PARATHION-METHYL (059)

EXPLANATION

Parathion-methyl was originally evaluated by the JMPR in 1965, and subsequently re-evaluated a number of times up to 1984. Re-evaluation in the CCPR periodic review programme was scheduled for 1991 but was postponed to 1992, awaiting a comprehensive set of US studies. These studies were not available in time for the 1992 Meeting, but the information that was available was reviewed at that time.

A list of residue studies carried out for the US EPA re-registration programme was supplied to the 1992 Meeting. It indicated that supervised residue trials on 29 crops and processing studies on six commodities were available.

It was initially proposed that these data should be reviewed by the 1993 JMPR, but as a result of the re-registration activities in the USA the use pattern was not clear. It was decided to postpone the review until the 1994 JMPR in order that information on current US GAP might be considered. Information on the US GAP was available for review in 1994. The compound was also scheduled for re-evaluation by the WHO Group of Experts at the 1994 JMPR.

Information was made available to the Meeting from national governments (Australia, Germany, The Netherlands, Thailand and the USA) and two manufacturers.

IDENTITY (Worthing, 1987)

ISO common name: parathion-methyl

Chemical name
IUPAC: *O*,*O*-dimethyl *O*-4-nitrophenyl phosphorothioate
CA: *O*,*O*,dimethyl *O*-(4-nitrophenyl) phosphorothioate

CAS No.: 298-00-0
CIPAC No.: 487

Structural formula:

Molecular formula: $C_8H_{10}NO_5PS$

Molecular weight: 263.2

Physical and chemical properties

Pure active ingredient

Vapour pressure: 1.3 mPa at 20°C
Melting point: 35-36°C
Solubility: 55-60 mg/l water (25°C). Readily soluble in common organic solvents.
Specific gravity: d^2 1.358

Technical material

Light to dark tan-coloured liquid
Purity: *c.* 80% pure

METABOLISM AND ENVIRONMENTAL FATE

Animal metabolism

Metabolism studies on lactating goats and laying hens were made available to the Meeting.

Residues were determined in the tissues, milk and excreta of a lactating goat (weighing 60 kg) dosed daily for 3 consecutive days by intubation with radiolabelled parathion-methyl ([^{14}C]phenyl) at 0.50 mg/kg bw, equivalent to 6 ppm parathion-methyl in the feed (Van Dijk, 1988b). Milk was collected each day; the animal was slaughtered 1 hour after the final dose for tissue collection.

The radioactivity, expressed as % of the total ^{14}C administered, recovered from the excreta and tissues was urine 19%, faeces 13%, milk <0.1%, edible tissues, organs and blood 2.8%. The distribution of ^{14}C in the milk and tissues is shown in Table 1. The report suggested that a major part of the ^{14}C was still present in the digestive tract, but no direct measurements were made. However, because the animal was slaughtered only 1 hour after the final dose when the ^{14}C level in the blood was at its peak it is quite likely that much of the final dose had remained in the digestive tract.

Neither parathion-methyl nor paraoxon-methyl was present in solvent extracts of milk, kidney, liver, muscle or fat. The identified metabolites are listed in Table 2.

Table 1. ^{14}C in milk and tissues of a lactating goat dosed daily for 3 days with parathion-methyl ([^{14}C]phenyl) at 0.50 mg/kg bw, and slaughtered 1 hour after the final dose (Van Dijk, 1988b).

Sample	^{14}C as % of total administered doses	^{14}C expressed as mg parathion-methyl per kg of tissue or milk
Kidney	0.3	1.6
Liver	0.5	0.59
Muscle	1.3	0.055
Fat	0.1	0.014

Sample	^{14}C as % of total administered doses	^{14}C expressed as mg parathion-methyl per kg of tissue or milk
Milk, 8 hours after first dose		0.026
Milk, 8 hours after second dose		0.036
Milk, 1 hour after final dose		0.020
Milk, total	0.047	

Table 2. Metabolites identified in extracts of milk and tissues from a lactating goat (Van Dijk, 1988b).

Metabolite	Metabolite concentration, expressed as mg parathion-methyl equivalents per kg				
	Milk	Kidney	Liver	Muscle	Fat
demethyl-paraoxon-methyl	0.013	0.17	0.14	-	-
N-acetylaminophenol	-	-	0.14	-	-
N-acetylaminophenyl glucuronide	-	0.21	0.037	0.001	-
amino-paraoxon-methyl	0.012	0.15	-	0.032	0.004
demethyl-amino-parathion-methyl	-	0.29	-	-	-
demethyl-amino-paraoxon-methyl	-	0.24	0.13	0.014	-
p-aminophenyl glucuronide	0.004	-	-	0.002	-
amino-parathion-methyl	-	0.029	-	-	<0.001
Unidentified metabolites	0.004	0.48	0.087	0.005	0.005

Tissue, egg and excreta residues were measured in laying hens (2 groups of 5 and 6, each bird weighing 1.5-2.0 kg) dosed orally daily by intubation for 1 day or 3 days with radiolabelled parathion-methyl ([^{14}C]phenyl) at 0.5 mg/kg bw, equivalent to 6 ppm parathion-methyl in the feed (Van Dijk, 1988a). The daily feed intake was approximately 8% of the body weight. Eggs and excreta were collected throughout, and birds were slaughtered 4, 8 and 12 hours (group 1) and 3 hours (group 2) after the final dose for tissue collection.

In the hens dosed for 3 days the radioactivity, expressed as % of total ^{14}C administered, recovered from excreta and tissues was excreta 43-64%, eggs <0.1%, edible tissues, organs and blood 0.5-5.5%. The levels of ^{14}C in eggs and tissues are shown in Table 3. Identified residues are listed in Table 4.

The metabolites identified in eggs were 4-nitrophenol and its sulphate. Demethyl-paraoxon-methyl (paraoxon-methyl with one methyl group removed) was detected in muscle. Metabolites with the nitro group reduced to an amino were identified in the liver. Parathion-methyl itself was detected in the kidneys, gizzard, heart, fat and skin; *p*-nitrophenol was found in all tissues except muscle.

Table 3. ^{14}C in eggs and tissues of laying hens dosed daily for 3 days with parathion-methyl ([^{14}C]phenyl) at 0.50 mg/kg bw, and slaughtered 3 hours after the final dose (Van Dijk, 1988a).

Sample	^{14}C expressed as mg parathion-methyl per kg of tissue or eggs (mean of 5 hens)
Liver	0.076
Kidney	0.24
Muscle	0.017
Gizzard	0.029
Heart	0.051
Fat	0.021
Eggs, 8 hours after second dose	0.015
Eggs, 3 hours after final dose	0.031

Table 4. Residues identified in extracts of eggs and tissues from laying hens (Van Dijk, 1988a).

Compound	Concentration, expressed as mg parathion-methyl equivalents per kg, in						
	Eggs	Kidney	Liver	Muscle	Gizzard	Heart	Fat
parathion-methyl	-	0.001	-	-	0.004	0.001	0.008
demethyl-paraoxon-methyl	-	0.014	-	0.010	-	-	-
N-acetylaminophenol	-	-	0.048	-	0.002	0.012	-
N-acetylaminophenyl glucuronide	-	0.11	0.017	-	-	0.013	-
demethyl-amino-parathion-methyl	-	-	-	-	-	0.003	-
p-aminophenyl glucuronide	-	0.020	-	-	-	0.001	-
4-nitrophenyl sulphate	0.024	-	-	-	-	-	-
4-nitrophenol	0.008	0.005	0.007	-	0.011	0.005	0.008
4-nitrophenyl phosphorothioate	-	0.008	-	-	-	-	-
4-aminophenol	-	0.014	-	-	-	0.002	-
Unidentified metabolites	-	0.038	-	-	0.001	0.010	-

Plant metabolism

Metabolism studies on potatoes, cotton and lettuce were made available to the Meeting.

Potato plants (3 months old, variety Hansa) growing in lysimeters were treated with radiolabelled parathion-methyl ([^{14}C]phenyl) once at rates equivalent to 1.5 and 4.7 kg ai/ha. Plants were harvested 5 and 21 days after treatment (Linke and Brauner, 1988). Very little ^{14}C was translocated to the tubers from the foliage (Table 5).

