water present in the canned beans. Although no details were available on the processing methods used, the two 1987 USA studies involved analysis of: fresh beans on arrival at the canning plant; the water used in the commercial washing process; the commercially canned beans; and the added water present in the cans. Summarized data from these studies, and the derived processing factors, are presented in Table 62.

Table 63 provides a summary of a processing study conducted in the USA on potatoes, where field-treated potatoes were peeled by hand, then either cubed and boiled or sliced and fried in oil at 190 °C.

Processing factors derived from the above studies, and from the reports of supervised residue trials on broccoli and peppers (summarized in the previous section), where washed and unwashed commodities were both analyzed for residues of acephate and methamidophos, are presented in Table 65.

Additional processing studies on mint (Lai 1987g) and maize (Lai, 1988c) were provided but the data were not included in the table of processing factors, as these crops have not been considered in this evaluation. In four residue trials on mint in the USA (1987), involving use of acephate at the maximum recommended rate (not specified), and with a PHI of 14 days, no detectable residues were reported in oil from fresh mint hay which contained up to 26 mg/kg acephate and up to 1.7 mg/kg methamidophos. Maximum residue levels in spent hay were 4.0 mg/kg (acephate) and 0.77 mg/kg (methamidophos).

In a study on maize from the USA, after ten applications of acephate at 2.2 kg ai/ha, residues of acephate in samples harvested 21 days after the last application were: grain, 0.1 mg/kg; forage, 4.6 mg/kg; silage, 6.0 mg/kg; fodder, 3.2 mg/kg. After processing, no residues were reported in the corn oil (crude, refined, bleached or deodorised), soapstock, reclaimed solvent, starch, gluten, steepwater distillate or processed water. Following dry milling, residues in maize grits, meal, flour and screenings were reported at levels of 0.1-0.13 mg/kg, while 0.07 mg/kg was found in the germ and 0.04 mg/kg in the hulls and press cake.

Table 60. Acephate and methamidophos residues in raw and processed citrus from processing studies in the USA.

CITRUS Location, year, (variety), reference	Application kg ai/ha	 kg ai/hl	 no.	PHI days	Acephate Residue (mg/kg)	 PF	Methamidophos Residue (mg/kg)	 PF
GRAPEFRUIT USA, California, 1973 (White Marsh), TMN-0565A T-2436	2.82	0.06	2	10	1.4 press liquor 0.22 juice 0.21 juice[1] 0.08 dried pulp 0.26 peel oil <0.02	 0.16 0.15 0.06 0.19 <0.01	0.05 press liquor 0.01 juice <0.01 juice <0.01 [1/] dried pulp 0.09 peel oil <0.01	 0.2 <0.2 <0.2 1.8 <0.2
				25	0.66 juice 0.19	 0.29	0.03 juice 0.01	 0.33
GRAPEFRUIT USA, California, 1973 (White Marsh), TMN-0565A T-2436	5.64	0.12	2	10	2.0 juice 0.36	 0.18	0.05 juice 0.02	 0.4
				25	0.85 juice 0.31	 0.36	0.03 juice 0.01	 0.33
LEMON USA, Arizona, 1973 (Lisbon), TMN-0565A T-2437	1.68	0.06	3	20	0.08 press liquor 0.04 juice 0.04 juice[1] 0.02 wet pulp <0.05 dried pulp 0.07 peel oil <0.02	 0.5 0.5 0.25 <0.63 0.88 <0.25	0.02 press liquor <0.01 juice <0.01 juice 0.01 [1/] wet pulp 0.01 dried pulp 0.02 peel oil <0.01	 <0.5 <0.5 0.5 0.5 1.0 <0.5
ORANGES USA, California, 1973 (Valencia), TMN-0565A T-2435	1.32 1.40	2198 2338	1 +2	20	0.6 press liquor 0.16 juice 0.18 juice[1] 0.1 wet pulp 0.3 dried pulp 0.45 peel oil 0.02	 0.27 0.3 0.17 0.5 0.75 0.03	0.05 press liquor <0.01 juice 0.03 juice 0.01 [1/] wet pulp 0.04 dried pulp 0.11 peel oil <0.02	 <0.2 0.6 0.2 0.8 2.2 <0.4
				40	0.2 juice 0.17	 0.85		

[1/] Commercially processed juice.

Table 61. Acephate and methamidophos residues in raw and processed apples from processing studies in the USA.

APPLES Location, year, (variety), reference	Application kg ai/ha	 kg ai/hl	 no.	PHI days	Acephate Residue (mg/kg)	 PF	Methamidophos Residue (mg/kg)	 PF
USA, Wisconsin, 1983 (Red Spur), TMN-0537 T-5902	1.12	0.03	3	143	fruit 0.02 sauce 0.01 juice 0.02	 0.5 1.0	fruit <0.01 sauce <0.01 juice <0.01	
USA, Wisconsin, 1985 (MacIntosh), TMN-0537 T-6432	1.12	0.12	3	106	fruit 0.46 juice 0.46 vet pomace 0.42 ry pomace 1.03	 1.0 0.91 2.2	fruit 0.02 juice 0.02 wet pomace 0.02 dry pomace 0.06 wet pomace 23% DM dry pomace 77% DM	 1.0 1.0 3.0
USA, Wisconsin, 1985 (MacIntosh), TMN-0537 T-6432	1.12	0.12 0.05	3 +1	9	fruit 1.0 juice 0.99 vet pomace 1.22 ry pomace 2.87	 0.99 1.2 2.9	fruit 0.03 juice 0.03 wet pomace 0.05 dry pomace 0.09 wet pomace 23% DM dry pomace 77% DM	 1.0 1.7 3.0

APPLES	Application			PHI	Acephate		Methamidophos	
Location, year, (variety), reference	kg ai/ha	kg ai/hl	no.	days	Residue (mg/kg)	PF	Residue (mg/kg)	PF
USA, Washington, 1993 (Red Delicious), TMN-0537A V10674-C (Lai 1995b)	1.12	0.12	3	118	0.06 washed 0.06 sauce 0.03 juice 0.06 wet pomace 0.05	 1.0 0.5 1.0 0.83	0.01 washed 0.01 sauce <0.01 juice <0.01 wet pomace <0.01 wet pomace 25% DM	 1.0 <1.0 <1.0 <1.0

Table 62. Acephate and methamidophos residues in washed tomatoes (France) and in processed tomato products (USA).

TOMATOES	Application			PHI	Acephate		Methamidophos	
Location, year, (variety), reference	kg ai/ha	kg ai/hl	no.	days	Residue (m/kg)	PF	Residue (mg/kg)	PF
France, Toulenne, 1986 (Bellotte), TMN-0672 T-2173	0.75	0.075	1	14 21	0.42 washed 0.46 0.19 washed 0.26	 .1 .4	0.14 washed 0.14 0.04 washed 0.07	 .0 .8
USA, California, 1987 (204C), TMN-0672A P73T-7112 (Lai, 1988d)	1.12	0.4	8	3	1.4 washed 1.8 canned 0.54 paste 5.6 purée 2.5 juice 1.3 wet pomace 0.84 dry pomace 1.4	 .3 0.39 4.0 .8 0.93 0.6 .0	0.08 washed 0.1 canned 0.04 paste 0.43 purée 0.17 juice 0.08 wet pomace 0.04 dry pomace 0.09 (paste c0.03) wet pomace 36% DM dry pomace 95% DM	 .3 0.5 5.4 2.1 .0 0.5 .1
USA, California, 1993 (UC 82B), TMN-0672D V10677-C (Lai, 1995c)	1.12	0.4	6	3	1.37 washed 0.29 paste 1.23 purée 0.73 juice 0.33 wet pomace 0.24 dry pomace 0.38	 0.21 0.9 0.54 0.24 0.18 0.28	0.08 washed 0.06 paste 0.37 purée 0.26 juice 0.09 wet pomace 0.06 dry pomace 0.05 wet pomace 23% DM dry pomace 93% DM	 0.75 4.6 3.3 .1 0.75 0.63

c = result obtained from control sample.

Table 63. Acephate and methamidophos residues in washed common beans (France) and in cooked, canned common beans from processing studies in the USA.

BEANS	Application			PHI	Acephate		Methamidophos	
Location, year, (variety), reference	kg ai/ha	kg ai/hl	no.	days	Residue (mg/kg)	PF	Residue (mg/kg)	PF
France, Villandraut, 1986 (Delinyl), TMN-0540C T-2180	0.9	0.075	1	14 21	1.62 washed 1.52 0.87 washed 0.96	 0.94 1.1	0.35 washed 0.34 0.16 washed 0.19	 0.97 0.56
France, Villandraut, 1986 (Triomphe de Farcy), TMN-0540C T-2172	0.64	0.075	1	14 21	1.3 washed 0.98 0.20 washed 0.14	 0.75 0.7	0.35 washed 0.20 0.05 washed 0.03	 0.57 0.6
France, Villandraut, 1986 (Triomphe de Farcy), TMN-0540C T-2172	1.11	0.075	1	21	0.23 washed 0.15	 0.65	0.05 washed 0.03	 0.6

BEANS	Application			PHI	Acephate		Methamidophos	
Location, year, (variety), reference	kg ai/ha	kg ai/hl	no.	days	Residue (mg/kg)	PF	Residue (mg/kg)	PF
USA, Florida, 1973 (Contender), TMN-0540A T-2483	1.12	0.32	6	7	2.0		0.76	
					canned 0.26	0.13	canned 0.25	0.33
					can water 0.26	0.13	can water 0.27	0.36
USA, New Jersey, 1973 Snap beans, TMN-0541 T-2444	1.12	2.4	4	9	1.6		0.55	
	1.12	0.48	air	9	canned 0.56	0.35	canned 0.30	0.54
			+1	9	can water 0.61	0.38	can water 0.29	0.53
USA, Illinois, 1987 (Del Monte 04-21), TMN-0540A, T-7116 TMN-0541A	0.84	3.0	4	22	0.43, 0.42		0.12, 0.13	
			air		washed 0.39	0.89	washed 0.12	1.0
					cooked 0.20	0.46	cooked 0.07	0.97
					canned 0.03	0.07	canned 0.03	0.24
					wash water 0.07	0.16	wash water 0.01	0.08
					cooking water 0.19	0.44	cooking water 0.07	0.56
					can water 0.02	0.05	can water 0.02	0.16
USA, Wisconsin, 1987 (Hy Style), TMN-0540A T-7017, sample storage data in 5.7/05	1.12	0.38	2	14	0.32		0.13	
					washed 0.23	0.72	washed 0.11	0.85
					cooked 0.17	0.53	cooked 0.09	0.69
					canned 0.08	0.25	canned 0.05	0.38
					wash water <0.01	<0.03	wash water <0.005	0.04
					cooking water 0.09	0.28	cooking water 0.05	0.38
					can water 0.08	0.25	can water 0.05	0.38

Note. Where not specified, the analysis was of the fresh bean with pod.

Table 64. Acephate and methamidophos residues in processed potatoes from a processing study in the USA.

POTATOES	Application			PHI	Acephate		Methamidophos	
Location, year, (variety), reference	kg ai/ha	kg ai/hl	no.	days	Residue (mg/kg)	PF	Residue (mg/kg)	PF
USA, California, 1977 (White Rose), TMN-0644 T-3994	1.12	0.22	6	21	1.98		0.08	
					raw peel 1.62	0.81	raw peel 0.11	1.4
					peeled, boiled 0.51	0.26	peeled, boiled 0.06	0.75
					chips 0.18	0.09	chips 0.05	0.63
					boiled peel 0.92	0.46	boiled peel 0.08	1.0
				28	1.55		0.06	
					raw peel 1.52	0.98	raw peel 0.14	2.3
					peeled, boiled 0.43	0.28	peeled, boiled 0.06	1.0
					chips 0.06	0.04	chips 0.03	0.5
					boiled peel 0.88	0.57	boiled peel 0.10	1.7

Table 65. Acephate and methamidophos residues in soya bean processing fractions from a processing study in the USA.

SOYA BEANS	Application			PHI	Acephate		Methamidophos	
Location, year, (variety), reference	kg ai/ha	kg ai/hl	no.	days	Residue (mg/kg)	PF	Residue (mg/kg)	PF
USA, Iowa, 1978 (Hark, Crosby, Amsoy 71), TMN-0654A T-4406	1.12	0.57	3	14	0.03		0.02	
					meal 0.03	1.0	meal 0.03	1.5
					crude oil <0.02	<0.67	crude oil <0.01	<0.5
					hulls 0.26	8.7	hulls 0.05	2.5
				22	0.02		0.01	
					meal <0.02	<1.0	meal <0.01	<1.0
					crude oil <0.02	<1.0	crude oil <0.01	<1.0
					hulls <0.02	<1.0	hulls <0.01	<1.0

SOYA BEANS	Application			PHI	Acephate		Methamidophos	
Location, year, (variety), reference	kg ai/ha	kg ai/hl	no.	days	Residue (mg/kg)	PF	Residue (mg/kg)	PF
USA, Iowa, 1978	2.24	1.03	3	14	0.11		0.02	
(Hark, Crosby,					meal 0.04	0.37	meal 0.05	2.5
Amsoy 71),					crude oil <0.02	<0.18	crude oil <0.01	<0.5
TMN-0654A T-4406					hulls 0.62	5.6	hulls 0.13	6.5
				22	0.06		0.03	
					meal 0.04	0.67	meal 0.05	1.67
					crude oil 0.03	0.5	crude oil <0.01	<0.33
					hulls 0.19	3.2	hulls 0.05	1.67

Table 66. Summary of processing factors associated with acephate and methamidophos residues in processed foods and feedstuffs.