The major metabolite in the tubers was 4-nitrophenol (Table 6). Additional amounts of parathion-methyl and 4-nitrophenol were released on acid hydrolysis.

Table 5. Distribution of ^{14}C in potato plants treated with radiolabelled parathion-methyl (Linke and Brauner, 1988).

Treatment, kg ai/ha	PHI, days	^{14}C as % of applied ^{14}C		^{14}C expressed as mg parathion-methyl per kg of tissue	
		Tuber	Foliage	Tuber	Foliage
1.5	5	0.004	26	0.011	6.8
	21	0.030	22	0.037	4.4
4.7	5	0.006	33	0.027	31
	21	0.014	22	0.068	14

Table 6. Distribution of identified residues in potato tubers resulting from foliar application of [^{14}C]parathion-methyl at 4.7 kg ai/ha (Linke and Brauner, 1988).

Compound	PHI 5 days		PHI 21 days	
	Metabolite ^{14}C as % of ^{14}C in the tubers	Metabolite expressed as parent, mg/kg	Metabolite ^{14}C as % of ^{14}C in the tubers	Metabolite expressed as parent, mg/kg
parathion-methyl	4.0	0.001	0.6	<0.001
4-nitrophenol	25	0.006	9.3	0.007
4-nitrophenol conjugate	7.2	0.002	3.7	0.003
4-nitrophenol glucoside			0.5	<0.001
demethyl-parathion-methyl	8.6	0.002	2.6	0.002
Non-polar metabolites (paraoxon-methyl may be half)	6.9	0.002	6.5	0.004

A cotton plant was sprayed with radiolabelled parathion-methyl ([^{14}C]phenyl) once at a rate equivalent to 0.38 kg ai/ha. Seeds and leaves were harvested 10 days after treatment for the determination of metabolite distribution (Linke *et al*., 1988). The seeds and leaves contained residues of 0.08 and 40 mg/kg respectively of ^{14}C expressed as parathion-methyl. The compounds identified in the seeds are listed in Table 7. In a separate experiment [^{14}C]parathion-methyl was applied directly to leaves of cotton plants with a syringe, and fifteen days later the leaves were examined for metabolites. The parent was the only intact phosphorus ester detected. Paraoxon-methyl was not detected.

Table 7. Distribution of identified residues in cotton seeds and leaves resulting from spray application to seeds of [^{14}C]parathion-methyl at 0.38 kg ai/ha and syringe application to leaves (Linke *et al*., 1988).

Compound	Seed		Leaves	
	Metabolite ^{14}C as % of ^{14}C in the seed	Metabolite expressed as parent, mg/kg	Metabolite ^{14}C as % of ^{14}C in the leaves	Metabolite expressed as parent, mg/kg
parathion-methyl	9.7	0.008	35	168
4-nitrophenol	12	0.009	10	48
4-nitrophenol glucoside	8.9	0.007	11	55
demethyl-parathion-methyl	4.4	0.004	11	55
demethyl-paraoxon-methyl			3.1	15

<u>Lettuce plants</u> in a greenhouse were treated once with [^{14}C]parathion-methyl at the equivalent of 1.1 kg ai/ha and harvested 14 and 21 days later (Ritter, 1988). Of the ^{14}C applied, 37% and 42% was recovered from the lettuce after 14 and 21 days respectively. The identified compounds are listed in Table 8. Other unidentified metabolites did not produce nitrophenol on hydrolysis, suggesting metabolism beyond the initial stages.

Bound or unextractable residues in lettuce were further characterised by Linke (1988). The bound residues were subjected to hydrolysis with 6N HCl at 100°C, then the remaining solid was treated with 2.5N NaOH at 70°C. Nitrophenol equivalent to 12% of the ^{14}C in the lettuce leaves was produced by the hydrolysis. It is likely to have come from a polar metabolite.

Table 8. Distribution of residues in lettuce resulting from spray application of [^{14}C]parathion-methyl at 1.1 kg ai/ha, with harvest 14 and 21 days later (Ritter, 1988).

Compound	Day 14		Day 21	
	Metabolite ^{14}C as % of ^{14}C in the leaves	Metabolite expressed as parent, mg/kg	Metabolite ^{14}C as % of ^{14}C in the leaves	Metabolite expressed as parent, mg/kg
parathion-methyl	19	2.2	9.9	0.97
4-nitrophenol	22	2.5	21	2.1
4-nitrophenol glucoside	2.6	0.30	3.4	0.33
demethyl-parathion-methyl	2.2	0.25	4.2	0.41

METHODS OF RESIDUE ANALYSIS

Analytical methods

Möllhoff (1968) extracted fruit and vegetables with acetone. Residues were cleaned up by solvent partitioning followed by column chromatography on Florisil. Parathion-methyl (and other organophosphorus pesticides) were then determined by GLC using an alkali flame-ionisation phosphorus detector.

Mölhoff (1969, 1972, 1974) described a method for determining parathion-methyl in soil, fruit, cereals, vegetables and tea. The extraction step depended on the water content of the sample; fruit and vegetables were extracted with acetone. Clean-up and GLC determination were as described above.

Seym (1991) extracted samples of grapes with acetone, or passed wine samples through a small "Chem-Elut" cartridge. Residues were eluted from the cartridge with dichloromethane. Clean-up was continued on a Florisil column. Determination was by GLC with a flame-photometric detector.

Blass (1990) described a similar method to analyse grapes, apples, apple sauce, pears, must, wine and apple juice. The gas chromatograph was equipped with a nitrogen-phosphorus detector. The limits of determination were 0.05 mg/kg.

Gillard (1989) described the residue method for parathion-methyl, paraoxon-methyl and *p*-nitrophenol employed in the supervised residue trials in the USA.

Crops are blended and refluxed with acidic methanol (80:20 methanol/0.1 N HCl). After evaporating the methanol from the filtered extract, the residues are partitioned into ethyl acetate. Parathion-methyl and paraoxon-methyl are then quantitatively determined by GLC with an FPD in the phosphorus mode. A portion of the ethyl acetate extract is cleaned up on a Florisil "Sep-Pak" for the subsequent determination of nitrophenol by HPLC with a UV detector set at 315 nm. An additional gel-permeation clean-up may be required at the ethyl acetate stage for oily samples. The validated LOD for the three compounds in most substrates is 0.05 mg/kg.

Stability of pesticide residues in stored analytical samples

Information on frozen storage stability was made available for many commodities: bean seeds and pods, dry bean seed, bluegrass hay, cabbage, celery, clover forage, hops, lettuce, maize, maize fodder, maize forage, mustard greens, onions, succulent pea forage, pea straw, dry peas, succulent pea pods and seed, soya bean seed, sunflower, turnip roots and tops, wheat, wheat forage and straw.

Residues of parathion-methyl and paraoxon-methyl were shown to be stable in commodities fortified at 1 mg/kg and held at -20°C for 24 months (Wassell and Gilles, 1991). At each storage interval the fortified samples were analysed, together with check and recovery samples. The calculated percentage remaining was corrected for the recovery in the associated recovery samples (Table 9). Parathion-methyl and its metabolites were stable in the commodities tested under these storage conditions.

Gillard (1992), using similar methods, showed that parathion-methyl was stable in another set of samples for 2 years (Table 10). Paraoxon-methyl was of marginal stability in lettuce; the results suggested that samples of lettuce to be analysed for paraoxon-methyl should not be stored longer than 6 months. The long-term storage of sunflower seed samples may also lead to loss of paraoxon-methyl residues.

In another set of experiments conducted according to similar protocols Davis (1992) showed that parathion-methyl was stable at freezer temperatures in all the samples tested (Table

11). Paraoxon-methyl residues in succulent pea pods, clover forage and soya bean seed had decreased to less than 70% of the original level after 2 years of storage.

The stability of residues in spiked samples of green and dry hops stored in a freezer at -15°C for 21 months (trial samples were stored for the same time) was marginal with results of 49-150% (mean 103%) of the added parathion-methyl and 22-120% (mean 58%) of the added paraoxon-methyl at the end of the storage period (Cone *et al.*, 1992). The stability of paraoxon-methyl in dry hops was inadequate; 35-55% of the added compound was found after storage.

Table 9. Frozen storage stability of parathion-methyl, paraoxon-methyl and 4-nitrophenol added at 1 mg/kg to homogenized commodities held for 24 months at a nominal -20°C (Wassell and Gilles, 1991).

COMPOUND	% of added residue found after interval (months) at -20°C								
Commodity	0	1	2	3	4	6	12	18	24
PARATHION-METHYL									
Snap bean seed and pod	95	103	113	104	93	87	96	117	98
Dry bean seed	101	116	122		107	94	106	100	95
Celery	103	110	107	96	97	92	99	100	106
Maize forage	98	105	118		99	84	98	113	95
Maize fodder	94	96	123	112	98	82	92	98	108
Maize	100	96	90	81	102	96	95	83	101
Turnip root	96	94	107	113	102	87	96	117	89
Turnip top	97	97	116	94	121	111	95	125	90
PARAOXON-METHYL									
Snap bean seed and pod	88	102	103	93	96	90	93	111	94
Dry bean seed	99	103	138		111	90	99	99	85
Celery	103	79	109	93	109	84	92	98	97
Maize forage	93	109	108		104	92	103	109	87
Maize fodder	87	99	118	102	104	81	93	104	105
Maize	95	95	100	89	93	101	97	96	93
Turnip root	95	95	108	98	83	91	87	125	76

COMPOUND Commodity	% of added residue found after interval (months) at -20°C								
	0	1	2	3	4	6	12	18	24
Turnip top	94	97	110	95	115	97	92	123	79
NITROPHENOL									
Snap bean seed and pod	97	111	100	132	98	103	106	115	111
Dry bean seed	106	63	121		120	91	108	106	91
Celery	108	83	111	105	98	90	103	90	104
Maize forage	97	153	100		110	95	98	106	101
Maize fodder	106	109	154	120	92	76	114	106	113
Maize	100	136	99	104	59	106	106	70	103
Turnip root	100	114	171	109	110	96	101	131	93
Turnip top	110	71	111	93	102	104	97	102	92

Table 10. Frozen storage stability of parathion-methyl, paraoxon-methyl and 4-nitrophenol added at 1 mg/kg to homogenized commodities held for 24 months at a nominal -20°C (Gillard, 1992).

COMPOUND Commodity	% of added residue found after interval (months) at -20°C								
	0	1	2	3	4	6	12	18	24
PARATHION-METHYL									
Lettuce[1]	98	100	100	99	99	97	95	96	92
Wheat straw[1]	110	93	110	95	103	103	100	87	89
Wheat forage	108	103	96	88	92	101	89	97	105
Wheat	94	103	91	67	77	92	96	94	105
Sunflower seed	96	82	98	96	101	101	88	111	64
Onion	117	97	116	94	96	103	94	97	88
Mustard greens	108	95	93	105	99	102	94	84	84

COMPOUND Commodity	% of added residue found after interval (months) at -20°C								
	0	1	2	3	4	6	12	18	24
PARAOXON-METHYL									
Lettuce[1]	121	85	80	68	74	75	58	44	58
Wheat straw[1]	126	92	103	92	96	99	88	73	71
Wheat forage	127	102	92	87	90	92	84	83	108
Wheat	97	94	84	85	87	87	74	72	108
Sunflower seed	113	76	91	87	99	83	65	98	52
Onion	122	93	105	87	88	94	87	78	71
Mustard greens	128	94	88	96	94	101	83	69	69
NITROPHENOL									
Lettuce[1]	91	101	102	112	112	88	112	131	103
Wheat straw[1]	124	102	114	103	95	100	90	96	119
Wheat forage	116	100	97	99	94	89	95	101	135
Wheat	107	95	97	83	92	74	89	107	115
Sunflower seed	98	87	114	88	107	108	148		90
Onion	106	100	103	129	94	90	101	93	103
Mustard greens	100	91	93	98	94	95	102	91	112

[1] the final sample was stored for 25 months

Table 11. Frozen storage stability of parathion-methyl, paraoxon-methyl and 4-nitrophenol added at 1 mg/kg to homogenized commodities held for 24 months at a nominal -20°C to -25°C (Davis, 1992).

COMPOUND Commodity	% of added residue found after interval (months) at -20°C to -25°C								
	0	1	2	3	4	6	12	18	24
PARATHION-METHYL									
Cabbage	98	101	82	76	99	94	99	106	98
Hay, bluegrass	101	97	87	117	108	94	114	104	125
Peas, dry	101	102	81	92	95	79	99	99	89
Pea straw, dry	100	94	89	96	81	74	91	85	93
Peas, succulent pods	101	92		90	87	95	93	92	85
Pea forage, succulent	104	89		92	91	103	107	93	98
Clover forage	101	99	89	92	85	93	102	97	95
Soya bean seed	93	101	98	89	83	103	103	104	97
PARAOXON-METHYL									
Cabbage	98	98	79	73	94	89	87	94	89
Hay, bluegrass	100	95	81	112	105	90	103	106	104
Peas, dry	102	91	76	86	90	76	85	84	81
Pea straw, dry	101	92	90	94	84	75	88	80	85
Peas, succulent pods	101	77		75	80	75	70	67	56

COMPOUND Commodity	% of added residue found after interval (months) at -20°C to -25°C								
	0	1	2	3	4	6	12	18	24
Pea forage, succulent	106	81		89	90	88	91	82	77
Clover forage	100	93	82	84	78	76	81	80	66
Soya bean seed	100	94	88	77	69	78	74	60	62
NITROPHENOL									
Cabbage	98	94	82	86	92	101	104	100	104
Hay, bluegrass	93	89	80	124	115	98	117	128	134
Peas, dry	101	113	80	103	100	86	102	100	96
Pea straw, dry	107	102	92	90	87	79	106	94	87
Peas, succulent pods	106	104		100	96	108	121	98	98
Pea forage, succulent	100	91		90	88	116	106	101	107
Clover forage	99	100	78	90	99	105	111	99	111
Soya bean seed	103	87	101	100	82	111	93	92	109

USE PATTERN

Parathion-methyl is registered in many countries as an insecticide for use on horticultural and agricultural crops. Uses are summarized in Table 12. The uses listed in the 1992 Residue Evaluations (pp. 705-707) should also be taken into account.

Table 12. Registered uses of parathion-methyl. All foliar applications.

Crop	Country	Form	Application			PHI, days
			Rate per applic, kg ai/ha	Spray conc kg ai/hl	No.	
Alfalfa	USA (NV, CA)	455 g/l EC	0.28-0.42			15
Alfalfa	USA	455 g/l EC	0.28-1.1			15
Apple	Netherlands	EC	0.11-0.36	0.024	3	21
Apple	USA	455 g/l EC	6.7	0.028-0.11	5	14
Apricot	USA	455 g/l EC	0.13	0.014	2	14
Artichoke	USA	455 g/l EC	1.1			7
Barley	USA	455 g/l EC	0.28-1.4			15
Beans	Australia (Qld)	500 g/l EC	0.35			14
Beans (French)	Australia (Qld)	500 g/l EC	0.35-0.55			14
Beans	Netherlands	EC	0.18-0.26		3	21
Beans (dry and green)	USA	455 g/l EC	1.7			21
Beans (dry and green)	USA	455 g/l EC	0.56			15
Beet (sugar and fodder beet)	Netherlands	EC	0.15-0.48		3	21
Beets (red)	USA	455 g/l EC	1.1			15 [2]
Blackberries	Netherlands	EC	0.073-0.088		3	21
Broccoli	USA	455 g/l EC	1.1-1.7			21