COMMODITY	Processing factor [1]			
	acephate	mean	methamidophos	mean
ORANGES [2]				
Juice	0.17 [3], 0.3, 0.85	0.44	0.2 [3], 0.6	0.4
Pulp (wet)	0.5	0.5	0.8	0.8
Pulp (dry)	0.75	0.75	2.2	2.2
GRAPEFRUIT [2]				
Juice	0.06, 0.15, 0.18, 0.29, 0.36	0.21	<0.02, <0.02, 0.33, 0.33, 0.4	0.29
Pulp (dry)	0.19	0.19	1.8	1.8
LEMONS [2]				
Juice	0.25 [3], 0.5	0.38	<0.5, 0.5 [3]	<0.5
Pulp (dry)	0.88	0.88	1.0	1.0
APPLES [4]				
Washed	1.0	1.0	1.0	1.0
Juice	0.99, 1.0, 1.0	1.0	1.0, 1.0	1.0
Sauce	0.5,	0.5		
Pomace (wet)	0.83, 0.91, 1.2	0.98	1.0, 1.7	1.35
Pomace (dry)	2.2, 2.9	2.6	3.0, 3.0	3.0
TOMATOES				
Washed	0.21, 1.1, 1.3, 1.4	1.0	0.75, 1.0, 1.3, 1.8	1.2
Canned	0.39	0.39	0.04	0.04
Juice	0.24, 0.93	0.58	1.0, 1.1	1.1
Purée	0.54, 1.8	1.2	2.1, 3.3	2.7
Paste	0.9, 4.0	2.5	4.6, 5.4	5.0
Pomace (wet)	0.18, 0.6	0.39	0.5, 0.75	0.63
Pomace (dry)	0.28, 1.0	0.64	0.63, 1.1	0.87
BEANS				
Washed	0.65, 0.7, 0.72, 0.89, 0.94, 1.1	0.83	0.56, 0.6, 0.6, 0.85, 0.97, 1.0	0.76
Cooked	0.46, 0.53	0.5	0.69, 0.97	0.83
Canned	0.07, 0.13, 0.25	0.15	0.24, 0.33, 0.38	0.32
Can water	0.05, 0.13, 0.25	0.14	0.16, 0.36, 0.38	0.3
SOYA BEANS [5]				
Meal	0.37, 1.0	0.685	1.5, 2.5	2.0
Hulls	5.6, 8.7	7.15	2.5, 6.5	4.5
Crude oil	<0.18, <0.67	<0.425	<0.5, <0.5	<0.5
POTATOES				
Peeled, boiled	0.26, 0.28	0.27	0.75, 1.0	0.88
Chips	0.04, 0.09	0.07	0.5, 0.63	0.57
Peel (raw)	0.81, 0.98	0.9	1.4, 2.3	1.9
Peel (boiled)	0.46, 0.57	0.52	0.75, 1.7	1.2
ARTICHOKES				
Cooked	0.13	0.13	0.25	0.25
BROCCOLI				
Washed	0.63, 0.63, 0.88	0.71	0.65, 0.76, 0.9	0.77
PEPPERS				
Washed	0.86, 0.91	0.88	1.0, 1.3	1.1

[1] Processing factors were not calculated for individual trials when residues in the raw agricultural commodity were *ca.* LOQ (0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos).

[2/] Processing factors from individual trials appeared to be a function of the PHI. Data from trials with a PHI of 20-40 days, and in which residues in the raw agricultural commodity were greater than 0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos, are reported in the table.
[3/] Processing factor derived from residues found in commercially processed juice.
[4/] Processing factors from individual trials appeared to be independent of PHI. Data from all trials in which residues in the raw agricultural commodity were greater than 0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos are reported in the table.
[5/] Processing factors from individual trials appeared to be a function of the PHI. Data from trials with a PHI of 14 days, and in which residues in the raw agricultural commodity were greater than 0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos, are reported in the table.

RESIDUES IN ANIMAL COMMODITIES

Farm animal feeding studies

Lactating cows

Two studies on the transfer of residues to the milk and tissues of lactating dairy cows were provided.

In the first, groups of 3 lactating Holstein dairy cattle were dosed by gelatin capsule, after the morning milking, with a 5:1 mixture of acephate and methamidophos at nominal levels equivalent to 3/0.6 ppm, 10/2 ppm and 30/6 ppm of acephate/methamidophos in the diet for 30 days (Tucker 1973b). The dosing period was followed a 6 day recovery period, during which time no acephate or methamidophos was given. Samples of milk were collected in the mornings and evenings for analysis. Average milk production was 15.7 kg/day/cow for days 1-5 of the study and 9.4 kg/day/cow for days 31-35. A single cow from each treatment group was sacrificed after 21 days of dosing and similarly at 1 and 6 days after dosing ceased. Samples of liver, heart, kidney, muscle, subcutaneous and peritoneal fat were collected for analysis by residue method RM-12A-2 (Table 67).

Residues in milk were considerably higher after the evening milking, compared with the morning milking, indicating rapid absorption and metabolism/elimination of the residues. The production of morning milk was generally 2-3× greater than for evening milking. Confirmation of the rapid elimination was obtained by analysis of samples after dosing ceased: residues in milk declined to <LOQ after 2 days recovery. Highest residues were observed in kidney, followed by muscle/heart, fat and liver. Residue levels were approximately in proportion to the dose.

Table 67. Residues of acephate and methamidophos in milk and tissues of lactating dairy cows orally dosed with 5:1 mixtures of acephate and methamidophos for 30 consecutive days, (Tucker 1973b).

Tissue and sampling time (days)		Residue (mg/kg)					
		Doses, 3/0.6 ppm		Doses, 10/2 ppm		Doses, 30/6 ppm	
		acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
Milk	1 (PM)	<0.01, 0.02, 0.01	<0.001 (3)	0.08, 0.12, 0.07	0.006, 0.012, 0.005	0.41, 0.27, 0.32	0.041, 0.025, 0.030
	2 (AM)	<0.01 (3)	<0.001 (3)	<0.01, 0.02, 0.02	<0.001 (3)	0.11, 0.11, <0.01	0.006, 0.005, <0.001
	2 (PM)	0.02 (3)	<0.001 (3)	0.11, 0.18, 0.11	0.07, 0.015, 0.010	0.55, 0.40, 0.44	0.053, 0.038, 0.035
	4 (AM)	<0.01 (3)	<0.001 (3)	0.04, 0.08, 0.06	<0.001 (3)	0.17 (3)	0.008, 0.007, 0.006
	4 (PM)	0.04, 0.03, 0.05	<0.001 (3)	0.13, 0.17, 0.37	0.009, 0.016, 0.040	0.53, 0.49, 0.14	0.064, 0.044, 0.011
	6 (AM)	<0.01 (3)	<0.001 (3)	0.03, <0.01, 0.05	<0.001 (2), 0.008	0.13, 0.03, 0.14	0.016, <0.001, 0.015
	6 (PM)	0.03, 0.01, 0.03	<0.001 (3)	0.12, 0.19, 0.08	0.012, 0.019, 0.012	0.42, 0.32, 0.37	0.073, 0.058, 0.048
	7 (AM)	<0.01 (3)	<0.001 (3)	<0.01, 0.06, <0.01	<0.001 (3)	0.22, 0.18, 0.23	0.010, 0.009, 0.008
	7 (PM)	<0.01 (3)	<0.001 (3)	0.06, 0.21, 0.13	<0.001, 0.016, 0.010	0.51, 0.63, 0.59	0.064, 0.065, 0.062
	10 (AM)	<0.01 (3)	<0.001 (3)	0.03, 0.09, 0.04	<0.001 (3)	0.21 (3)	0.08, 0.007, 0.008
	10 (PM)	0.05, 0.05, 0.04	<0.001 (3)	0.18, 0.22, 0.16	0.012, 0.022, 0.012	0.60, 0.55, 0.47	0.082, 0.060, 0.056

Tissue and sampling time (days)	Residue (mg/kg)					
	Doses, 3/0.6 ppm		Doses, 10/2 ppm		Doses, 30/6 ppm	
	acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
12 (AM)	<0.01 (3)	<0.001 (3)	0.04, 0.10, <0.01	<0.001 (3)	0.2,1 0.19, 0.17	0.008, 0.006, 0.006
12 (PM)	0.04, 0.06, 0.05	<0.001 (3)	0.13, 0.23, 0.13	0.010, 0.019, <0.001	0.68, 0.55	0.068, 0.052
14 (AM)	0.01, 0.01, <0.01	<0.001 (3)	0.04, 0.09, <0.01	<0.001 (3)	0.21, 0.16, 0.16	0.008, <0.001, 0.006
14 (PM)	0.02, 0.04, 0.02	<0.001 (3)	017, 0.18, 0.12	0.011, 0.014, 0.008	0.53, 0.48, 0.43	0.073, 0.043, 0.043
17 (AM)	<0.01 (3)	<0.001 (3)	0.04, 0.16, 0.05	<0.001, 0.008, <0.001	0.18, 0.14, 0.16	0.006, <0.001, 0.007
17 (PM)	0.03, 0.04, 0.03	<0.001 (3)	0.15, 0.28, 0.15	0.10, 0.20, 0.009	0.54, 0.54, 0.50	0.07,1 0.052, 0.068
19 (AM)	<0.01 (3)	<0.001 (3)	0.04, 0.08, 0.04	<0.001 (3)	0.18, 0.18, 0.17	0.007, 0.05, 0.006
19 (PM)	0.03, 0.03, 0.04	<0.001 (3)	0.23 0.14	0.022, 0.011	0.52, 0.43, 0.46	0.086, 0.053, 0.058
21 (AM)	<0.01 (3)	<0.001 (3)	0.05, 0.24, 0.06	<0.001, 0.012, <0.001	0.20, 0.20, 0.17	0.009, 0.007, 0.006
21 (PM)	0.05, 0.05	<0.001 (2)	0.16, 0.31	0.012, 0.027	0.55, 0.48	0.070, 0.045
24 (AM)	<0.01 (2)	<0.001 (2)	0.04, 0.08	<0.001 (2)	0.17, 0.16	0.007 (2)
24 (PM)	0.04 (2)	<0.001 (2)	0.20, 0.28	0.013, 0.023	0.52 (2)	0.073, 0.055
26 (AM)	<0.01 (2)	<0.001 (2)	0.06, 0.10	<0.001 (2)	0.23, 0.21	0.006, 0.005
26 (PM)	0.05 (2)	<0.001 (2)	0.17, 0.23	0.012, 0.020	0.65, 0.55	0.063, 0.057
28 (AM)	<0.01 (2)	<0.001 (2)	0.04, 0.09	<0.001(2)	0.20, 0.11	0.008, <0.001
28 (PM)	0.05 (2)	<0.001 (2)	0.21, 0.25	0.011, 0.023	0.61, 0.49	0.078, 0.052
30 (AM)	0.01 (2)	<0.001 (2)	0.04, 0.06	<0.001(2)	0.18, 0.17	0.008, 0.005
30 (PM)	0.04, 0.05	<0.001 (2)	0.16, 0.21	0.009, 0.020	0.66, 0.57	0.076, 0.074
+1 (AM)	<0.01 (2)	<0.001 (2)	0.04, 0.07	<0.001 (2)	0.15, 0.13	0.005, <0.001
+1 (PM)	<0.01	<0.001	0.03	<0.001	0.07	<0.001
+2 (AM)	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
+2 (PM)	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
+3 (AM)	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
+3 (PM)	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
Liver 21	<0.02	<0.01	<0.02	<0.01	0.08	<0.01
+1	<0.02	<0.01	<0.02	<0.01	0.02	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Heart 21	0.03	<0.01	0.10	0.01	0.32	0.06
+1	0.02	<0.01	0.02	<0.01	0.10	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Kidney 21	0.03	<0.01	0.21	0.01	0.57	0.05
+1	<0.02	<0.01	0.04	<0.01	0.21	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Muscle 21	0.03	<0.01	0.08	<0.01	0.28	0.04
+1	<0.02	<0.01	0.03	<0.01	0.13	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Subcutaneous fat 21	<0.02	<0.01	0.03	<0.01	0.13	0.02
+1	0.03	<0.01	0.03	<0.01	0.08	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Peritoneal fat 21	<0.02	<0.01	0.02	<0.01	0.04	<0.01
+1	<0.02	<0.01	<0.02	<0.01	0.03	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01

In a separate study, groups of 4 lactating dairy cattle were dosed twice daily by gelatin capsule with a 5:1 mixture of acephate and methamidophos at nominal levels (based on daily average feed consumption of 19 kg/cow) equivalent to 15/3 ppm, 30/6 ppm and 60/12 ppm acephate/methamidophos in the diet for 28 days (Lai 1987h). The daily dose was divided into two and one portion administered at the morning and evening milkings. The dosing period was followed by a 3-day recovery period, during which time no acephate or methamidophos was given. Analysis of freshly prepared and aged dosing solutions revealed that the methamidophos dose ranged from 41 to 73% of the target dose level. However, the under-dosing with methamidophos was not expected to

affect the results significantly. Samples of milk comprising equal portions of morning and evening milk were collected for analysis. Milk samples from days 25, 26 and 27 of the high dose group were pooled and processed to obtain pasteurized milk, non-fat solids, milk-fat solids, milk sugar (lactose) and protein. Three cows from each treatment group were sacrificed after 28 days of dosing, with the remaining cow in each dose group sacrificed three days after dosing ceased. Samples of liver, kidney, muscle (cardiac and pectoral) and fat (subcutaneous and peritoneal) were collected for analysis according to residue method RM-12A-6 (Table 68). Samples were analyzed within 60 days, except for individual fat samples, which were analyzed within 180 days. However, the results for composite fat samples analyzed within 60 days were in agreement with the individual samples analyzed after 180 days freezer storage (-20 °C).

Residue levels in milk and tissues were approximately in proportion to the dose. Acephate residues in milk reached plateau levels by 4 days of dosing. Kidney contained the highest residues, followed by muscle and fat, with liver containing the lowest residues. During the recovery period, when no acephate or methamidophos was administered, residues in milk and tissues declined with an estimated half-life of <1 day.

Table 68. Residues of acephate and methamidophos in milk and tissues of lactating dairy cows orally dosed with 5:1 mixtures of acephate and methamidophos for 28 consecutive days, (Lai 1987h).