Crop	Country	Form	Application			PHI, days
			Rate per applic, kg ai/ha	Spray conc kg ai/hl	No.	
Broccoli	USA	455 g/l EC	0.56			7
Brussels sprouts	USA	455 g/l EC	0.56			7
Brussels sprouts	USA	455 g/l EC	1.1-1.7			21
Cabbage	USA	455 g/l EC	0.56			7
Cabbage	USA	455 g/l EC	1.1-1.7			21
Carrots	Australia (Qld)	500 g/l EC	0.35			14
Carrots	USA	455 g/l EC	1.1			15
Cauliflower	USA	455 g/l EC	1.1-1.7			21
Cauliflower	USA	455 g/l EC	0.56			7
Celery	USA	455 g/l EC	1.1			15
Cereals	Germany	400 g/kg WP	0.18	0.75		
Cereals	Netherlands	EC	0.36	0.06-0.18	3	21
Cherries	USA	455 g/l EC	0.13	0.014		14
Cherry	Netherlands	EC	0.11-0.19		3	21
Clover	USA	455 g/l EC	0.28-1.1			15
Clover	USA (NV, CA)	455 g/l EC	0.28-0.42			15
Collards	USA	455 g/l EC	1.1-1.7			21
Collards	USA	455 g/l EC	0.56			7
Cotton	USA	455 g/l EC	0.14-3.4			1
Cucumbers	USA	455 g/l EC	0.28			15
Cucurbits	Australia (Qld)	500 g/l EC	0.35			14
Currants, black, red, white	Netherlands	EC	0.073-0.088		3	21
Egg fruit	Australia (Qld)	500 g/l EC	0.35			14
Gooseberries	USA	455 g/l EC	0.13	0.014		14
Grapes	Germany	400 g/kg WP	0.12-0.36	0.02	1-2	35
Grapes	Netherlands	EC	0.072-0.24		3	28
Grapes	USA	455 g/l EC	0.84	0.11		14
Grass (forage)	USA	455 g/l EC	0.56-0.84			15
Hops	USA	455 g/l EC	1.1			15
Kale	USA	455 g/l EC	0.56			7
Kale	USA	455 g/l EC	1.1-1.7			21
Kohlrabi	USA	455 g/l EC	0.56			7
Kohlrabi	USA	455 g/l EC	1.1-1.7			21
Lettuce	USA	455 g/l EC	1.1			21
Maize	Netherlands	EC	0.48	0.06-0.24	1	21
Maize	USA	455 g/l EC	0.28-0.56			12
Mustard	USA	455 g/l EC	0.56			7
Mustard	USA	455 g/l EC	1.1-1.7			21

Crop	Country	Form	Application			PHI, days
			Rate per applic, kg ai/ha	Spray conc kg ai/hl	No.	
Nuts	Netherlands	122 g/l EC	0.12-0.19	0.012	3	21
Oats	USA	455 g/l EC	0.28-1.4			15
Onions	Netherlands	EC	0.36	0.06-0.18	3	21
Onions	USA	455 g/l EC	0.56			15
Peach	Netherlands	EC	0.11-0.19		3	21
Peach G	Netherlands	EC	0.11-0.24		3	28
Peach	USA	455 g/l EC	4.5	0.028-0.11	5	14
Pear	Netherlands	EC	0.11-0.36	0.024	3	21
Pear	USA	455 g/l EC	0.13	0.014	2	14
Peas	Australia (Qld)	500 g/l EC	0.35-0.55			14
Peas	Netherlands	EC	0.24-0.36	0.024-0.18	3	21
Peas	USA	455 g/l EC	1.1			15
Peas	USA	455 g/l EC	0.56			7
Peppers	USA	455 g/l EC	1.1			15
Plum	Netherlands	EC	0.11-0.24		3	28
Plum G	Netherlands	EC	0.11-0.19		3	21
Plum	USA	455 g/l EC	4.5	0.028-0.11	5	14
Pome fruit	Germany	400 g/kg WP	0.30	0.020	2	28
Potato	Netherlands	EC	0.12-0.24	0.02-0.12	1	21
Potatoes	Australia (Qld)	500 g/l EC	0.35			14
Potatoes	USA	455 g/l EC	1.7			5
Prunes	USA	455 g/l EC	4.2	0.028-0.11	5	14
Rape seed	Netherlands	EC	0.48	0.08-0.24	3	21
Raspberries, red, black	Netherlands	EC	0.073-0.088		3	21
Rice	USA	455 g/l EC	0.56-0.84			15
Rutabagas	USA	455 g/l EC	1.1-1.7			21
Rutabagas	USA	455 g/l EC	0.56			7
Rye	USA	455 g/l EC	0.28-1.4			15
Soya beans	USA	455 g/l EC	0.42-1.1			20
Spinach	USA	455 g/l EC	1.1			21
Spinach	USA	455 g/l EC	0.56			15
Strawberries	USA	455 g/l EC	0.56-0.78			14
Strawberries G	Netherlands	EC	0.044-0.094	0.0073	3	28G, 21F
Sugar beet	USA	455 g/l EC	0.28-0.42			20 (60)[1]
Sunflowers	USA	455 g/l EC	1.1		3	30
Sweet potatoes	USA	455 g/l EC	0.42			5
Tomatoes	Australia (Qld)	500 g/l EC	0.35			14
Tomatoes	USA	455 g/l EC	0.56			7

Crop	Country	Form	Application			PHI, days
			Rate per applic, kg ai/ha	Spray conc kg ai/hl	No.	
Tomatoes	USA	455 g/l EC	1.7			15
Turnips	USA	455 g/l EC	0.56-0.84			15[2]
Vegetables	Australia	500 g/l EC	0.35			14
Vegetables	Netherlands	EC	0.037-0.27		1	3, 28
Vegetables G	Netherlands	EC	0.014-0.18		1	21
Vetch	USA	455 g/l EC	1.4			20
Vetch	USA	455 g/l EC	0.28-1.1			15
Wheat	USA	455 g/l EC	0.28-1.4			15

[1] 60 days PHI for tops to be fed to animals
[2] 21 days PHI for tops to be used for food or feed
G glasshouse use. FG field and glasshouse use

RESIDUES RESULTING FROM SUPERVISED TRIALS

Results of supervised trials on horticultural and agricultural crops are summarized in Tables 13 to 55.

Table 13. Fruit. Germany, Thailand.
Table 14. Green and bulb onions. USA, Hungary.
Table 15. Cabbages. USA.
Table 16. Broccoli. USA.
Table 17. Sweet corn. USA.
Table 18. Head and leaf lettuce. USA.
Table 19. Mustard greens. USA.
Table 20. Turnip greens. USA.
Table 21. Spinach. USA.
Table 22. Snap beans. USA.
Table 23. Dry beans. USA.
Table 24. Lima beans. USA.
Table 25. Succulent and dried peas. USA, Hungary.
Table 26. Dry soya beans. USA.
Table 27. Carrots. USA.
Table 28. Potatoes. USA.
Table 29. Sugar beet. USA.
Table 30. Turnips. USA.
Table 31. Artichoke. USA.

Where residues were not detected they are recorded in the Tables as less than the limit of determination (LOD), e.g. <0.05 mg/kg. Residues have generally been rounded to 2 significant figures or, near the LOD, to 1 significant figure. Only when (rarely) residues were detected in control samples are they recorded in the Tables.

The reported residues were not adjusted for background or recovery. Residues in all commodities, including animal feeds, are expressed on a fresh-weight basis.

Most of the residues are recorded as pairs; these are duplicate samples from a single replicate split plot.

In the US supervised trials the spray equipment was generally calibrated before each application. Backpacks, bicycle framed CO_2 pressure sprayers and tractor-mounted booms were used for ground application. Fixed-wing aircraft and helicopters were used for aerial spraying. Aerial spraying trials are indicated by an "a" in the Tables in one of the "Application" columns.

Plot sizes in the US trials were in the range 50-500 m^2 (and larger) for ground application, and 1000-4000 m^2 (and larger) for aerial application. Supervised trials in the USA were generally sited in States that are major producers of the crop concerned.

Extensive analytical recovery data were provided for each commodity. Recoveries of parathion-methyl, paraoxon-methyl and *p*-nitrophenol were mostly good, with few outside the 70-120% range. As expected, the recoveries at the LOD were more widely scattered than at higher concentrations.

Substrates which caused analytical problems were soya bean hulls and refined soya bean oil, with mean recoveries of parathion-methyl of 51% and 61% respectively. Interference in the analytical method was experienced in some cabbage trials in the USA (California) where oxydemeton-methyl which had been applied to the crop as part of the normal insect control regime caused interference in the GLC determination of parathion-methyl.

In a supervised trial on spice pepper in Hungary in 1991, parathion-methyl was applied once at 0.75 kg ai/ha (0.13 kg ai/hl) 14 days before harvest, when residues were not detectable (<0.006 mg/kg) in 4 replicates.

Table 13. Residues of parathion-methyl in fruit from foliar application of parathion-methyl in supervised trials in Germany and Thailand. Underlined residues are from treatments according to GAP.

CROP Country, year (Variety)	Application				PHI, days	Parathion-methyl, mg/kg	Ref.
	Form	kg ai/ha	kg ai/hl	No.			
APPLES							
Germany, 1990 (Jonathan)	WP	0.30	0.10	2	0 7 14 28 35	0.39, 0.48 <0.05 (2) <0.05 (2) <0.05 (2), s<0.05 (2), j<0.05 (2) <0.05 (2)	0645-90
Germany, 1990 (Delicious)	WP	0.30	0.10	2	0 7 14 28 35	0.53, 0.53 0.10, 0.11 <0.05 (2) <0.05 (2) <0.05 (2)	0646-90
PEARS							
Germany, 1990 (Conference)	WP	0.30	0.10	2	0 7 14 28	0.66, 0.72 <0.05 (2) <0.05 (2) <0.05 (2)	0647-90
Germany, 1990 (Tongern)	WP	0.30	0.10	2	0 7 14 28 35	0.44, 0.59 0.08, 0.08 <0.05 (2) <0.05 (2) <0.05 (2)	0648-90

GRAPES							
Germany, 1990 (Müller-Thurgau)	WP	1×0.12 +1×0.24 +1×0.36	1×0.08 +1×0.12 +1×0.08	3	0 7 28 35 42	0.55, 0.76 0.03, 0.03 <0.01 (2) <0.01 (2), m<0.01 (2), w<0.01 (2) <0.01 (2)	0649-90
Germany, 1990 (Riesling)	WP	1×0.12 +1×0.16 +1×0.36	1×0.08 +1×0.08 +1×0.08	3	0 7 28 35 42	0.88, 0.88 0.03, 0.04 <0.01 (2) <0.01 (2), m<0.01 (2), w<0.01 (2) <0.01 (2)	0650-90
Germany, 1990 (Nerner)	WP	1×0.12 +1×0.24 +1×0.36	1×0.08 +1×0.12 +1×0.08	3	0 7 28 35 42	0.40, 0.58 0.04, 0.04 <0.01 (2) <0.01 (2) <0.01 (2)	0651-90
Germany, 1990 (Portugieser)	WP	1×0.12 +1×0.16 +1×0.36	1×0.08 +1×0.08 +1×0.08	3	0 7 28 35 42	0.51, 0.56 0.03, 0.03 <0.01 (2) <0.01 (2), m<0.01 (2), w<0.01 (2) <0.01 (2)	0652-90
Thailand, 1992 (White Malaga)	EC	2.5	0.05	8	0 1 3 5 7 10	2.6 0.54 0.10 0.02 0.02 0.01	Palakool 01
Thailand, 1992 (White Malaga)	EC	5.0	0.10	8	0 1 3 5 7 10	6.5 1.3 0.27 0.06 0.02 0.02	Palakool 01

s sauce, j juice, m must, w wine

Table 14. Residues of parathion-methyl and metabolites in green and bulb onions from foliar application of parathion-methyl in supervised trials in the USA and in Hungary. Underlined residues are from treatments according to GAP. All EC applications.

CROP Country, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
BULB ONION								
Hungary, 1991	0.70	0.14	1	14	<0.006 (4)			
USA (CA), 1988 (Southport Late)	1.1	0.60	6	15	<0.05 (2)	<0.05 (2) c 0.11	<0.05 (2)	MP-ON-3107
USA (CA), 1988 (Southport Lake)	1.1	0.60	a 6	15	<0.05 (2)	<0.05 (2) c 0.08	<0.05 (2)	MP-ON-3108
USA (WA), 1988 (Walla Walla Sweet)	1.1	0.60	5	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-ON-3109
USA (TX), 1989 (Ben Shamen)	1.1	1.5	6	15	0.11, 0.13		<0.05 (2)	MP-ON-3110
USA (TX), 1989 (Ben Shamen)	1.1	2.2	a 6	15	0.20, 0.21 c 0.07		<0.05 (2)	MP-ON-3111
USA (MI),1988 (Early Yellow Globe)	1.2	0.59	6	15	<0.05	0.08 c 0.08	0.09	MP-ON-7087
USA (NY), 1988 (Early Yellow Globe)	1.1	0.48	6	15	0.40, 0.58	<0.05 (2)	0.08, 0.09	MP-ON-7088
GREEN ONION								
USA (CA), 1988	1.1	0.30	6	15	0.37, 0.38	0.19, 0.33 c 0.20	0.40, 0.62	MP-ON-3112
USA (CA), 1989 (Evergreen)	0.56	0.29	a 6	15	<0.05 (2)	0.24, 0.24 c 0.15	0.23, 0.14 c 0.09	MP-ON-3113
USA (AZ), 1989 (Sweet Spanish)	1.1	0.50	6	15	0.09, 0.10 c 0.06		0.36, 0.50	MP-ON-3114
USA (CA), 1989 (K-99)	1.1	1.2	a 6	15	<0.05 (2)	<0.05 (2)	0.05, 0.07	MP-ON-3115
USA (NJ), 1988 (Ebeneezer)	1.1	0.40	6	15	0.08, 0.16	<0.05, 0.05	0.07, 0.11	MP-ON-7086

a aerial application, c control sample

Table 15. Residues of parathion-methyl and metabolites in cabbages from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All trials with 6 EC applications.

State, year (Variety)	Application		PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Headstart)	5×1.7 +1×0.56	5×0.45 +1×0.15	10 10	<0.50 (2) wl <0.05 (2)	0.09, 0.08 wl <0.05 (2)	0.80, 0.91 wl 0.05, 0.05	MP-CB-3031
CA, 1988 (Headstart)	1.7	0.45	21 21	<0.50 (2) wl <0.05 (2)	0.12, 0.06 wl <0.05 (2)	0.58, 0.49 wl <0.05 (2)	MP-CB-3031
CA, 1988 (Headstart) a	5×1.7 +1×0.56	5×0.85 +1×0.28	10 10	<0.50 (2) wl <0.05 (2)	0.24, 0.19 wl <0.05 (2)	0.69, 0.55 wl <0.05 (2)	MP-CB-3033
CA, 1988 (Headstart) a	1.7	0.85	21 21	<0.50 (2) wl <0.05 (2)	0.08, 0.08 wl <0.05 (2)	0.57, 0.42 <0.05 (2)	MP-CB-3033
TX, 1988 (Bravo)	5×1.7 +1×0.56	5×1.7 +1×0.57	10 10	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.18, 0.21 wl <0.05 (2)	MP-CB-3034
TX, 1988 (Bravo)	1.7	1.7	21 21	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.11, 0.06 wl <0.05 (2)	MP-CB-3034
FL, 1989 (Bravo)	5×1.7 +1×0.56	5×0.32 +1×0.11	10 10	<0.05 (2) wl <0.05 (2)	0.22, 0.21 wl <0.05 (2)	2.0, 2.2 wl <0.05, 0.06	MP-CB-7018
FL, 1989 (Bravo)	1.7	0.32	21 21	<0.05 (2) wl <0.05 (2)	0.22, 0.23 wl <0.05 (2)	1.1, 1.4 wl <0.05 (2)	MP-CB-7018
NJ, 1988 (Danish)	5×1.7 +1×0.56	5×0.31 +1×0.10	10 10	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.05, 0.07 wl <0.05 (2)	MP-CB-7020
NJ, 1988 (Danish)	1.7	0.31	21 21	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	MP-CB-7020
NY, 1988 (King Cole)	5×1.7 +1×0.56	5×0.48 +1×0.16	10 10	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.14, 0.13 wl <0.05, 0.06	MP-CB-7022
NY, 1988 (King Cole)	1.7	0.48	21 21	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.06, <0.05 wl <0.05 (2)	MP-CB-7022
NY, 1988 (King Cole)	5×1.7 +1×0.56	5×3.7 +1×1.2	10 10	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.69, 0.55 wl <0.05 (2)	MP-CB-7024
NY, 1988 (King Cole)	1.7	3.7	21 21	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.11, 0.22 wl <0.05 (2)	MP-CB-7024
WI, 1988 (Gourmet)	5×1.7 +1×0.56	5×0.88 +1×0.29	10 10	<0.05 (2) wl <0.05 (2)	0.06, 0.07 wl <0.05 (2)	0.68, 0.70 wl <0.05 (2)	MP-CB-7025
WI, 1988 (Gourmet)	1.7	0.88	22 22	<0.05 (2) wl <0.05 (2)	<0.05 (2) wl <0.05 (2)	0.15, 0.09 wl <0.05 (2)	MP-CB-7025

a aerial application. wl includes wrapper leaves.