Tissue and sampling time (days)		Residue (mg/kg)					
		Dose, 15/3 ppm		Dose, 30/6 ppm		Dose, 60/12 ppm	
		acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
Milk	0	0.02 (3), <0.02	<0.01 (4)	0.11, 0.04, 0.06, 0.06	0.01, <0.01 (3)	0.15, 0.19, 0.14, 0.13	0.02, 0.05, 0.02, 0.02
	1	0.14, 0.13, 0.12, 0.16	0.01, <0.01, 0.01, <0.01	0.20, 0.23, 0.29, 0.31	0.02 (3), 0.03	0.71, 0.66, 0.74, 0.65	0.06, 0.7, 0.07, 0.02
	4	0.11, 0.14, 0.14, 0.13	<0.01 (3), 0.01	0.45, 0.30, 0.29, 0.28	0.03, 0.02 (3)	0.84, 0.79, 0.95, 0.85	0.06, 0.05, 0.08, 0.06
	8	0.14, 0.15 (3)	0.01, <0.0,1 0.01, 0.01	0.23, 0.24, 0.33, 0.28	0.03, 0.02, 0.03, 0.02	0.94, 0.88, 0.98, 0.88	0.07, 0.06, 0.09, 0.07
	12	0.12, 0.14, 0.13, 0.12	<0.01 (4)	0.31, 0.27, 0.29, 0.27	0.02 (4)	0.82, 0.83, 0.98, 0.79	0.06, 0.04, 0.06, 0.04
	16	0.15, 0.15, 0.14, 0.14	<0.01, <0.01, 0.01, 0.01	0.24, 0.23, 0.31, 0.32	0.02 (4)	0.92, 0.97, 0.92, 0.81	0.06 (3), 0.05
	20	0.13, 0.13, 0.15, 0.17,	<0.01 (3), 0.01	0.41, 0.33, 0.31, 0.42	0.02, 0.02, 0.01, 0.01	0.96, 0.84, 0.78, 0.75	0.04, 0.04, 0.05, 0.04
	24	0.17, 0.18, 0.20, 0.18	0.01 (4)	0.39, 0.36, 0.37, 0.44	0.02 (4)	0.77, 0.92, 0.83, 0.89	0.06, 0.07, 0.07, 0.06
	25					0.79, 0.77, 0.72, 0.69	0.05, 0.06, 0.07, 0.05
	26					0.66, 0.77, 0.77, 0.73	0.06, 0.07, 0.07, 0.06
	27					0.77 0.97 0.85 0.90	0.04, 0.07, 0.06, 0.06
	28	0.16, 0.12, 0.22, 0.19	<0.01, <0.01, 0.01, 0.01	0.36, 0.43, 0.36, 0.35	0.02, 0.01, 0.02, 0.03	0.81, 0.85, 0.85, 0.88	0.05, 0.04, 0.06, 0.06
	29	<0.02	<0.01	0.43	<0.01	0.89	<0.01
	30	<0.02	<0.01	<0.02	<0.01	0.07	<0.01
Liver	28	0.02 (3)	<0.01 (3)	0.04, 0.03, 0.03	<0.01 (3)	0.06, 0.15, 0.10	0.01, 0.02, 0.01
	+3	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Kidney	28	0.19, 0.26, 0.26	0.01, 0.02, 0.02	0.40, 0.34, 0.34	0.04, 0.02, 0.03	0.63, 0.73, 0.85	0.05, 0.07, 0.07
	+3	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Muscle (cardiac)	28	0.07, 0.10, 0.11	<0.01, <0.01, 0.01	0.16, 0.13, 0.15	0.02, 0.01, 0.01	0.28, 0.33, 0.40	0.03, 0.04, 0.04
	+3	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Muscle (pectoral)	28	0.09, 0.12, 0.11	<0.01 (3)	0.2,1 0.15, 0.16	0.01, <0.01, <0.01	0.37, 0.29, 0.40	0.02, 0.02, 0.03
	+3	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01

Tissue and sampling time (days)	Residue (mg/kg)					
	Dose, 15/3 ppm		Dose, 30/6 ppm		Dose, 60/12 ppm	
	acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
Fat (subcutaneous + peritoneal) 28	0.05, 0.05, 0.10	<0.01 (3)	0.15, 0.09, 0.10	<0.01 (3)	0.17, 0.31, 0.40	<0.01 (3)
+3	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01

Processing of whole milk (pooled milk from the high dose group on days 25, 26 and 27) did not reveal any concentration of residues in skim milk, protein or milk fat (Table 69).

Table 69. Residues of acephate and methamidophos in milk fractions after processing (Lai 1987h).

Milk fraction	Residue (mg/kg)	
	acephate	methamidophos
Pasteurized milk	0.83	0.05
Non-fat milk solids	0.62	0.06
Milk fat solids	0.06	<0.01
Milk sugar (lactose)	0.45	0.04
Protein	0.44	0.03
Milk (days 25-27)	0.66-0.97	0.04-0.07
Mean milk (days 25-27)	0.78 ± 11%	0.06 ± 16%

Pigs

Tucker (1973c) fed three groups of 4 Crossbred pigs (2 females, 2 males/group) a ration (Purina Hog Starter) containing acephate and methamidophos at 3.0/0.6, 10/2.0 and 30/6.0 ppm for 30 days. The feed was available *ad libitum*, 24 hours a day. The weights of the pigs at the start of the study were in the range 12-16 kg while the slaughter weights were 14-35 kg. The feeding period was followed by a 6 day recovery period, during which time acephate- and methamidophos-free feed was given. One pig from each treatment group was sacrificed after 21 and 27 days of feeding and one following 1 and 6 days recovery. Samples of liver, heart, kidney, muscle (anterior, posterior and middle), fat (subcutaneous and peritoneal fat) and brain were collected for analysis according to residue method RM-12A-2 (Table 70).

The highest residues in rank order were observed in muscle, kidney, brain, fat and liver. Residue levels were approximately in proportion to the dose. On ceasing dosing, residues in tissues rapidly declined such that they were <LOQ by 6 days of recovery. The half-life for decline was estimated to be <1 day.

Table 70. Residues of acephate and methamidophos in tissues of pigs fed a diet incorporating 5:1 mixtures of acephate and methamidophos for 30 consecutive days, (Tucker 1973c).

Tissue and sampling time (days)	Residue (mg/kg)					
	Dose, 3/0.6 ppm		Dose, 10/2 ppm		Dose, 30/6 ppm	
	acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
Liver 21	<0.02	<0.01	0.03	<0.01	0.08	<0.01
27	<0.02	<0.01	0.12	0.01	<0.02	<0.01
+1	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Heart 21	<0.02	<0.01	0.05	<0.01	0.09	<0.01
27	0.05	<0.01	0.16	0.02	0.49	0.09
+1	<0.02	<0.01	<0.02	<0.01	0.02	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Kidney 21	<0.02	<0.01	0.08	<0.01	0.13	<0.01
27	0.04	<0.01	0.17	0.03	0.42	0.08
+1	<0.02	<0.01	<0.02	<0.01	0.03	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Muscle 21	<0.02	<0.01	0.03	<0.01	0.07	<0.01
27	0.05	<0.01	0.15	0.02	0.48	0.07
+1	<0.02	<0.01	<0.02	<0.01	0.03	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Subcutaneous fat 21	<0.02	<0.01	0.04	<0.01	0.06	<0.01

Tissue and sampling time (days)	Residue (mg/kg)					
	Dose, 3/0.6 ppm		Dose, 10/2 ppm		Dose, 30/6 ppm	
	acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
27	<0.02	<0.01	0.05	<0.01	0.10	0.01
+1	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Peritoneal fat 21	NS	NS	NS	NS	NS	NS
27	<0.02	<0.01	0.07	<0.01	NS	NS
+1	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01
Brain 21	0.02	<0.01	0.06	<0.01	0.16	<0.01
27	0.04	<0.01	0.09	0.01	0.25	0.03
+1	<0.02	<0.01	<0.02	<0.01	0.03	<0.01
+6	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01

NS = not sampled.

Procedural recoveries from tissues fortified with acephate and methamidophos at 0.05 mg/kg were as follows. Acephate: muscle 76, 92%; liver, 78, 70%; kidney 64, 90%; subcutaneous fat 92, 70%; peritoneal fat 118, 112%; heart 90, 80%; brain 84, 80%. Methamidophos: muscle 109, 122%; liver 104, 86%; kidney, 110, 134%; subcutaneous fat 102, 91%; peritoneal fat 94, 104%; heart 125, 114%; brain 108, 90%.

Chickens

Leary and Lee (1972) fed three groups of 29 White Leghorn chickens (25 females, 4 males/group) diets containing acephate at 3, 10 and 30 ppm for 92 days, starting when the chickens were 24 weeks of age. The feed was available *ad libitum*, 24 hours a day. Egg samples were collected at 7, 14 and 92 days of feeding and at 3, 7, 14 and 28 days after cessation of dosing and during the recovery period. Samples of tissues (muscle, kidney, liver and fat) were collected from birds sacrificed after 7 and 92 days of feeding and after 7 and 28 days on a control diet (recovery period). Residue analysis was according to residue method RM-12A-1 and the results are summarized in Table 71.

Eggs and muscle were the only tissues to contain residues above the LOQ at either feed level. Residues declined to <LOQ by 3 to 7 days after the cessation of dosing.

Table 71. Residues of acephate and methamidophos in eggs and tissues of chickens fed a diet incorporating acephate for periods of up to 92 days, (Leary and Lee 1972).

Tissue and sampling time (days)	Residue (mg/kg)					
	Dose, 3 ppm		Dose, 10 ppm		Dose, 30 ppm	
	acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
Eggs 7	<0.01	<0.001	0.08	0.005	0.19	0.016
14	<0.01	<0.001	0.09	0.006	0.19	0.014
92	<0.01	<0.001	0.06	0.002	0.13	0.013
+3	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
+7	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
+28	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
Fat 7	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
92	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
+7	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
+28	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Kidney 7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
92	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
+7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
+28	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Liver 7	<0.02	<0.002	<0.02	<0.002	<0.02	<0.002
92	<0.02	<0.002	<0.02	<0.002	<0.02	<0.002
+7	<0.02	<0.002	<0.02	<0.002	<0.02	<0.002
+28	<0.02	<0.002	<0.02	<0.002	<0.02	<0.002
Muscle 7			0.01	0.003	0.12	0.046
92			0.01, 0.01	0.003, 0.008	0.02, 0.01	0.01, 0.006
+7			<0.01, <0.01	0.001, <0.001	<0.01, <0.01	<0.001, <0.001

Tissue and sampling time (days)	Residue (mg/kg)					
	Dose, 3 ppm		Dose, 10 ppm		Dose, 30 ppm	
	acephate	methamidophos	acephate	methamidophos	acephate	methamidophos
+28			<0.01, <0.01	<0.001, <0.001	<0.01, <0.01	<0.001, <0.001

Quail

Feed treated at 10 and 30 ppm was fed to Bobwhite quail (5 females, 3 males/group, all ca. 200 g bw) for 148 days (Fletcher 1972). At the end of this period, the birds were maintained on untreated feed for a further 31 days. Samples of eggs were collected at intervals. Birds were sacrificed on the first day after treated feed was stopped and 31 days later. Samples of muscle, kidney, liver and fat were collected for analysis utilizing method RM-12A-1 and the results are summarized in Table 72.

Residues above the LOQ were detected in eggs, muscle and fat. However, these declined to <LOQ by 7 days of recovery on untreated feed.

Table 72. Residues of acephate and methamidophos in eggs and tissues of Bobwhite quail fed a diet incorporating acephate for periods of up to 148 days, (Fletcher 1972).

Tissue and sampling time (days)	Residue (mg/kg)			
	Dose, 10 ppm		Dose, 30 ppm	
	acephate	methamidophos	acephate	methamidophos
Eggs 92-98	0.14	<0.001	0.34	0.014
112-118	0.19	0.007	0.28	0.017
+1-2	0.12	0.005	0.14	0.010
+6-7	<0.01	<0.001	<0.01	<0.001
+14-15	<0.01	<0.001	<0.01	<0.001
+20-21	<0.01	<0.001	<0.01	<0.001
+27-28	<0.01	<0.001	<0.01	<0.001
Muscle	0.01	<0.001	0.04	<0.001
+31	<0.01	<0.001	<0.01	<0.001
Liver	<0.01	<0.001	<0.01	<0.001
+31	<0.01	<0.001	<0.01	<0.001
Kidney	<0.01	<0.001	<0.01	<0.001
+31	<0.01	<0.001	<0.01	<0.001
Fat	0.06	0.014	0.03	0.006
+31	<0.01	<0.001	0.04	<0.001

NATIONAL MAXIMUM RESIDUE LIMITS

The Meeting was aware of the MRLs for acephate shown in Table 73.

Table 73. National MRLs for acephate.

Country	MRL, mg/kg	Commodity
Australia	10	lettuce (head), lettuce (leaf)
	5	citrus, brassica (cole or cabbage vegetables), peppers (sweet), tomatoes
	2	cotton seed
	1	bananas, dwarf bananas, soya beans (dry)
	0.5	potatoes, tree tomatoes
	0.5	macadamia nuts
	0.2	edible offal (mammalian), eggs, meat (mammalian) except sheep meat
	0.1	sugar beet
	0.1 (*)	macadamia nuts
	0.01 (*)	sheep meat
Austria	2	cabbages (head)
	1	artichokes, cauliflowers, citrus, lettuce, pome fruit
	0.5	tomatoes
	0.02	other fruit, potatoes, other vegetables

Country	MRL, mg/kg	Commodity
Belgium	3	beans (with pods)
	2	Brussels sprouts, cabbages (head), cauliflowers
	1	citrus, lettuce, pome fruit
	0.5	tomatoes
	0.2	artichokes, peaches
	0.02	other fruit, potatoes, other vegetables
Canada	5	celery
	2	cauliflowers, peppers
	1.5	Brussels sprouts
	1	beans, lettuce
	0.5	corn, cranberries, potatoes, soybeans
	0.3	cabbages
	0.05	milk
Denmark	2	cabbagse (head)
	1	citrus, lettuce
	0.5	tomatoes
	0.02	other fruit, potatoes, other vegetables
EU	3	beans (with pods), peas (with pod)
	2	flowering brassicas, head brassicas, plums
	1	citrus, lettuce, pome fruit
	0.5	egg plants, tomatoes
	0.2	artichokes, peaches
	0.1	tea, hops (dry)
	0.02	other fruit, other vegetables, cereals, tree nuts
France	3	beans
	2	broccoli, cabbages (head), cauliflowers
	1	citrus, lettuce, pome fruit
	0.5	tomatoes
	0.2	artichokes
	0.02	other fruit, potatoes, other vegetables
Finland	3	beans (with pods),French beans
	2	broccoli, Brussels sprouts, cabbages (head), cauliflowers, peaches
	1	citrus, lettuce, pome fruit
	0.5	tomatoes
	0.2	artichokes
	0.02	other fruit, potatoes, other vegetables
Germany	3	beans (with pod), peas (with pod)
	2	brassica vegetables except leafy brassicas, plums
	1	citrus, lettuce, pome fruit
	0.5	tomatoes, egg plants
	0.2	artichokes
	0.1	hops, tea
	0.02	other fruit, potatoes, other vegetables
Israel	5	cabbages, melons, peppers, tomatoes, water melons
	2	cotton, forage corn, mangoes, sweet corn
	0.5	garlic, kohlrabi, onions
	0.1	almonds, eggs, fat, meat, milk, poultry fat, poultry meat