Table 16. Residues of parathion-methyl and metabolites in broccoli from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
TX, 1988 (Commander)	1.7	0.89	6	21	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-BR-3021
TX, 1988 (Commander)	4×1.7 +2×0.56	4×0.89 +2×0.29	6	7	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-BR-3021
TX, 1988 (Commander)	1.7	3.5	a 6	21	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-BR-3023
TX, 1988 (Commander)	4×1.7 +2×0.56	4×3.5 +2×1.2	a 6	7	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-BR-3023
CA, 1989	1.7	0.90	6	21	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-BR-3024
CA, 1989	4×1.7 +2×0.56	4×0.90 +2×0.30	6	7	<0.05 (2)	<0.05 (2)	0.14, 0.16	MP-BR-3024
CA, 1988 (501 Green Valiant)	4×1.7 +2×0.56	4×0.45 +2×0.15	6	7	0.06, 0.10	0.12, 0.14	0.16, 0.21	MP-BR-3026
CA, 1988 (501 Green Valiant)	1.7	0.45	6	21	0.05, <0.05	<0.05 (2)	0.18, 0.15	MP-BR-3026
CA, 1988 (510 Green Valiant)	2×1.7 +2×0.84 +3×1.7	2×0.90 +2×0.45 +3×0.90	a 7	21	<0.05 (2)	<0.05 (2)	0.08, 0.07	MP-BR-3028
CA, 1988 (510 Green Valiant)	2×0.56 +2×1.7 +3×0.56	2×0.30 +2×0.90 +3×0.30	a 7	7	<0.05 (2)	<0.05 (2)	0.13, 0.09	MP-BR-3028
OR, 1988 (Gem)	4×1.7 +2×0.56	4×0.90 +2×0.30	6	7	<0.05 (2)	<0.05 (2)	0.33, 0.27	MP-BR-3029
OR, 1988 (Gem)	1.7	0.90	6	21	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-BR-3029

a aerial application.

Table 17. Residues of parathion-methyl and metabolites in sweet corn from foliar application of parathion-methyl in supervised trials in the USA. All EC applications with 3 days PHI.

State, year (Variety)	Application		Residues, mg/kg			Ref.
	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1989	0.37	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3047
CA, 1989 (Jubilee)	1.3	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3049
TX, 1988 (Funk's Sweet G-90)	12	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3050
WA, 1989 (Jubilee)	1.2	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3185
FL, 1988 (Merit)	0.37	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7056
NY, 1988 (Jubilee)	2.5	6	0.09, <0.05	<0.05 (2)	<0.10 (2)	MP-CN-7057
WI, 1988 (Commander)	3.0	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7058

a aerial application

Table 18. Residues of parathion-methyl and metabolites in head and leaf lettuce from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications. All 21 days PHI.

CROP State, year (Variety)	Application		Residues, mg/kg			Ref.
	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
LETTUCE, HEAD						
AZ, 1988 (Vanguard-75)	0.46	6	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	MP-LE-3089
CA, 1988 (Empire)	0.60	6	0.41, 0.76 1.2, 0.97 wl	<0.05 (2) <0.05 (2) wl	0.13, 0.16 0.36, 0.21 wl	MP-LE-3091
CA, 1988 (Empire)	0.60	a 6	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	MP-LE-3092
TX, 1988 (Great Lakes 659)	0.74	6	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	MP-LE-3093
TX, 1988 (Great Lakes 659)	2.4	a 6	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	MP-LE-3094
FL, 1989 (Mesa 659)	0.41	6	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05, 0.07 wl	MP-LE-7068
NJ, 1988 (Montello)	0.21	6	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	MP-LE-7070
MI, 1988 (Ithaca)	0.59	6	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	<0.05 (2) <0.05 (2) wl	MP-LE-7072
LETTUCE, LEAF						
AZ, 1988 (Boston Dark Green)	0.46	6	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-LE-3095
CA, 1988 (Waldmann's Green)	0.60	6	1.6, 1.3	<0.05 (2)	0.11, 0.19	MP-LE-3097
CA, 1988 (Waldmann's Green)	0.60	a 6	<0.05 (2)	<0.05 (2)	<0.05, 0.07	MP-LE-3098
TX, 1988 (Cos Romaine)	1.2	6	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-LE-3099
FL, 1988 (Royal Red Leaf)	0.41	6	0.11, 0.07	<0.05 (2)	0.17, 0.18	MP-LE-7074
NJ, 1988 (Black Seeded Simpson)	0.21	6	0.23, 0.17	<0.05 (2)	0.09, <0.05	MP-LE-7076
MI, 1988 (Black Seeded Simpson)	0.54	6	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-LE-7078
TX, 1989 (Black Seeded Simpson)	2.4	6	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-LE-3192

a aerial application, wl includes wrapper leaves

Table 19. Residues of parathion-methyl and metabolites in mustard greens from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Florida Broadleaf)	5×1.7	5×0.60	6	10	<0.05 (2)	<0.05 (2)	1.1, 0.91	MP-MG-3101

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
	+1×0.56	+1×0.20						
CA, 1988 (Florida Broadleaf)	1.7	0.60	6	21	<0.05 (2)	<0.05 (2)	0.20, 0.26	MP-MG-3101
CA, 1988 (Florida Broadleaf)	5×1.7 +1×0.56	5×0.90 +1×0.30	a 6	10	<0.05 (2)	<0.05 (2)	0.78, 0.84	MP-MG-3103
CA, 1988 (Florida Broadleaf)	1.7	0.90	a 6	21	<0.05 (2)	<0.05 (2)	0.23, 0.39	MP-MG-3103
TX, 1988 (Florida Broadleaf)	5×1.7 +1×0.56	5×1.8 +1×0.60	6	10	<0.05 (2)	<0.05 (2)	0.29, 0.15	MP-MG-3104
TX, 1988 (Florida Broadleaf)	1.7	1.8	6	21	0.09, <0.05	<0.05 (2)	0.45, 0.15	MP-MG-3104
TX, 1988 (Florida Broadleaf)	5×1.7 +1×0.56	5×3.6 +1×1.2	a 6	10	0.10, 0.05	<0.05 (2)	1.1, 1.0	MP-MG-3106
TX, 1988 (Florida Broadleaf)	1.7	3.6	a 6	21	<0.05 (2)	<0.05 (2)	0.28, 0.16	MP-MG-3106
FL, 1988 (Florida Broadleaf)	2×1.7 +1×0.56	2×0.57 +1×0.19	3	10	0.51, 0.15	0.09, <0.05	1.2, 0.69	MP-MG-7080
FL, 1988 (Florida Broadleaf)	1.7	0.57	3	21	<0.05, 0.06	<0.05 (2)	0.37, 0.69	MP-MG-7080
LO, 1988 (Florida Broadleaf)	2×1.7 +1×0.56	2×0.74 +1×0.25	3	10	<0.05 (2)	<0.05 (2)	0.06, 0.12	MP-MG-7082
LO, 1988 (Florida Broadleaf)	1.7	0.74	3	21	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-MG-7082
OH, 1988 (Green Wave)	2×1.7 +1×0.56	2×0.90 +1×0.30	3	10	<0.05 (2)	<0.05 (2)	0.09, 0.08	MP-MG-7084
OH, 1988 (Green Wave)	1.7	0.90	3	21	<0.05 (2)	<0.05 (2)	0.07, <0.05	MP-MG-7084