Country	MRL, mg/kg	Commodity
Italy	3	beans (with pods), French beans
	2	broccoli, Brussels sprouts, cabbages (head), cauliflowers
	1	citrus, lettuce, pome fruit
	0.5	tomatoes
	0.2	artichokes
	0.02	beans (without pods), other fruit, potatoes, other vegetables
Japan	10	celery, Japanese radish (including radish) leaves, turnip (including rutabaga) leaves, tea
	5	horseradish, watercress, Chinese cabbages, cabbage, Brussels sprouts, kale, komastsuna, kyona, cauliflowers, broccoli, other cruciferous vegetables, lettuce (cos, leaf lettuce), tomatoes, pimentos (sweet pepper), egg plants, other solanaceous vegetables, cucumbers (including gherkins), okra, citrus, grapes
	3	beans (dry), kidney beans (with pods, immature), other vegetables
	2	garlic, Japanese persimmons, cotton seed
	1	potatoes, Japanese radish (including radish) roots, turnip (including rutabaga) roots, other fruit,
	0.5	corn (including maize, sweet corn), soya beans (dry), yams, onions, other liliaceous vegetables, parsley, other umbelliferous vegetables, soya beans, cranberries, water melons
	0.2	peanuts (dry), other composite vegetables, other cucurbitaceous vegetables
	0.1	sugar beet, burdock, welsh onions (including leeks), multiplying onions (including shallots), ginger, peas (with pods, immature), other nuts
Korea	10	celery, radish leaves
	5	cabbages, Korean cabbages, citrus, cucumbers, egg plants, grapes, kale, Korean lettuce, lettuce, peppers (sweet), tomatoes
	4	green and red peppers
	3	kidney beans, mung beans, red beans, other vegetables
	2	persimmons, garlic, cotton seed
	1	radishes (root), other fruit
	0.5	corn, onions, potatoes, soya beans, watermelons
	0.2	peanuts
	0.1	ginger, leeks, nuts, welsh onions
Luxembourg	3	beans (with pods), French beans
	2	broccoli, Brussels sprouts, cabbages (head), cauliflowers
	1	citrus, lettuce, pome fruit
	0.5	peppers
	0.2	artichokes, peaches
	0.02	other fruit, potatoes, other vegetables
Mexico	10	lettuce (head)
	4	cotton seed hulls, peppers
	3	beans, Brussels sprouts
	2	cauliflowers, cotton seed
	1	soya beans
	0.1	cattle fat, cattle meat, eggs, hogs fat, hogs meat, milk, poultry fat, poultry meat
Netherlands	3	beans (with pods)
	2	broccoli, Brussels sprouts, cabbages (head), cauliflowers
	1	citrus, lettuce, pome fruit
	0.5	tomatoes
	0.2	artichokes, peaches
	0.02	other fruit, potatoes, other vegetables

Country	MRL, mg/kg	Commodity
Spain	3	beans (with pods), French beans
	2	broccoli, Brussels sprouts, cabbages (head), cauliflowers
	1	citrus, lettuce, pome fruit
	0.5	tomatoes
	0.2	artichokes
	0.02	other fruit, potatoes, other vegetables
Sweden	3	beans (with pods), French beans
	2	broccoli, Brussels sprouts, cabbages (head), cauliflowers
	1	citrus, lettuce, pome fruit
	0.5	tomatoes
	0.2	artichokes
	0.02	other fruit, peaches, potatoes, other vegetables
Switzerland	2	Brussels sprouts, cabbages (head)
	1	citrus, lettuce
	0.5	grapes, pome fruit, potatoes, plums, other vegetables
	0.1	tea
	0.02	cereals, oilseeds, other fruit, root and tuber vegetables
Taiwan	1	fruit vegetables (tomatoes, egg plants, sweet peppers, etc.), leaf vegetables (cabbages, cauliflowers, Chinese cabbages, broccoli, lettuce, Brussels sprouts, mustard, Chinese mustard, Chinese kale, celery, water spinach, spinach, lettuce, garland chrysanthemums, leaf-beet, garlic, spring onions, Chinese leeks, etc.), melon vegetables (cucumbers, bitter melons, luffa, wax gourds, pumpkins, vegetable pears, etc.), peas and beans (snap beans, snow peas, vegetable soy beans, lablab, asparagus beans, kidney beans, etc.), root vegetables (radishes, carrots, ginger, onions, potatoes, bamboo shoots, asparagus, co-ba, taro, etc.)
	0.5	rice, other cereals and crops (corn, sorghum, sweet potatoes, etc.)
	0.1	pome (apples, pears, peaches, plums, Japanese apricots, cherries, jujubes, persimmons, etc.).
United Kingdom	3	beans (with pods), French beans
	2	broccoli, Brussels sprouts, cabbage (head), cauliflower
	1	citrus, lettuce, pome fruit
	0.5	tomato
	0.2	artichoke, peaches
	0.02	beans (without pods), other fruit, potato, other vegetables, vegetables (dry)
United States	15	mint hay
	10	lettuce (head), celery
	8	cotton meal
	4	cotton seed hulls, peppers, soya bean meal
	3	beans, Brussels sprouts
	2	cauliflowers, cotton seed
	1	soya beans
	0.5	cranberries
	0.2	peanuts
	0.1	cattle fat, cattle meat, cattle meat by-products, eggs, goat fat, goat meat, goat meat by-products, hog fat, hog meat, hog meat by-products, horse fat, horse meat, horse meat by-products, milk, poultry fat, poultry meat, poultry meat by-products, sheep fat, sheep meat, sheep meat by-products
	0.05	macadamia nuts
	0.02	processed foods

* At or about the lower limit of determination.

RESIDUES IN FOOD IN COMMERCE OR AT CONSUMPTION

Monitoring data

Recent information on national residue monitoring programmes involving acephate and

methamidophos in Australia, UK and in the European Community was provided.

In the residue monitoring data from the Australian Residue Survey of 2001-2002, pecan and macadamia nuts were tested for residues using a multi-residue method. No acephate or methamidophos residues were detected in any of the 45 pecan samples tested, nor were any residues reported in the 134 samples of macadamia nuts tested. Reporting limits were 0.05 mg/kg for macadamia nuts and 0.1 mg/kg for pecans.

The results of the residue monitoring conducted in the UK during 2001, as part of the co-ordinated EU residue monitoring programme, are summarized in Table 74.

Table 74. Results for acephate from the UK 2001 pesticide residue monitoring programme.

Commodity Year (months)	Samples analyzed	Samples with detects	Samples <LOR [1/]	Samples with residues in range, mg/kg				
				≤0.01	>0.01, ≤0.02	>0.02, ≤0.05	>0.05, ≤0.1	>0.1, ≤0.2
Grapes, 2001 (Jan-Sep)	54	0	54					
Star fruit, 2001 (Apr-Aug)	25	0	25					
Kiwifruit, 2001 (Jan-Sep)	47	0	47					
Mangoes, 2001 (May-Aug)	36	0	36					
Peaches, 2001 (Apr-Jun)	19	1	18					1
Nectarines, 2001 (Apr-Jun)	17	1	16				1	
Cow's milk, 2001 (Jul-Sep)	51	0	51					

[1/] LOR was the limit of reporting (0.01 mg/kg).

The co-ordinated EU residue monitoring programme for 2000, covering rice, cucumbers, head cabbage and peas, included acephate as one of the 20 pesticides analyzed in the programme and the results are summarized in Table 75.

Table 75. Results for acephate from the co-ordinated EU 2000 residue monitoring programme.

Commodity, year	Samples analyzed	Samples with detects	Samples <LOR [1/]	Samples with residues in range, mg/kg		
				<=2.0	>2.0	Max residue (mg/kg)
Rice, 2000	869	0	869			
Cucumber, 2000	1176		1176			
Cabbage, head, 2000	962	0	958	4		
Peas, 2000	730	0	730			

[1/] LOR was the limit of reporting.

Monitoring data from the USA, extracted from the USDA Pesticides Data Program for a range of fresh and processed foods sampled between 1998 and 2000, are summarised in Table 76.

Table 76. Results for acephate from the 1998-2000 USDA Pesticides Data Program.

Year Commodity	Samples analyzed	Samples with detects	% Samples with detects	Range of values detected (mg/kg)	Range of LORs [1/] (mg/kg)
1998					
Apple juice	694	2	0.3	0.003 - 0.007	0.002 -0.006
Cantaloupes	408	11	2.7	0.003 - 0.020	0.002 -0.006
Grape juice	665	0			0.002 -0.006
Green beans, canned & frozen	346	165	47.7	0.003 - 0.54	0.002 -0.006
Orange juice	700	0			0.002 -0.033
Pears, single serving	344	1	0.3	0.021	0.002 -0.012
Pears	712	1	0.1	0.01	0.002 -0.012
Spinach, canned	695	0			0.002 -0.012
Strawberries, fresh	610	0			0.002 -0.012
Strawberries, frozen	47	0			0.002 -0.010
Sweet potatoes	357	0			0.002 -0.006
Tomatoes	717	4	0.6	0.008 - 0.033	0.002 - 0.010
Winter squash, fresh	530	5	0.9	0.003 - 0.12	0.002 - 0.006
Winter squash, frozen	149	0			0.002 -0.006
1999					
Apples	379	1	0.3	0.007	0.004
Apples, single serving	1427	4	0.3	0.007 - 0.016	0.004

Year Commodity	Samples analyzed	Samples with detects	% Samples with detects	Range of values detected (mg/kg)	Range of LORs [1/] (mg/kg)
Cantaloupes	826	12	1.5	0.003 - 0.099	0.002 - 0.006
Cucumbers	730	2	0.3	0.003	0.002 - 0.012
Grape juice	713	0			0.002 - 0c006
Lettuce	185	29	15.7	0.003 - 0.25	0.002 - 0.005
Pears, canned	371	0			0.002 - 0.012
Pears, fresh	359	0			0.002 - 0.012
Pears, single serving	352	0			0.002 - 0.012
Spinach, frozen	715	3	0.4	0.003 - 0.007	0.002 - 0.012
Strawberries, fresh	640	2	0.3	0.007	0.002 - 0.012
Strawberries, frozen	71	0			0.002 - 0.012
Sweet bell peppers	718	181	25.2	0.003 - 1.4	0.002 -0.010
Tomatoes, canned	368	2	0.5	0.007 - 0.008	0.002 -0.010
2000					
Apples	184	0			0.006
Cantaloupes	406	0			0.002 -0.006
Carrots	184	0			0.002
Cherries	275	0			0.002 - 0.004
Cucumbers	737	4	0.5	0.010-0.079	0.002 - 0.006
Grapes	142	0			0.002
Green beans	720	192	26.7	0.003 - 1.6	0.002 -0.003
Lettuce	740	112	15.1	0.003 - 0.16	0.002 - 0.005
Nectarines	96	0			0.002
Oranges	215	0			0.002
Peaches, composite	536	1	0.2	0.026	0.004
Peaches, single serving	534	1	0.2	0.023	0.004
Pears, canned	366	1	0.3	0.008	0.002 - 0.005
Pineapples	104	0			0.002
Potatoes	369	1	0.3	0.008	0.002 -0.005
Strawberries, fresh	518	0			0.002 - 0.010
Strawberries, frozen	37	0			0.002 -0.010
Sweet bell peppers	738	151	20.5	0.003 - 1.3	0.002 - 0.003
Tomatoes, canned	369	0			0.002 - 0.010

[1/] LOR is the limit of reporting.

Eight market basket surveys were conducted in the USA during 1984 and 1985, with 26-62 commodities being collected and analyzed in each of these quarterly surveys. The edible portions of each commodity from each location per survey were combined and analyzed for the presence of acephate and methamidophos (LOD 0.01-0.02 mg/kg). Detectable residues of acephate were found in cantaloupes, celery, crisp head lettuce and tomatoes (all less than 0.1 mg/kg) and in sweet peppers, in which a maximum of 0.72 mg/kg was recorded.

Methamidophos residues were also detected: in cantaloupes, celery, cucumbers, crisp head lettuce at ≤0.1 mg/kg, and in tomatoes and sweet peppers at levels up to 0.26 mg/kg.

No residue of either compound was detected in any commercially processed food, except canned snap beans, in which residues of 0.02 mg/kg (acephate) and 0.01 mg/kg (methamidophos) were found.

APPRAISAL

Acephate has been evaluated several times, first in 1976 and most recently in 1996. It was listed under the Periodic Review Programme by the 28th Session of the CCPR for residue review by the 2003 JMPR (ALINORM 97/24). The 2002 JMPR established an ADI and acute RfD for acephate of 0-0.01 mg/kg bw and 0.05 mg/kg bw, respectively. The present Meeting received information on the metabolism and environmental fate of acephate, methods of residue analysis, freezer storage stability, national registered use patterns, supervised residue trials and national MRLs.

Some information on GAP, national MRLs and residue data was reported by the governments of Australia, Germany and The Netherlands.

Acephate is a broad-spectrum organophosphorus insecticide with uses on many crops.

Animal metabolism

Studies on lactating goats, quail and laying hens were reported to the present Meeting.

In the three goat studies, when [*S*-methyl-^{14}C]acephate either alone or in combination with [*S*-methyl-^{14}C]methamidophos and/or with [carbonyl-^{14}C]acephate was used, most of the ^{14}C in the tissues was incorporated into natural products: proteins and amino acids in liver, kidney, muscle and milk, lipids in fat and milk, and lactose in milk. Acephate constituted a maximum of 47% of the ^{14}C in the milk. At 18-20 h after the last dose of [*S*-methyl-^{14}C]acephate or [carbonyl-^{14}C]acephate, the parent compound accounted for 4.2-4.8%, 14-26% and 22-26% of the ^{14}C in the liver, kidney and muscle respectively but was not detected in the fat.

Only traces of acephate were detected in the tissues of quail 3 days after dosing with [*S*-methyl-^{14}C]acephate, which is consistent with other observations that the metabolism of acephate is rapid. Acephate was a major component of the residue in egg whites and yolks, muscle and fat (maximum of 64% of the radiolabel in muscle, 62% in egg whites, 33% in yolks and 26% in the fat from laying hens dosed with [*S*-methyl-^{14}C]- and [carbonyl-^{14}C]acephate. Incorporation into lipids and proteins accounted for most of the ^{14}C in yolk, liver and fat.

The metabolism of acephate proceeds by hydrolysis of the ester/thioester and amide moieties to form SMPT, OMAPAA and methamidophos. Liberated carbon fragments enter the metabolic pool and are incorporated into natural products, principally proteins and lipids and, in the case of milk, lactose.

Plant metabolism

Studies on bean, cabbage and tomato seedlings, and on lettuce, cotton and bean plants were reported.

Acephate was the major component of the extracted ^{14}C residue in bean, cabbage and tomato seedlings treated by either foliar application or stem injection with [*S*-methyl-^{14}C]acephate. Small amounts of methamidophos were also detected. Residues of acephate were translocated and the pesticide is considered to be systemic.

Twenty days after the third foliar application to lettuce of [*S*-methyl-^{14}C]acephate and [carbonyl-^{14}C]acephate, the parent compound was the main identified component (45-53%) of the extracted ^{14}C residue and the metabolites were methamidophos (11%), SMPT (11-15%) and a metabolite tentatively identified as OMAPAA (29%). Similar results were obtained with beans, harvested 14 days after three foliar applications of acephate with the same labels: acephate accounted for 62-74% of the ^{14}C in the forage and 14-15% in the beans, and the metabolites were methamidophos (7.3-7.7% of the TRR), SMPT (6.5-14%) and OMAPAA (23-57%). Most of the remaining ^{14}C was distributed in natural products (starch, protein, pectin, hemicellulose, cellulose).

In cotton harvested 21 days after three foliar applications of the same labels as above, ^{14}C residues in the trash were predominantly acephate (40-41%), with smaller amounts of SMPT (17-29%) and OMAPAA (1-27%). Methamidophos was only a minor metabolite (<2% of the TRR). In contrast, acephate represented a relatively small fraction of the ^{14}C in cotton seed meal and hulls (0.8-7.3%). OMAPAA (1-24% in hulls, 1-22% in meal) was the main metabolite with smaller amounts of SMPT (1-4.2%). Most of the ^{14}C in cotton seed was incorporated into natural products.

In plants, acephate is metabolized by ester/thioester and amide hydrolysis reactions to form methamidophos, SMPT and OMAPAA as the main metabolites. Further metabolism results in the incorporation of acephate-derived fragments into natural plant products.

Environmental fate in soil

Information was provided on the soil adsorption of acephate and on its behaviour or fate during soil and solution photolysis, aerobic and anaerobic degradation in soil, column leaching of aged residues and field dissipation.

Acephate did not undergo significant direct photolysis on soil surfaces. In aqueous solution it was stable to hydrolysis except at high pH. At pH 9 about 40% of the initial ^{14}C was present as acephate after 23 days.

The aerobic soil degradation of acephate was rapid with half-lives of ≥7 days. The main route of degradation appeared to be microbial metabolism as only minimal degradation occurred in sterile soils and the degradation rate generally increased with both soil organic matter and moisture contents. The major degradation products were methamidophos, OMAPAA, DMPT, SMPT and SMPAA.

In field dissipation, the residues of acephate did not move down the soil profile and dissipation was rapid, with half-lives of less than 3 days for both acephate and methamidophos.

In summary, acephate is not significantly degraded by hydrolysis, except in waters having high pH values. Photochemical transformation is expected to be a minor route of degradation. Degradation in field and aquatic environments is rapid and acephate is not expected to persist in the environment.

Analytical methods

Samples in the field trials were analyzed for acephate and methamidophos by solvent extraction (ethyl acetate or in the case of oily crops and fats acetonitrile/hexane), clean-up by solvent partition and/or silica column or gel permeation chromatography followed by GC separation with FPD (phosphorus mode), NPD (nitrogen mode), thermionic or ion-selective MS detection. LOQs of 0.01-0.02 mg/kg for acephate and 0.01 mg/kg for methamidophos were reported for numerous commodities.

Stability of pesticide residues in stored analytical samples

The available data indicated that the combined residues of acephate and methamidophos are stable during frozen storage at -20°C in or on eggs for 6 months; cattle meat and milk for 7 months or cattle kidney for 6 months; goat liver for 3 months; apples for 16 months; apple sauce and juice for 55 days; pinto beans for 15 months; snap beans for 15 months; Brussels sprouts for 9 months; celery for 12 months; maize grain and silage for 7 months; maize meal, flour and presscake for 2 months; cotton seed for 48 days; Bermuda grass forage and hay for 2 months; pasture grass for 9 months; lettuce for 17 months; pigeon peas for 14 months; bell peppers for 13 months; rice grain and straw for 17 months, and fresh and spent spearmint hay for 2 months.

Field-incurred residues were stable in tomato juice and purée and canned tomatoes when stored at ambient temperature (not specified) for up to 3 months.

Definition of the residue

A main metabolite of acephate in or on crops is methamidophos, which is a pesticide in its own right with its own MRLs. Analytical methods used for acephate can distinguish between acephate and methamidophos (i.e. they are not common moiety methods). Residues of methamidophos arising from the use of acephate must be reconciled with an MRL for compliance purposes. This could be achieved either by defining the residue of acephate as the sum of acephate and methamidophos or by establishing specific methamidophos MRLs for methamidophos residues arising from the use of acephate. In national systems the definition of the residue for acephate is generally acephate *per se*, and methamidophos residues resulting from the use of acephate are accounted for by separate MRLs.

For the estimation of dietary intake it is necessary to account for the residues of both acephate and methamidophos, and their relative toxicity must be taken into account. A conservative approach is to sum the residues after scaling the methamidophos residues for "potency", based on the ratio of the acephate to methamidophos maximum ADIs for STMR estimates and acute RfDs for HR estimates. The ratios are based on mass and do not require correction for molecular weight.

For acephate STMR estimation, residue = acephate + (2.5 x methamidophos)
For acephate HR estimation, residue = acephate + (5 x methamidophos)

The FAO Manual (page 51) states that "preferably no compound, metabolite or analyte should appear in more than one residue definition". The Meeting agreed that the acephate residue should be defined as acephate.

The log P_{ow} for acephate is –0.9 and this, together with the animal metabolism and feeding studies, indicates that acephate should not be classified as fat-soluble.

Definition of acephate residue

for compliance with MRLs: acephate

for estimation of dietary intake: acephate and methamidophos

The definitions apply to both plant and animal commodities.

Supervised trials

When evaluation of the supervised trial data leads to an estimated maximum residue level for acephate, it is also necessary to ensure that residues of methamidophos arising from the use of acephate are covered by a maximum residue level for methamidophos. As methamidophos is also under periodic review by the current Meeting, residues of methamidophos arising from the use of acephate will be considered together with those from uses of methamidophos *per se* in the methamidophos evaluation.

Supervised trials were reported on alfalfa, apples, artichokes, beans, broccoli, Brussels sprouts, cabbage, cauliflower, citrus fruits (grapefruit, lemons, oranges, mandarins), cotton, cucumbers, egg plants, hops, leeks, lettuce, peaches, pears, peppers, plums, potatoes, soya beans, sugar beet and tomatoes.

No information on trials or GAP was reported for tree tomatoes (current CXL 0.5 mg/kg) and the Meeting recommended withdrawal of the CXL.

As acephate residues in crops decrease relatively slowly, the number of applications has a significant influence on the final residue. To account for the influence of multiple sprays, the Meeting decided that, when an upper limit on the number of sprays was not specified by GAP, 2-3 applications would be the minimum number acceptable for estimating a maximum residue level.

In some cases untreated control samples contained residues of acephate and methamidophos. Trials were considered acceptable providing the residues in control samples were less than 10% of the residues in the treated crop.

Citrus fruits. Trials on citrus fruits were conducted in Argentina (no GAP), Brazil (GAP 0.039 kg ai/hl, PHI 21 days), Greece (no GAP), Japan (GAP 0.5-2.5 kg ai/ha, 0.03-0.06 kg ai/hl, PHI 30 days), New Zealand (GAP 0.078 kg ai/hl, PHI 14 days), South Africa (no GAP) and the USA (GAP 0.56-0.84 kg ai/ha to non-bearing trees).

Data were reported from supervised trials on grapefruit, lemons, mandarins, natsudaidai and oranges, but only those on mandarins and natsudaidai were conducted according to GAP.

In two trials in Japan on natsudaidai, residues of acephate were 0.1 and 3.0 mg/kg (0.01 and 0.33 mg/kg for methamidophos). The Meeting decided that this was not sufficient to estimate a maximum residue level. Fourteen trials on mandarins in Japan, that approximated Japanese GAP, showed acephate residues of 0.38, 0.4, 0.49, 0.68, 0.78, 0.85, 0.88, 0.98, 1.7, 1.7, 1.8, 1.8, 2.6 and 5.2 mg/kg, and methamidophos residues of 0.02, 0.03, 0.04, 0.05, 0.06, 0.08, 0.08, 0.09, 0.09, 0.1, 0.14, 0.15, 0.25 and 0.26 mg/kg. In a single trial on mandarins in New Zealand. conducted according to GAP in that country, the residue of acephate was 3.3 mg/kg and of methamidophos 0.29 mg/kg.

The residues of acephate and methamidophos, combined as explained above, for the purpose of estimating the STMR (median underlined) were 0.43, 0.48, 0.64, 0.78, 0.91, 1.1, 1.1, 1.2, 1.9, 2.1, 2.1, 2.2, 3.2 and 5.9 mg/kg on a whole fruit basis. The HR for dietary intake purposes was estimated to be 6.5 mg/kg.

The Meeting estimated a maximum residue level, STMR and HR for acephate in mandarins of 7, 1.15 and 6.5 mg/kg, all based on whole fruit as insufficient information was available to estimate residues in the edible portion.

Methamidophos residues in mandarins (0.02, 0.03, 0.04, 0.05, 0.06, 0.08, 0.08, 0.09, 0.09, 0.13, 0.14, 0.15, 0.25 and 0.26 mg/kg) are considered in the evaluation of methamidophos, for the estimation of maximum residue levels.

Pome fruits. Trials on apples were conducted in Denmark (no GAP), France (GAP 0.06 kg ai/hl, PHI 21 days), Germany (no GAP), Greece (GAP 0.075 kg ai/hl, PHI 15 days), Italy (GAP 0.034-0.064 kg ai/hl, PHI 30 days), The Netherlands (no GAP), Spain (GAP apples 1.1 kg ai/ha, 0.075 kg ai/hl, PHI 14 days, pome fruit 0.038-0.11 kg ai/hl, PHI 21 days), Switzerland (no GAP), the USA (no GAP) and Yugoslavia (no GAP). Trials in The Netherlands and Germany were evaluated according to GAP in France.

In two trials in France, which approximated French GAP, residues of acephate were 3.7 and 4.2 mg/kg (methamidophos 0.22 and 0.28 mg/kg), and in two trials in The Netherlands and three in Germany, all matching French GAP, residues of acephate were 0.65, 1.5, 2.8, 3.2 and 3.6 mg/kg (methamidophos 0.04, 0.06, 0.13, 0.14 and 0.16 mg/kg). One trial in Italy (0.56 mg/kg, methamidophos <0.1 mg/kg) and two in Greece (0.35, 0.39 mg/kg, methamidophos 0.03, 0.04 mg/kg) complied with the GAP of the respective countries.

The Meeting considered that the residues of acephate on apples were all from the same population and that the data should be combined for estimating a maximum residue level and STMR. The residues of acephate in apples from trials according to GAP (n=10) were 0.35, 0.39, 0.56, 0.65, 1.5, 2.8, 3.2, 3.6, 3.7 and 4.2 mg/kg.

Trials on pears were conducted in France (GAP 0.06 kg ai/hl, PHI 21 days), Italy (GAP 0.034-0.064 kg ai/hl, PHI 30 days), South Africa (GAP 0.038 kg ai/hl, PHI 30 days) and Spain (GAP pears 1.2 kg ai/ha, 0.075 kg ai/hl, PHI 21 days, pome fruit 0.038-0.11 kg ai/hl, PHI 21 days).

In one trial in Italy and two in Spain, conducted according to the GAP of those countries, acephate residues were 0.26, 0.28 and 0.55 mg/kg, with methamidophos residues of 0.03, 0.06 and <0.1 mg/kg.

The Meeting agreed to combine the data for the residues of acephate on apples and pears, to estimate a maximum residue level and STMR. The residues from trials according to GAP (n=13) were 0.26, 0.28, 0.35, 0.39, 0.55, 0.56, 0.65, 1.5, 2.8, 3.2, 3.6, 3.7 and 4.2 mg/kg.

The appropriately scaled and totalled residues of acephate and methamidophos for estimating the STMR (median underlined) were 0.34, 0.44, 0.45, 0.53, 0.7, 0.75, 0.81, 1.7, 3.1, 3.6, 4.1, 4.3 and 4.8 mg/kg. The HR was estimated to be 5.4 mg/kg.

The Meeting estimated a maximum residue level, STMR and HR for acephate in pome fruits of 7, 0.81 and 5.4 mg/kg.

Methamidophos residues in apples and pears from the use of acephate (n=13) were <0.1, <0.1, 0.03, 0.03, 0.04, 0.04, 0.06, 0.06, 0.13, 0.14, 0.16, 0.22 and 0.28 mg/kg and are further considered in the methamidophos evaluation.

Stone fruits. Trials on peaches were conducted in France (GAP 0.06 kg ai/hl, PHI 21 days), Greece (GAP 0.038-0.075 kg ai/hl, PHI 15 days), Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days) and Spain (GAP peaches 2.8 kg ai/ha, 0.075 kg ai/hl, PHI 21 days, stone fruit 0.038-0.11 kg ai/hl, PHI 21 days).

In one trial in Italy and one in Spain, conducted approximately according to Spanish GAP, residues were <0.02 and 0.1 mg/kg (methamidophos 0.02 and 0.03 mg/kg).

Two peach trials in each of Greece, Spain and France, conducting according to GAP in Greece, gave acephate residues of 0.46, 0.46, 0.63, 1.0, 1.4 and 1.4 mg/kg (methamidophos residues 0.09, 0.1, 0.16, 0.22, 0.28 and 0.35 mg/kg).

The appropriately adjusted and totalled residues of acephate and methamidophos for estimating the STMR (median underlined) were 0.69, 0.71, 1.0, 1.7, 2.0 and 2.3 mg/kg. The HR was 3.2 mg/kg.

The Meeting considered that the residues of acephate and methamidophos in peaches and nectarines treated at the same rate would be similar and noted that GAP in Greece was for stone fruit which includes both peaches and nectarines. The Meeting estimated maximum residue level, STMR and HR values of 2, 1.35 and 3.2 mg/kg, respectively, for acephate in peaches and nectarines.

Residues of methamidophos in peaches from the use of acephate were 0.09, 0.1, 0.16, 0.22, 0.28 and 0.35 mg/kg. These residues are considered in the evaluation of methamidophos for the estimation of maximum residue levels.

Trials on plums were conducted in France (no GAP), Germany (no GAP), Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days), South Africa (GAP 0.038 kg ai/hl, PHI 28 days) and the UK (no GAP).

In a single trial in South Africa, conducted according to South African GAP for plums, residues were 0.08 mg/kg (acephate) and <0.02 mg/kg (methamidophos).

The Meeting considered that a single trial on plums was inadequate to estimate a maximum residue level.

Leeks. Trials on leeks were conducted in France (no GAP), Germany (no GAP) and The Netherlands (no GAP). As no GAP was available the trials were not evaluated further.

Brassica vegetables. Trials on broccoli were reported from Australia (GAP 0.78-0.98 kg ai/ha, 0.075-0.098 kg ai/hl, PHI 14 days), Brazil (GAP 0.075 kg ai/hl, PHI 14 days), Canada (no GAP but cauliflower 0.56-0.83 kg ai/ha, PHI 28 days), France (no GAP), Japan (GAP 0.075-0.5 kg ai/ha, PHI 14 days), Spain (GAP 1.1 kg ai/ha, 0.11 kg ai/hl, PHI 14 days) and the USA (no GAP but cauliflower 0.56-1.3 kg ai/ha, PHI 14 days).

A single trial on broccoli in Australia complied with Australian GAP and showed a residue of 0.12 mg/kg (methamidophos 0.08 mg/kg). One trial in Brazil matched the GAP of that country, with an acephate residue of 0.2 mg/kg. Two trials in France and two in Spain, assessed against the GAP of Spain, showed residues of 0.05, 0.30, 0.34 and 1.2 mg/kg (methamidophos 0.03, 0.09, 0.10 and 0.33 mg/kg).