a aerial application

Table 20. Residues of parathion-methyl and metabolites in turnip greens from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Purple Top White Globe)	4×0.90 +2×0.56	4×0.48 +2×0.30	6	7	3.8, 2.6	0.13, 0.09	1.8, 1.4	MP-TU-3149
CA, 1988 (Purple Top White Globe)	0.90	0.48	6	21	1.8, 1.2	<0.05 (2)	1.9, 2.3	MP-TU-3149
CA, 1988 (Purple Top White Globe)	4×0.90 +2×0.56	4×0.48 +2×0.30	a 6	7	0.22, <0.05	<0.05 (2)	0.58, 0.47	MP-TU-3151
CA, 1988 (Purple Top White Globe)	0.90	0.48	a 6	21	<0.05 (2)	<0.05 (2)	0.20, 0.34	MP-TU-3151
TX, 1988 (Purple Top White Globe)	4×0.90 +2×0.56	4×0.59 +2×0.37	6	7	0.16, 0.20	<0.05 (2)	1.5, 1.7	MP-TU-3152
TX, 1988 (Purple Top White Globe)	0.90	0.59	6	21	<0.05 (2)	<0.05 (2)	1.3, 1.3	MP-TU-3152
TX, 1988 (Purple Top White Globe)	4×0.90 +2×0.56	4×1.9 +2×1.2	a 6	7	0.91, 0.94	0.14, 0.13	1.3, 1.0	MP-TU-3154

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
TX, 1988 (Purple Top White Globe)	0.90	1.9	a 6	21	<0.05 (2)	<0.05 (2)	1.2, 1.1	MP-TU-3154
WA, 1988 (Purple Top)	4×0.90 +2×0.56	4×0.32 +2×0.20	6	7	0.07, <0.05	0.05, <0.05	1.0, 0.53	MP-TU-3155
WA, 1988 (Purple Top)	0.90	0.32	6	21	<0.05 (2)	<0.05 (2)	0.13, 0.18	MP-TU-3155
GA, 1988 (Purple Globe)	4×0.90 +2×0.56	4×0.31 +2×0.19	6	7	<0.05 (2)	<0.05 (2)	1.8, <0.10	MP-TU-7130
GA, 1988 (Purple Globe)	0.90	0.31	6	21	<0.05 (2)	<0.05 (2)	≤0.10, 0.18	MP-TU-7130
NJ, 1988 (Purple Top White Globe)	4×0.90 +2×0.56	4×0.32 +2×0.20	6	7	<0.05 (2)	<0.05 (2)	0.48, 0.56	MP-TU-7132
NJ, 1988 (Purple Top White Globe)	0.90	0.32	6	21	<0.05 (2)	<0.05 (2)	0.46, 0.39	MP-TU-7132

a aerial application

Table 21. Residues of parathion-methyl and metabolites in spinach from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Polka)	5×1.1 +1×0.56	5×0.30 +1×0.15	6	15	0.06, <0.05	<0.05 (2)	0.43, 0.37	MP-SP-3136
CA, 1988 (Polka)	1.1	0.30	6	21	<0.05 (2)	<0.05 (2)	0.34, 0.45	MP-SP-3136
CA, 1988 (Walters)	2×1.1 +1×0.56	2X0.57 +1×0.28	a 3	15	<0.05 (2)	<0.05 (2)	0.18, 0.22	MP-SP-3138
CA, 1988 (Walters)	1.1	0.57	a 3	21	<0.05 (2)	<0.05 (2)	0.13, 0.15	MP-SP-3138
CA, 1989 (St Helens)	3×1.1 +1×0.56	3×0.44 +1×0.22	4	15	0.05, 0.05	<0.05 (2)	0.32, 0.40	MP-SP-3139
CA, 1989 (St Helens)	1.1	0.44	4	21	0.06, 0.06	<0.05 (2)	0.26, 0.41	MP-SP-3139
TX, 1988 (Coho)	5×1.1 +1×0.56	5×1.2 +1×0.58	6	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SP-3141
TX, 1988 (Coho)	1.1	1.2	6	21	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SP-3141
TX, 1988 (Coho)	5×1.1 +1×0.56	5×2.2 +1×1.1	a 6	15	<0.05 (2)	<0.05 (2)	0.06, 0.09	MP-SP-3143
TX, 1988 (Coho)	1.1	2.2	a 6	21	<0.05 (2)	<0.05 (2)	0.12, <0.05	MP-SP-3143
CO, 1988 (Melody)	4×1.1 +1×0.56	4×0.24 +1×0.12	5	15	0.30, <0.05	0.10, <0.05	1.2, 0.09	MP-SP-3187
CO, 1988 (Melody)	1.1	0.24	5	21	<0.05 (2)	<0.05 (2)	0.06, <0.05	MP-SP-3187
NJ, 1988 (America)	5×1.1 +1×0.56	5×0.21 +1×0.10	6	15	0.07, 0.06	<0.05 (2)	0.47, 0.42	MP-SP-7123
NJ, 1988 (America)	1.1	0.21	6	21	0.09, 0.07	<0.05 (2)	0.50, 0.36	MP-SP-7123

a aerial application

Table 22. Residues of parathion-methyl and metabolites in snap beans (whole pods) from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications at 1.7 kg/ai. All 21 days PHI.

State, year (Variety)	Application		Residues, mg/kg			Ref.
	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Blue Lake)	0.51	6	<0.05 (2)	<0.05 (2)	0.75, 0.89	MP-LB-3084
CA, 1988 (Blue Lake 274)	1.8	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-LB-3086
OR, 1988 (OSU 91G)	0.90	6	<0.05 (2)	<0.05 (2)	0.62, 0.56	MP-LB-3087
CA, 1988 (Blue Lake)	0.51	6	<0.05 (2)	<0.05 (2)	0.50, 0.71	MP-LB-3508
OR, 1988 (OSU 91G)	1.8	6	<0.05 (2)	<0.05 (2)	0.51, 0.56	MP-LB-3509
FL, 1988 (Sprite)	0.57	6	<0.05 (2)	<0.05 (2)	2.9, 2.6	MP-LB-7011
NY, 1988 (Improved Tendergreen)	0.60	6	<0.05 (2)	<0.05 (2)	0.47, 0.66	MP-LB-7013
NY, 1988 (Improved Tendergreen)	3.7	a 6	<0.05 (2)	<0.05 (2)	0.74, 0.78	MP-LB-7015
WI, 1988 (Venture VB 4004)	0.80	4	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-LB-7016

a aerial application

Table 23. Residues of parathion-methyl and metabolites in dry beans from foliar application of parathion-methyl in supervised trials in the USA. All EC applications at 1.7 kg ai/ha. All 15 days PHI.

State, year (Variety)	Application		Residues, mg/kg			Ref.
	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Baby White)	0.49	6	<0.05 (2)	<0.05 (2)	0.16, 0.13	MP-DB-3072
CA, 1988 (Red Kidney)	1.8	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-DB-3074
MI, 1988 (Seafarer Navy Bean)	0.78	6	<0.05 (2)	<0.05 (2)	0.18, 0.16	MP-DB-7001
NB, 1988 (Pinto)	0.90	6	<0.05 (2)	<0.05 (2)	0.60, 0.53	MP-DB-7003
NB, 1988 (Pinto)	18	a 6	<0.05 (2)	<0.05 (2)	0.49, 0.57	MP-DB-7005
ND, 1988 (Topaz, Pinto)	1.8	6	<0.05 (2)	<0.05 (2)	0.17, 0.16	MP-DB-7006

a aerial application

Table 24. Residues of parathion-methyl and metabolites in lima beans (whole pods) from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications at 1.7 kg ai/ha. All 21 days PHI.