Trials on cauliflowers were reported from Australia (GAP 0.78-0.98 kg ai/ha, 0.075-0.098 kg ai/hl, PHI 3 days), Brazil (GAP 0.075 kg ai/hl, PHI 14 days), France (no GAP), Germany (no GAP), Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days) and The Netherlands (GAP 0.75 kg ai/ha, PHI 14 days).

One trial conducted according to GAP for cauliflowers was reported from Australia (1.4 mg/kg acephate, 0.20 mg/kg methamidophos), and one from Brazil (0.1 mg/kg acephate) matched the GAP of that country.

In eight trials in The Netherlands, conducted according to GAP, acephate residues were <0.01, 0.02, 0.03, 0.06, 0.07, 0.08, 0.1, and 0.11 mg/kg, with methamidophos residues <0.01 (5), 0.01 (2) and 0.03 mg/kg.

Because acephate is a systemic pesticide, the Meeting decided that the residue data for broccoli and cauliflowers could be used as mutual support for the estimation of a maximum residue level for flowerhead brassicas. The results of the trials on broccoli and cauliflower in rank order (n=16) were <0.01, 0.02, 0.03, 0.05, 0.06, 0.07, 0.08, 0.1, 0.1, 0.11, 0.12, 0.2, 0.3, 0.34, 1.2 and 1.4 mg/kg (methamidophos <0.01(5), 0.01(2), 0.03(2), 0.08, 0.09, 0.10, 0.2 and 0.33 mg/kg).

The calculated total residues of acephate and methamidophos for estimating the STMR (median underlined) were <0.05, <0.06, <0.09, <0.1, 0.11, 0.13, <u>0.13</u>, <u>0.19</u>, 0.32, 0.53, 0.59, 1.9, 1.9 and 2.0 mg/kg. The HR was 2.85 mg/kg. The Meeting estimated a maximum residue level, STMR and HR of 2, 0.16 and 2.85 mg/kg, respectively, for flowerhead brassicas.

Residues of methamidophos in broccoli and cauliflowers arising from the use of acephate (n=14) were <0.01 (5), 0.01 (2), 0.03 (2), 0.08, 0.09, 0.10, 0.2 and 0.33 mg/kg. They are considered in the evaluation of methamidophos for the estimation of a maximum residue level.

Trials on Brussels sprouts were reported from Australia (GAP 0.75-0.98 kg ai/ha, 0.075-0.098 kg ai/hl, PHI 3 days), Belgium (no GAP), Germany (no GAP), The Netherlands (GAP 0.75 kg ai/ha, PHI 28 days), South Africa (no GAP), the UK (no GAP) and the USA (GAP 0.56-1.3 kg ai/ha, maximum 2.2 kg ai/ha/season, PHI 14 days).

Two trials on Brussels sprouts in Australia matched GAP with residues of 1.5 and 12 mg/kg (methamidophos 0.11 and 1.0 mg/kg).

Trials on head cabbages were reported from Australia (GAP 0.78-0.98 kg ai/ha, 0.075-0.098 kg ai/hl, PHI 3 days), Brazil (GAP 0.075 kg ai/hl, PHI 14 days), Canada (GAP 0.56-0.83 kg ai/ha, PHI 28 days), France (GAP 0.075 kg ai/hl, PHI 7 days), Germany (no GAP), Japan (GAP 0.3-1 kg ai/ha, 0.03-0.05 kg ai/hl, PHI 7 days), The Netherlands (GAP 0.75 kg ai/ha, PHI 14 days), South Africa (GAP 0.23-0.38 kg ai/ha, PHI 3 days), the UK (no GAP) and the USA (no GAP).

One trial according to GAP for cabbages was conducted in Australia (22 and 1.5 mg/kg for acephate and methamidophos respectively). In two trials in France, complying with GAP, residues of acephate were 0.06 and 0.87 mg/kg (methamidophos <0.01 and 0.09 mg/kg).

The Meeting considered that the number of trials on Brussels sprouts and cabbages complying with GAP was inadequate for estimating a maximum residue level and recommended withdrawal of the existing CXL of 2 mg/kg for head cabbages.

Cucumbers. Trials were reported from France (no GAP), Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days), Puerto Rico (no GAP), Spain (GAP 1.7 kg ai/ha, 0.038-0.11, PHI 21 days) and the USA (no GAP).

Acephate residues in 2 indoor trials in Italy matching the GAP (± 30%) of Spain were 0.14 and 0.31 mg/kg (methamidophos <0.05 and 0.07 mg/kg). One field trial in Spain (acephate 1.9 mg/kg, methamidophos 0.19 mg/kg) also matched GAP in that country. The Meeting considered the number of trials inadequate to estimate a maximum residue level for cucumbers.

Egg plants. Trials were reported from France (no GAP), Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days) and Spain (GAP 0.038-0.11 kg ai/hl, PHI 14 days).

Acephate residues in 3 trials in France and Spain matching the GAP (± 30%) of Spain were 0.09, 0.22 and 0.51 mg/kg (methamidophos 0.01, 0.05 and 0.07 mg/kg). The Meeting considered the number of trials inadequate to estimate a maximum residue level for egg plants.

Tomatoes. Trials were reported from Australia (GAP 0.75-0.98 kg ai/ha, 0.075-0.098 kg ai/hl, PHI 3 days), Brazil (GAP 0.075 kg ai/hl, PHI 7 days), Canada (seedling drench), France (GAP 0.075 kg ai/hl, PHI 3 days), Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days), Japan (GAP 0.5-1.0 kg ai/ha, 0.025-0.05 kg ai/hl, PHI 1 day), Spain (GAP 0.038-0.11 kg ai/hl, PHI 14 days) and the USA (no GAP).

Acephate is registered in Spain for use on tomatoes at 0.11 kg ai/hl, with harvest permitted 14 days after the last application. In three trials in Spain, matching GAP, acephate residues were 0.05, 0.08 and 0.18 mg/kg (0.03, 0.05 and 0.11 mg/kg for methamidophos); in one trial in France and two in Italy, also matching Spanish GAP ± 30%, residues were 0.08, 0.14 and 0.33 mg/kg (methamidophos 0.03, 0.05 and 0.15 mg/kg); in a single trial in Brazil, according to GAP, <0.05 mg/kg; and in a single trial in Australia, also according to GAP, 1.8 mg/kg (0.5 mg/kg methamidophos). The Meeting considered that the trials in Brazil and Australia were in different residue populations from those in France, Italy and Spain and should not be combined to estimate a maximum residue level. Residues of acephate in tomatoes in rank order (n=6) were 0.05, 0.08, 0.08, 0.14, 0.18 and 0.33 mg/kg. The Meeting considered the database to be insufficient to estimate a maximum residue level for tomatoes and recommended withdrawal of the existing CXL of 1 mg/kg.

Peppers. Trials were reported from Canada (GAP sweet peppers, 0.83 kg ai/ha, PHI 7 days), France (no GAP), Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days), Spain (GAP 2.25 kg ai/ha, 0.038-0.11 kg ai/hl, PHI 14 days) and the USA (GAP bell peppers 0.28-1.3 kg ai/ha, maximum 2.2 kg ai/ha/season, PHI 7 days; non-bell, 0.56 kg ai/ha, maximum 1.1 kg ai/ha/season, PHI 7 days).

In one trial in Canada on sweet peppers, according to Canadian GAP, acephate residues were 3.7 mg/kg (methamidophos 1.6 mg/kg). Acephate residues in two trials in Italy and one in Spain (indoor crop), approximating the GAP of Spain, were 0.84, 1.1 and 2.9 mg/kg (methamidophos 0.25, 0.25 and 0.29 mg/kg); in three trials in Spain, approximating the GAP of Italy, 0.03, 1.5 and 2.2 mg/kg (0.05, 0.24 and 0.34 mg/kg for methamidophos) in crops grown indoors; and in two trials in France (one indoor), according to GAP in Italy, 0.34 mg/kg indoor (0.22 mg/kg methamidophos) and 1.0 mg/kg in the field (0.35 mg/kg methamidophos).

Residues of acephate in indoor-grown sweet peppers (n=5) were 0.03, 0.34, 1.5, 2.2 and 2.9 mg/kg (methamidophos 0.05, 0.22, 0.24, 0.25 and 0.34 mg/kg), and in field-grown sweet peppers (n=4) 0.84, 1.0, 1.1 and 3.7 mg/kg (methamidophos 0.25, 0.29, 0.35 and 1.6 mg/kg).

The Meeting considered that the residues in indoor and field sweet peppers could be combined for the purposes of estimating a maximum residue level. Residues in sweet peppers in rank order (n=9) were 0.03, 0.34, 0.84, 1.0, 1.1, 1.5, 2.2, 2.9 and 3.7 mg/kg. The appropriately scaled and totalled residues of acephate and methamidophos for estimating the STMR (median underlined) were 0.16, 0.89, 1.6, 1.7, <u>1.9</u>, 2.1, 3.1, 3.5 and 7.7 mg/kg. The HR was 11.7 mg/kg. The Meeting estimated a maximum residue level, STMR and HR for acephate in peppers of 5 mg/kg, 1.9 mg/kg and 11.7 mg/kg respectively.

Methamidophos residues were 0.05, 0.22, 0.24, 0.25, 0.25, 0.29, 0.34, 0.35 and 1.6 mg/kg and are considered in the evaluation of methamidophos for the estimation of maximum residue levels.

<u>Lettuce</u>. Trials were reported from Belgium (no GAP), Canada (GAP head lettuce, 0.56-0.83 kg ai/ha, PHI 7 days), France (GAP 0.075 kg ai/hl, PHI 14 days) and Germany (no GAP).

In one trial in Canada and two in France, approximating national GAPs, acephate residues in head lettuce were 0.28, 0.67 and 1.1 mg/kg, respectively (methamidophos 0.03, 0.06 and 0.09 mg/kg). The Meeting considered the number of trials inadequate to estimate a maximum residue level and recommended withdrawal of the existing CXL of 5 mg/kg for head lettuce.

<u>Beans</u>. Field trials on common beans (snap, green and French) were reported from Canada (no GAP), France (no GAP), Germany (no GAP), Italy (GAP green beans 0.034-0.064 kg ai/hl, PHI 21 days), Spain (GAP 1.1 kg ai/ha, 0.11 kg ai/hl, maximum 2 sprays, PHI 14 days) and the USA (GAP 0.28-1.3 kg ai/ha, maximum 2.2 kg ai/ha/season, PHI 14 days).

Acephate residues in green (French) beans in 2 trials in Italy (0.92 and 0.96 mg/kg) and five in Spain (0.06, 0.07, 0.72, 1.2 and 2.9 mg/kg), approximating the GAP of Spain, were 0.06, 0.07, 0.72, 0.92, 0.96, 1.2 and 2.9 mg/kg (methamidophos 0.01, 0.04, 0.15, 0.19, 0.34, 0.45 and 0.54 mg/kg).

Acephate residues in green (snap) beans in a single trial in the USA, approximating national GAP, were 0.39 mg/kg (methamidophos 0.15 mg/kg).

Residues of acephate in green beans in rank order (n=8) were 0.06, 0.07, 0.39, 0.72, 0.92, 0.96, 1.2 and 2.9 mg/kg. The appropriately scaled and totalled residues of acephate and methamidophos for estimating the STMR (median underlined) were 0.1, 0.11, 0.77, <u>1.3</u>, <u>1.4</u>, 1.8, 2.1 and 4.3 mg/kg. The calculated HR was 5.6 mg/kg. The Meeting estimated a maximum residue level, STMR and HR for acephate in beans, except broad bean and soya bean, of 5 mg/kg, 1.35 mg/kg and 5.6 mg/kg, respectively.

Residues of methamidophos in beans in rank order, median underlined, (n=8) were 0.01, 0.04, 0.15, <u>0.15</u>, <u>0.19</u>, 0.34, 0.45 and 0.54 mg/kg. These residues are considered in the evaluation of methamidophos for the estimation of maximum residue levels.

<u>Beans (dry)</u>. Field trials were reported from the USA on dry beans, including lima beans, red kidney beans and Navy beans but none was conducted according to GAP and the trials were not considered further.

<u>Soya beans (dry)</u>. Field trials were reported from the USA and assessed against the GAP of Mexico (0.5-1.1 kg ai/ha, PHI 14 days). Acephate residues in seven trials approximating GAP were <0.02,

<0.02, 0.03, 0.03, 0.03, 0.14 and 0.17 mg/kg (methamidophos <0.01, <0.01, <0.01, <0.01, 0.02, 0.06 and 0.06 mg/kg).

Residues of acephate and methamidophos adjusted and totalled for estimating the STMR and HR (median underlined) were 0.045, 0.045, 0.055, 0.055, 0.08, 0.29 and 0.32 mg/kg. The HR was 0.47 mg/kg. The Meeting estimated a maximum residue level, STMR and HR for acephate in soya bean (dry) of 0.3 mg/kg, 0.055 mg/kg and 0.47 mg/kg respectively. The maximum residue level is recommended to replace the existing CXL of 0.5 mg/kg for soya beans (dry).

Residues of methamidophos in soya beans in rank order, median underlined (n=7), were <0.01, <0.01, <0.01, ≤0.01, 0.02, 0.06 and 0.06 mg/kg. These residues are considered in the evaluation of methamidophos for the estimation of maximum residue levels.

Potatoes. Field trials were reported from Canada (GAP 0.56-0.83 kg ai/ha, PHI 21 days), France (no GAP), Italy (GAP 0.34-0.63 kg ai/ha, PHI 21 days), the UK (no GAP) and the USA (no GAP).

In one trial in France, approximating the GAP of Italy, acephate residues in potatoes were <0.02 mg/kg (methamidophos <0.01 mg/kg). The Meeting considered that one trial was inadequate to estimate a maximum residue level for potatoes and recommended the withdrawal of the existing CXL (0.5 mg/kg).

Sugar beet. Field trials were reported from France (GAP 0.5 kg ai/ha, PHI 21 days), Italy (GAP 0.34-0.63 kg ai/ha, PHI 21 days) and the UK (no GAP). As none of the trials matched GAP, they were not evaluated further. The Meeting recommended the withdrawal of the existing CXLs for sugar beet (0.1 mg/kg) and sugar beet leaves or tops (10 mg/kg).

Globe artichokes. Trials conducted in France (GAP 0.075 kg ai/hl, PHI 14 days) and Italy (GAP 0.034-0.064 kg ai/hl, PHI 21 days) were reported.

In three French trials, approximating French GAP, acephate residues were 0.54, 1.3 and 1.6 mg/kg (methamidophos 0.08, 0.12 and 0.13 mg/kg), and in four trials conducted according to GAP in Italy the residues of acephate were 0.08, 0.08, 0.08 and <0.1 mg/kg (methamidophos 0.02, 0.02, 0.04 and 0.08 mg/kg).

The Meeting decided that the residues in the trials in France and Italy were from different populations and should not be combined to estimate a maximum residue level, HR or STMR. The Meeting considered the number of trials in France inadequate for the purpose and decided to use the trials in Italy to estimate a maximum residue level. Residues of acephate and methamidophos, adjusted and totalled for estimating the STMR and HR (median underlined) were 0.13, 0.13, 0.18 and 0.3 mg/kg. The HR was 0.5 mg/kg.

The Meeting estimated a maximum residue level, STMR and HR for acephate in globe artichokes of 0.3 mg/kg, 0.155 mg/kg and 0.5 mg/kg, respectively.

The residues of methamidophos were 0.02, 0.02, 0.04 and 0.08 mg/kg. These residues are considered in the evaluation of methamidophos for the estimation of maximum residue levels.

Alfalfa. Trials in the USA (no GAP) were reported. As none of the trials matched GAP they were not evaluated further. The Meeting recommended the withdrawal of the existing CXL of 10 mg/kg for alfalfa forage (green).

Hops. Trials conducted in France (no GAP), Germany (no GAP), the UK (no GAP) and the USA (no GAP) were reported. As none of the trials matched GAP they were not evaluated further.

Fate of residues in processing

The Meeting received reports of processing studies for acephate in citrus fruits (oranges, lemons and grapefruit), apples, tomatoes, beans, potatoes and soya beans, investigating the effects of washing and further processing on incurred residues of acephate and methamidophos in a range of processed fractions.

No data were provided on the processing of mandarins. In the three citrus studies from field trials in the USA, the data were sufficient for the Meeting to derive mean citrus processing factors of 0.34 (juice) and 0.61 (dry pulp) for acephate and 0.4 (juice) and 1.66 (dry pulp) for methamidophos.

Processing factors for apple juice, sauce, and wet pomace were derived from two field trials in the USA, where initial acephate residues in the fruit were 0.46-1.0 mg/kg. For juice, processing factors were 1.0 for acephate and methamidophos, and for wet pomace they were 0.98 and 1.35, respectively. The Meeting noted that washing did not significantly reduce residue levels of either compound in fruit treated 118 days before harvest and that residues of acephate in apple sauce were about half those in the raw fruit.

Studies on the effects of washing, cooking and/or canning on residues of acephate and methamidophos in common beans in the USA and France were evaluated. The Meeting noted a slight reduction in residue levels in washed beans. Cooking resulted in a reduction of acephate (mean processing factor of 0.5) and methamidophos (mean processing factor of 0.83).

The results of processing trials conducted in the USA, in 1978, with the production of soya bean meal, hulls and crude oil were reported in summary form. Residues in the crude oil were below the reported limits of quantification except in one sample, where acephate residues (0.03 mg/kg) were half those measured in the fresh beans. Processing factors estimated by the Meeting for acephate were 0.69 for meal, 7.15 for hulls and <0.425 for crude oil and, for methamidophos, they were 2.0, 4.5 and <0.5, respectively.

The Meeting noted that in a study on globe artichokes, reported in summary, there was a significant reduction in residues in cooked artichokes.

Farm animal dietary burden

The Meeting estimated the farm animal dietary burdens of acephate residues, using the diets in Appendix IX of the FAO Manual. The calculation from the maximum residue levels and STMRs in the feed provides the dietary burdens suitable for estimating maximum residue levels and STMRs, respectively, in animal commodities. In the case of acephate, the animal diet consists of commodities that are blended and the dietary burden is therefore calculated only from STMRs. This results in the same dietary burden for both maximum residue level and STMR estimation in animal commodities (Table 77). The dry matter (DM) content is taken as 100% where maximum residue levels and STMRs are already expressed on the dry weight. The figures in parentheses are for methamidophos.

Table 77. Estimated maximum and STMR farm animal dietary burdens.

Commodity	STMR	Group	% DM	STMR ÷ DM	% in chosen diets			Residue, mg/kg		
					Beef	Dairy	Poultry	Beef	Dairy	Poultry
Wet apple pomace	2.2×0.98 = 2.15 (0.06×1.35 = 0.081)	AB	40	5.39 (0.2025)	40	20		2.15 (0.081)	1.075 (0.0405)	
Soya bean seed	0.03 (0.01)	VD	89	0.0337 (0.0112)	15	15	20	0.0051 (0.0017)	0.0051 (0.0017)	0.0067 (0.0022)
Soya bean meal	0.03×0.69 = 0.021 (0.01×2 = 0.02)	AL	92	0.022 (0.022)						
Soya bean hulls	0.03×7.15 = 0.2145 (0.01×4.5 = 0.045)	AL	90	0.238 (0.05)						
TOTAL					55	35	20	2.2 (0.083)	1.1 (0.0422)	0.0067 (0.0022)

The acephate and (methamidophos) dietary burdens for animal commodity maximum residue level and STMR estimation (residue levels in animal feeds expressed on a dry weight basis) are beef cattle 2.2 (0.083) ppm, dairy cattle 1.1 (0.0422) ppm and poultry 0.0067 (0.0022) ppm.

Farm animal feeding studies

The Meeting received information on residues in animal tissues and milk, after dairy cows were dosed after the morning milking by capsule with mixtures of acephate and methamidophos in a ratio of 5:1, specifically chosen to reflect typical ratios observed in crop field trials, for 30 days, equivalent to 3:0.6, 10:2 and 30:6 ppm in the diet. Residues in the milk reached a plateau within 7 days and were

always higher in the evening samples. Average residues of the parent compound in morning and evening milk collected from day 7 through to day 30 for the 10:2 ppm dose group were 0.062 and 0.19 mg/kg, respectively, and returned to below the LOQ within two days of the end of dosing. Tissue residues in single animals slaughtered after 21 days of dosing were: <0.02 (<0.01) mg/kg in liver, 0.03 (<0.01) mg/kg in heart, 0.03 (<0.01) mg/kg in kidney, 0.03 (<0.01) mg/kg in muscle and <0.02 (<0.01) mg/kg in fat for the 3:0.6 ppm dose group; and, respectively, <0.02 (<0.01) mg/kg, 0.10 (0.01) mg/kg, 0.21 (0.01) mg/kg 0.08 (<0.01) mg/kg) and 0.03 (<0.01) mg/kg for the 10:2 ppm dose group; and 0.08 (<0.01) mg/kg, 0.32 (0.06) mg/kg, 0.57 (0.05) mg/kg, 0.28 (0.04) mg/kg) and 0.13 (0.02) mg/kg for the 30:6 ppm dose group. Within 6 days of dosing ceasing, residues in the tissues were all below the LOQ.

In another study with dairy cows, the dose was split into two and administered after the morning and after the evening milking. The capsules contained mixtures of acephate and methamidophos in a ratio of 5:1 at rates nominally equivalent to 15:3, 30:6 and 60:12 ppm in the diet. Residues in the milk reached a plateau by day 4, at 0.15 (0.01), 0.33 (0.02) and 0.85 (0.06) mg/kg for the three groups. The residues in the milk were below the LOQ within two days of the end of dosing for the 15:3 and 30:6 ppm groups and 0.07 (<0.01) mg/kg for the 60:12 ppm group. Maximum residues in the tissues in three animals slaughtered after 28 days were: 0.02 (<0.01) mg/kg in the liver, 0.11 (0.01) mg/kg in the heart, 0.26 (0.02) mg/kg in the kidney, 0.12 (<0.01) mg/kg in muscle and 0.10 (<0.01) mg/kg in fat for the 15:3 ppm group; 0.04 (<0.01) mg/kg, 0.16 (0.02) mg/kg, 0.40 (0.04) mg/kg, 0.21 (0.01) mg/kg and 0.15 (<0.01) mg/kg, respectively, for the 30:6 ppm group; and 0.15 (0.02) mg/kg, 0.40 (0.04) mg/kg, 0.85 (0.07) mg/kg, 0.40 (0.03) mg/kg and 0.40 (<0.01) mg/kg, respectively, for the 60:12 ppm group. Three days after dosing ceased, residues in all tissues were below the LOQ in all groups.

The Meeting also received information on residues in the tissues of pigs fed a ration containing acephate and methamidophos for 30 days, at rates of 3:0.6, 10:2 and 30:6 ppm in the diet. Maximum residues at 3:0.6 ppm were <0.02 (<0.01) mg/kg in the liver, 0.05 (<0.01) mg/kg in the heart, 0.04 (<0.01) mg/kg in the kidney, 0.05 (<0.01) mg/kg in muscle, <0.02 (<0.01) mg/kg in fat and 0.04 (<0.01) mg/kg in brain. Residues in all tissues were below the LOQ within a day of the end of dosing.

In a trial on laying hens fed a diet containing acephate at 3 ppm for up to 92 days, residues were below the LOQ in the tissues and eggs. At higher feeding levels, maximum acephate and (methamidophos) residues in eggs were 0.09 (0.006) mg/kg from a 10 ppm feeding level and 0.19 (0.016) mg/kg at 30 ppm; and, in tissues, were below the LOQ in fat, kidney and liver, and 0.01 (0.008) mg/kg and 0.12 (0.046) mg/kg in muscle from the 10 and 30 ppm groups, respectively.

Similar results were obtained when quail were fed diets incorporating acephate at 10 and 30 ppm for up to 148 days. Maximum residues in the eggs were 0.19 (0.007) mg/kg and 0.34 (0.014) mg/kg in the 10 and 30 ppm groups, respectively. In liver and kidney residues were below the LOQ, in fat 0.06 (0.014) and 0.04 (<0.001) mg/kg, and in muscle 0.01 (<0.001) and 0.04 (<0.001) mg/kg, at the two feeding levels.

Animal commodity maximum residue levels

The calculated maximum/STMR dietary burdens for beef and dairy cattle were 2.2 (0.083) and 1.1 (0.042) mg/kg respectively, so the levels of residues in tissues and milk can be obtained by extrapolation from the highest residues in tissues at the 3 ppm feeding level and the mean residue in milk at the 15 ppm level (in the second study where cows were dosed in the morning and evening). The maximum acephate and (methamidophos) residues expected are <0.02 (<0.01) mg/kg in liver, 0.022 (<0.01) mg/kg in fat, 0.022 (<0.01) mg/kg in muscle and 0.022 (<0.01) mg/kg in kidney, and the mean residue in milk is 0.011 (0.00014) mg/kg. As the dietary burden for STMR estimation is the same as for maximum residue level estimation, the STMRs and HRs can be calculated from the above values. Essentially no residues of methamidophos are expected in tissues or milk, so the STMRs and HRs for dietary intake estimation are the estimated acephate residues (Table 78).

Table 78. Estimated maximum residue levels of acephate in cattle tissues and mean residue level in milk.

Dietary burden (ppm) [1] / Feeding level [ppm] [2]		Acephate, methamidophos residues, mg/kg [3]				
		Milk Mean	Fat High	Muscle High	Liver High	Kidney High
MRL/STMR for beef cattle	(2.2, 0.083) [3, 0.6]		*(0.022, <0.01)* 0.03, <0.01	*(0.022, <0.01)* 0.03, <0.01	*(<0.02, <0.01)* <0.02, <0.01	*(0.022, <0.01)* 0.03, <0.01
MRL/STMR for dairy cattle	(1.1, 0.042) [15, 3]	*(0.011, 0.00014)* 0.15, 0.01				

[1] Values in parentheses are the estimated dietary burdens (Table 77).
[2] Values in square brackets are the actual feeding levels in the animal feeding residue transfer study.
[3] Residue values in parentheses in *italics* are estimated from the dietary burden, the feeding levels in the transfer study and the residues found in the transfer study. "High" is derived from the highest individual animal tissue residue in the relevant feeding group. "Mean" is derived from the mean animal tissue (or milk) residue in the relevant feeding group.

The maximum dietary burden for pigs is 0.008 (0.003) ppm, based on the feeding of soya beans at 25% of the total diet. The residues of both acephate and methamidophos in all tissues are expected to be <0.01 mg/kg at this level.

The Meeting estimated maximum residue levels for meat (from mammals other than marine mammals) 0.05 mg/kg, edible offal (mammalian) 0.05 mg/kg, and milks 0.02 mg/kg. The estimates are recommended to replace the existing CXLs of 0.1 mg/kg for cattle fat and meat, pig fat and meat and milks.

The maximum dietary burden for poultry is 0.0067 (0.0022) ppm. The levels of acephate and methamidophos residues in all tissues and eggs are expected to be <0.01 mg/kg at this level.

The Meeting estimated maximum residue levels for poultry meat 0.01 (*) mg/kg, poultry offal 0.01 (*) mg/kg and eggs 0.01 (*) mg/kg. As no residues are expected at the maximum feeding level for poultry, the STMRs for poultry meat, edible offal and eggs are zero.

RECOMMENDATIONS

On the basis of the data from supervised trials, the Meeting concluded that the residue levels listed in Table 79 are suitable for establishing maximum residue limits and for IEDI assessment.

Definition of the residue for compliance with MRLs: *acephate*; for estimation of dietary intake: *acephate and methamidophos*.

The definitions apply to plant and animal commodities.

Table 79. Summary of recommendations.

Commodity		MRL, mg/kg		STMR or STMR-P, mg/kg	HR or HR-P, mg/kg
CCN	Name	New	Prev		
AL 1021	Alfalfa forage (green)	W	10		
VS 0620	Artichokes, globe	0.3	-	0.155	0.5
VP 0061	Beans, except broad bean and soya bean	5	-	1.35	5.6
VB 0400	Broccoli	W	2		
VB 0041	Cabbages, head	W	2		
MF 0812	Cattle fat	W	0.1		
MM 0812	Cattle meat	W	0.1		
VB 0404	Cauliflowers	W	2		
SO 0691	Cotton seed	W	0.2		
MO 0105	Edible offal (Mammalian)	0.05		0.022	0.022
PE 0112	Eggs	0.01 (*) note	0.1	0	0.01
VB 0042	Flower head brassicas	2	-	0.16	2.85
VL 0482	Lettuce, head	W	5		
FC 0003	Mandarins (incl mandarin-like hybrids)	7	-	1.15	6.5
MM 0095	Meat (from mammals other than marine mammals)	0.05		0.022 muscle 0.022 fat	0.022 muscle 0.022 fat
ML 0106	Milks	0.02	0.1	0.011	0.011

Commodity		MRL, mg/kg		STMR or STMR-P, mg/kg	HR or HR-P, mg/kg
CCN	Name	New	Prev		
FS 0245	Nectarines	2	-	1.35	3.2
FS 0247	Peaches	2	-	1.35	3.2
VO 0051	Peppers	5		1.9	11.7
MF 0818	Pig fat	W	0.1		
MM 0818	Pig meat	W	0.1		
FP 0009	Pome fruits	7	-	0.81	5.4
VR 0587	Potatoes	W	0.5		
PM 0110	Poultry meat	0.01 (*) note	0.1	0 fat 0 muscle	0.01 fat 0.01 muscle
PO 0111	Poultry, Edible offal of	0.01 (*) note	-	0	0.01
VD 0541	Soya beans (dry)	0.3	0.5	0.055	0.47
VR 0596	Sugar beet	W	0.1		
AV 0596	Sugar beet leaves or tops	W	10		
VO 0448	Tomatoes	W	1		
FT 0312	Tree tomatoes	W	0.5		
JF 0226	Apple juice			0.81	
OC 0541	Soya bean oil, crude			0.023	

* At or about the LOQ.

Note: animal commodity, no residues expected from consumption of feed commodities with acephate residues as evaluated by JMPR

DIETARY RISK ASSESSMENT

The Meeting considered how best to approach the dietary risk assessment of mixed residues of acephate and methamidophos and decided that an appropriately conservative approach would be to calculate the sum of the acephate and methamidophos residues, after scaling the methamidophos residues to account for the difference in toxicity. The relevant factors for chronic and short-term intake were derived from the ratios of the acephate and methamidophos maximum ADI and acute RfD values and are 2.5 and 5, respectively. Dietary intake estimates for the combined adjusted residues were compared with the acephate maximum ADI and acute RfD.

Long-term intake

The evaluation of acephate resulted in estimates of maximum residue levels and STMRs for raw and processed commodities. Consumption data were available for 22 raw or processed food commodities and were used in the dietary intake calculation. The results are shown in Table 80.

The International Estimated Daily Intakes (IEDIs) for the 5 GEMS/Food regional diets, based on estimated STMRs were in the range 2-20% of the maximum ADI of 0.01 mg/kg bw (Table 79). The Meeting concluded that the long-term intake of residues of acephate from uses that have been considered by the JMPR is unlikely to present a public health concern.

Table 80. International Estimated Daily Intakes (IEDIs) of acephate for the 5 GEMS/Food regional diets (ADI = 0-0.01 mg/kg bw/day).

Code	Commodity	STMR or STMR-P mg/kg	Diets: g/person/day. Intake = daily intake: µg/person									
			Mid-East		Far-East		African		Latin American		European	
			diet	intake	diet	intake	diet	intake	diet	intake	diet	intake
FP 0226	Apples (note 1)	0.81	7.5	6.1	4.7	3.8	0.3	0.2	5.5	4.5	40.0	32.4
JF 0226	Apple juice	0.81	4.5	3.6	0	0.0	0	0.0	0.3	0.2	3.8	3.1
VS 0620	Artichokes, globe	1.55	2.3	3.6	0.0	0.0	0.0	0.0	0.0	0.0	5.5	8.5
VP 0061	Beans except broad bean & soya bean (green pods & immature seeds)	1.35	3.9	5.3	0.9	1.2	0.0	0.0	4.4	5.9	13.2	17.8
VB 0400	Broccoli (note 2)	0.16	0.5	0.1	1.0	0.2	0.0	0.0	1.1	0.2	2.7	0.4
VB 0401	Broccoli, Chinese (note 2)	0.16	-	-	-	-	-	-	-	-	-	-
VB 0404	Cauliflowers (note 2)	0.16	1.3	0.2	1.5	0.2	0	0.0	0.3	0.0	13	2.1
MO 0105	Edible offal (mammalian)	0.022	4.2	0.1	1.4	0.0	2.8	0.1	6.1	0.1	12.4	0.3
PE 0112	Eggs	0	14.6	0.0	13.1	0.0	3.7	0.0	11.9	0.0	37.6	0.0

Code	Commodity	STMR or STMR-P mg/kg	Diets: g/person/day. Intake = daily intake: µg/person									
			Mid-East		Far-East		African		Latin American		European	
			diet	intake	diet	intake	diet	intake	diet	intake	diet	intake
FC 0003	Mandarins (incl. mandarin-like hybrids)	1.15	8.8	10.1	0.2	0.2	0.0	0.0	6.3	7.2	6.0	6.9
MM 0095	Meat from mammals other than marine mammals: 20% as fat	0.022	7.4	0.2	6.6	0.1	4.8	0.1	9.4	0.2	31.1	0.7
MM 0095	Meat from mammals other than marine mammals: 80% as muscle	0.022	29.6	0.7	26.2	0.6	19.0	0.4	37.6	0.8	124.4	2.7
ML 0106	Milks	0.011	116.9	1.3	32.1	0.4	41.8	0.5	160.1	1.8	289.3	3.2
-d	Peaches & nectarines	1.35	2.5	3.4	0.5	0.7	0.0	0.0	0.8	1.1	12.5	16.9
FP 0230	Pears (note 1)	0.81	3.3	2.7	2.8	2.3	0.0	0.0	1.0	0.8	11.3	9.2
VO 0051	Peppers	1.9	3.4	6.5	2.1	4.0	5.4	10.3	2.4	4.6	10.4	19.8
PM 0110	Poultry meat: 10% as fat	0	3.1	0.0	1.3	0.0	0.6	0.0	2.5	0.0	5.3	0.0
PM 0110	Poultry meat: 90% as muscle	0	27.9	0.0	11.9	0.0	5.0	0.0	22.8	0.0	47.7	0.0
PO 0111	Poultry, edible offal of	0	0.1	0.0	0.1	0.0	0.1	0.0	0.4	0.0	0.4	0.0
FP 0231	Quinces (note 1)	0.81	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
VD 0541	Soya beans (dry)	0.055	4.5	0.2	2.0	0.1	0.5	0.0	0.0	0.0	0.0	0.0
OC 0541	Soya bean oil, crude	0.023	1.3	0.0	1.7	0.0	3.0	0.1	14.5	0.3	4.3	0.1
Total intake (µg/person) =				44.0		13.9		11.7		27.9		124.1
Bodyweight per region (kg bw) =				60		55		60		60		60
ADI (µg/person) =				600		550		600		600		600
%ADI =				7.3		2.5		2.0		4.7		20.7
Rounded %ADI =				7		3		2		5		20

Note 1: Group maximum residue level proposed for pome fruit.
Note 2: Group maximum residue level proposed for flowerhead brassicas.

Short-term intake

The international estimated short-term intake (IESTI) for acephate (including any contribution from the presence of methamidophos residues) was calculated for the raw or processed food commodities for which HRs were estimated and for which consumption data were available. Where group maximum residue levels were estimated, the IESTI was calculated for all commodities within the group for which consumption data were available. The results are shown in Tables 81 and 82.

The IESTI varied from 0 to 260% of the acute RfD (0.05 mg/kg bw) for the general population and from 0 to 630% for children aged 6 years or less. The short-term intakes from pome fruit, mandarins, cauliflower and sweet peppers were 140-260% of the acute RfD for the general population, and from pome fruit, mandarins, peaches, nectarines, beans, broccoli, cauliflower, chili peppers and sweet peppers 110-630% for children. The information provided to the Meeting precluded a conclusion that the acute dietary intake from these commodities would be below the acute RfD.

The Meeting concluded that the short-term intake of residues of acephate from uses that have been considered by the JMPR is unlikely to present a public health concern, with the exception of those from pome fruit, mandarins, peaches, nectarines, beans except broad beans and soya beans, broccoli, cauliflower and peppers.

Table 81. Assessment of risks to the general population from the short-term dietary intake of residues of acephate (acute RfD = 0.05 mg/kg bw, i.e. 50 µg/kg bw).

Codex Code	Commodity	STMR or STMR-P mg/kg	HR or HR-P mg/kg	Large portion diet			Unit weight			Variability factor	Case	IESTI µg/kg bw/day	% acute RfD, rounded
				Country	Body wt (kg)	Large portion, g/person	Unit wt, g	Country	Unit wt, edible portion, g				
FP 0226	Apples (note 1)	-	5.4	USA	65.0	1348	110	FRA	100	3	2a	128.63	260
JF 0226	Apple juice	0.81	-	-	-	-	-	-	-	-	3	-	-
VS 0620	Artichoke globe	-	0.5	FRA	62.3	534	230	FRA	99	3	2a	5.87	10

Codex Code	Commodity	STMR or STMR-P mg/kg	HR or HR-P mg/kg	Large portion diet			Unit weight			Variability factor	Case	IESTI µg/kg bw/day	% acute RfD, rounded
				Country	Body wt (kg)	Large portion, g/person	Unit wt, g	Country	Unit wt, edible portion, g				
VP 0061	Beans except broad bean & soya bean (green pods & immature seeds)	-	5.6	FRA	62.3	312	-	-	-	-	1	28.00	60
VB 0400	Broccoli (note 2)	-	2.85	USA	65.0	376	608	USA	474	3	2b	49.50	100
VB 0404	Cauliflowers (head) (note 2)	-	2.85	UNK	70.1	579	1733	UNK	780	3	2b	70.62	140
PE 0840	Chicken eggs	-	0.01	FRA	62.3	219	-	-	-	-	1	0.04	0
MO 0105	Edible offal (mammalian)	-	0.022	FRA	62.3	277	-	-	-	-	1	0.10	0
FC 0206	Mandarins	-	6.5	JPN	52.6	409	70	JPN	70	3	2a	67.81	140
MM 0095	Meat from mammals other than marine mammals: 20% as fat	-	0.022	AUS	67.0	104	-	-	-	-	1	0.03	0
MM 0095	Meat from mammals other than marine mammals: 80% as muscle	-	0.022	AUS	67.0	417	-	-	-	-	1	0.14	0
ML 0106	Milks	0.011	-	USA	65.0	2466	-	-	-	-	3	0.42	1
FS 0245	Nectarines	-	3.2	USA	65.0	590	110	FRA	99	3	2a	38.80	80
FS 0247	Peaches	-	3.2	SAF	55.7	685	110	FRA	99	3	2a	50.74	100
FP 0230	Pears (note 1)	-	5.4	USA	65.0	693	100	FRA	89	3	2a	72.35	140
VO 0444	Peppers, chili (note 3)	-	11.7	USA	65.0	90	45	USA	43	3	2a	31.82	60
VO 0445	Peppers, sweet (incl. pimento) (note 3)	-	11.7	FRA	62.3	207	172	UNK	160	3	2a	99.04	200
PM 0110	Poultry meat: 10% as fat	-	0.01	AUS	67.0	43	-	-	-	-	1	0.01	0
PM 0110	Poultry meat: 90% as muscle	-	0.01	AUS	67.0	388	-	-	-	-	1	0.06	0
PO 0111	Poultry, edible offal of	-	0.01	USA	65.0	248	-	-	-	-	1	0.04	0
FP 0231	Quinces (note 1)	-	5.4	AUS	67.0	175	92	USA	56	3	2a	23.14	50
VD 0541	Soya beans (dry)	0.01	-	JPN	52.6	159	-	-	-	-	3	0.03	0
OC 0541	Soya bean oil, crude	0.005	-	-	-	-	-	-	-	-	3	-	-

Note 1: Group maximum residue level proposed for pome fruit.
Note 2: Group maximum residue level proposed for flowerhead brassicas.
Note 3: Maximum residue level proposed for peppers includes both peppers, sweet, and peppers, chili.

Table 82. Assessment of risks to children up to 6 years from the short-term dietary intake of residues of acephate (acute RfD = 0.05 mg/kg bw, i.e. 50 µg/kg bw).

Codex Code	Commodity	STMR or STMR-P mg/kg	HR or HR-P mg/kg	Large portion diet			Unit weight			Variability factor	Case	IESTI µg/kg bw/day	% acute RfD, rounded
				Country	Body wt (kg)	Large portion, g/person	Unit wt, g	Country	Unit wt, edible portion, g				
FP 0226	Apples (note 1)	-	5.4	USA	15.0	679	110	FRA	100	3	2a	316.42	630
JF 0226	Apple juice	0.81	-	-	-	-	-	-	-	-	3	-	-
VS 0620	Artichoke globe	-	0.5	FRA	17.8	89	230	FRA	99	3	2b	7.50	20
VP 0061	Beans except broad bean & soya bean (green pods & immature seeds)	-	5.6	FRA	17.8	203	-	-	-	-	1	-	-
VB 0400	Broccoli (note 2)	-	2.85	USA	15.0	164	608	USA	474	3	2b	93.62	190
VB 0404	Cauliflowers (head) (note 2)	-	2.85	NLD	17.0	209	1733	UNK	780	3	2b	105.25	210
PE 0840	Chicken eggs	-	0.01	FRA	17.8	134	-	-	-	-	1	0.08	0

Codex Code	Commodity	STMR or STMR-P mg/kg	HR or HR-P mg/kg	Large portion diet			Unit weight			Variability factor	Case	IESTI µg/kg bw/day	% acute RfD, rounded
				Country	Body wt (kg)	Large portion, g/person	Unit wt, g	Country	Unit wt, edible portion, g				
MO 0105	Edible offal (mammalian)	-	0.022	FRA	17.8	203	-	-	-	-	1	0.25	1
FC 0206	Mandarins	-	6.5	JPN	15.9	353	70	JPN	70	3	2a	201.66	400
MM 0095	Meat from mammals other than marine mammals: 20% as fat	-	0.022	AUS	19.0	52	-	-	-	-	1	0.06	0
MM 0095	Meat from mammals other than marine mammals: 80% as muscle	-	0.022	AUS	19.0	208	-	-	-	-	1	0.24	0
ML 0106	Milks	0.011	-	USA	15.0	1286	-	-	-	-	3	0.94	2
FS 0245	Nectarines	-	3.2	AUS	19.0	302	110	FRA	99	3	2a	84.23	170
FS 0247	Peaches	-	3.2	AUS	19.0	315	110	FRA	99	3	2a	86.48	170
FP 0230	Pears (note 1)	-	5.4	UNK	14.5	279	100	FRA	89	3	2a	170.19	340
VO 0444	Peppers, chili (note 3)	-	11.7	AUS	19.0	31	45	USA	43	3	2b	56.34	110
VO 0445	Peppers, sweet (incl. pimento) (note 3)	-	11.7	AUS	19.0	60	172	UNK	160	3	2b	110.92	220
PM 0110	Poultry meat: 10% as fat	-	0.01	AUS	19.0	22	-	-	-	-	1	0.01	0
PM 0110	Poultry meat: 90% as muscle	-	0.01	AUS	19.0	201	-	-	-	-	1	0.11	0
PO 0111	Poultry, edible offal of	-	0.01	USA	15.0	37	-	-	-	-	1	0.02	0
FP 0231	Quinces (note 1)	-	5.4	NLD	17.0	1	92	USA	56	3	2b	0.97	2
VD 0541	Soya beans (dry)	0.01	-	JPN	15.9	88	-	-	-	-	3	0.06	0
OC 0541	Soya bean oil, crude	0.005	-	-	-	-	-	-	-	-	3	-	-

Note 1: Group maximum residue level proposed for pome fruit.
Note 2: Group maximum residue level proposed for flowerhead brassicas.
Note 3: Maximum residue level proposed for peppers includes both peppers, sweet, and peppers, chili.

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