State, year (Variety)	Application		Residues, mg/kg			Ref.
	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Baby White)	0.49	6	<0.05 (2)	<0.05 (2)	0.34, 0.29	MP-LB-3081
CA, 1988 (Baby White)	1.8	a 6	<0.05 (2)	<0.05 (2)	0.14, 0.18	MP-LB-3083
DE, 1988 (Fordhook 242)	0.58	6	<0.05 (2)	<0.05 (2)	0.98, 1.0	MP-LB-7008
DE, 1988 (Fordhook 242)	3.6	a 6	<0.05 (2)	<0.05 (2)	0.37, 0.43	MP-LB-7010

a aerial application.

Table 25. Residues of parathion-methyl and metabolites in succulent and dried peas from foliar application of parathion-methyl in supervised trials in the USA and Hungary. Underlined residues are from treatments according to GAP. All EC applications.

CROP State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
PEAS, DRY								
Hungary, 1991	0.35	0.14	1	51	<0.02 (3)			
DE, 1988 (Alaska)	5×1.1 +1×0.56	5×0.38 +1×0.19	6	10	0.07, 0.07	<0.05 (2)	0.08, 0.05	MP-PE-7089
DE, 1988 (Alaska)	1.1	0.38	6	15	0.15, 0.18	<0.05 (2)	0.10, 0.16	MP-PE-7089
MN, 1988 (Alaska 146)	3×1.1 +1×0.56	3×0.60 +1×0.30	4	10	<0.05 (2)	<0.05 (2)	0.21, 0.19	MP-PE-7091
MN, 1988 (Alaska 146)	1.1	0.60	4	15	<0.05 (2)	<0.05 (2)	0.14, 0.14	MP-PE-7091
ND, 1988 (Trapper)	5×1.1 +1×0.56	5×1.2 +1×0.60	6	10	0.06, <0.05	<0.05 (2)	0.20, 0.20	MP-PE-7093
ND, 1988 (Trapper)	1.1	1.2	6	15	0.06, 0.06	<0.05 (2)	0.20, 0.29	MP-PE-7093
DE, 1988 (Alaska)	1.1	2.4	a 6	10 15	<0.05 (2) <0.05 (2)	<0.05 (2) <0.05 (2)	0.09, <0.05 0.07, 0.05	MP-PE-7095
DE, 1988 (Alaska)	5×1.1 +1×0.56	5×2.4 +1×1.2	a 6	10	0.13, 0.16	<0.05 (2)	0.14, 0.17	MP-PE-7095
PEAS, SUCCULENT PODS								
DE, 1988 (Wando)	5×1.1 +1×0.56	5×0.38 +1×0.19	6	10	0.21, 0.19	<0.05 (2)	0.18, 0.10	MP-PE-7096
DE, 1988 (Wando)	1.1	0.38	6	15	0.68, 0.60	<0.05 (2)	0.21, 0.37	MP-PE-7096
MN, 1988 (Asgrow XPG 206)	3×1.1 +1×0.56	3×0.60 +1×0.30	4	10	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-PE-7098
MN, 1988 (Asgrow XPG 206)	1.1	0.60	4	10	<0.05, 0.08	<0.05 (2)	<0.05, 0.11	MP-PE-7098

CROP State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
WI, 1988 (Ego)	4×1.1 +1×0.56	4×0.56 +1×0.23	5	9	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-PE-7100
WI, 1988 (Ego)	1.1	0.47	5	14	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-PE-7100
WI, 1988 (9888F)	4×1.1 +1×0.56	4×2.9 +1×1.5	a 5	10	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-PE-7102
WI, 1988 (9888F)	1.1	2.9	a 5	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-PE-7102

a aerial application

Table 26. Residues of parathion-methyl and metabolites in dry soya beans from foliar application of parathion-methyl in supervised trials in the USA. All 2 EC applications.

State, year (Variety)	Application		PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
IA, 1988 (Pioneer 9271)	0.56	0.28	15	<0.05	<0.05	<0.05	MP-SY-2101
IA, 1988 (Pioneer 9271)	2.7	1.3	15	0.15	<0.05	0.15	MP-SY-2101
MO, 1988 (Williams 82)	0.56	0.28	15	<0.05	<0.05	<0.05	MP-SY-2102
MO, 1988 (Williams 82)	2.8	1.4	15	<0.05	<0.05	<0.05	MP-SY-2102
IL, 1988 (BSR-201)	0.56	0.23	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SY-7117
MN, 1988 (Agri-Pro 1776)	0.56	0.24	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SY-7118
LA, 1988 (Forrest)	0.56	0.40	14	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SY-7119
GA, 1988 (Coker 488)	0.56	0.97	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SY-7120
IA, 1988 (Pioneer 9271)	0.56	0.28	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SY-7121
NC, 1988 (Asgrow A5149)	0.56	0.26	15	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-SY-7122

Table 27. Residues of parathion-methyl and metabolites in carrots from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All with 6 EC applications. All 15 days PHI.

State, year (Variety)	Application		Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Pacmor)	1.1	0.60	0.57, 0.79	<0.05 (2)	<0.10 (2)	MP-CT-3058
CA, 1988 (Pacmor)	1.1a	0.60	0.22, 0.09	<0.05 (2)	<0.10 (2)	MP-CT-3060
TX, 1988 (Danver)	1.1	0.73	0.49, 0.47	<0.05 (2)	<0.10 (2)	MP-CT-3061
TX, 1988 (Danver)	1.1a	2.4	0.26, 0.07	<0.05 (2)	<0.10 (2)	MP-CT-3063
WA, 1988 (Nantes Coreless)	1.1	0.40	<0.05, 0.67	<0.05 (2)	<0.10 (2)	MP-CT-3064
MI, 1988 (Scarlet Nantes)	1.2	0.59	0.35, 0.38	<0.05 (2)	<0.10 (2)	MP-CT-7027

a aerial application

Table 28. Residues of parathion-methyl and metabolites in potatoes from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications. All 5 days PHI.

State, year (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
ID, 1988 (Russet Burbank)	1.7	0.90	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-3122
ID, 1988 (Russet Burbank)	1.7	1.8	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-3124
CA, 1988 (Red La Sota)	1.7	0.72	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-3125
CA, 1988 (Red La Sota)	1.7	1.1	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-3501
CA, 1988 (Red La Sota)	3.4	2.1	6	<0.05	<0.05	<0.10	MP-PO-3501
ID, 1988 (Russet Burbank)	1.7	0.90	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-3502
ID, 1988 (Russet Burbank)	8.4	4.5	6	<0.05	<0.05	<0.10	MP-PO-3502
FL, 1988 (Red Lasoda)	1.7	0.48	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-7103
ME, 1988 (Atlantic)	1.8	0.47	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-7105
WI, 1988 (Russet Burbank)	1.7	0.88	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-PO-7107

a aerial application

Table 29. Residues of parathion-methyl and metabolites in sugar beet from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications. All 20 days PHI.

State, year (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
ID, 1988 (WS 88)	0.42	0.23	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3144
CA, 1988 (SS-NB2)	0.42	0.23	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3146
CA, 1988 (SS-NB2)	0.42	0.23	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3148
ID, 1988 (WS 88)	0.42	0.45	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3186
CA, 1988 (SS-NB2)	0.42	0.23	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3503
CA, 1988 (SS-NB2)	2.1	1.1	6	<0.05	<0.05	<0.10	MP-SB-3503
ID, 1988 (WS 88)	0.42	0.23	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3504
ID, 1988 (WS 88)	2.1	1.1	6	<0.05	<0.05	<0.10	MP-SB-3504
MN, 1988 (Ultramono)	0.42	0.22	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-7124
ND, 1988 (ACS ACH 176)	0.43	0.45	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-7126

a aerial application

Table 30. Residues of parathion-methyl and metabolites in turnips from foliar application of parathion-methyl in supervised trials in the USA (1988). Underlined residues are from treatments according to GAP. All EC applications.

State, (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, (Purple Top White Globe)	4×0.90 +2×0.56	4×0.48 +2×0.30	6	7	<0.05, 0.11	<0.05 (2)	<0.10 (2)	MP-TU-3149
CA, (Purple Top White Globe)	0.90	0.48	6	15	<0.05 (2)	<0.05 (2)	<0.10, 0.10	MP-TU-3149
CA, (Purple Top White Globe)	4×0.90 +2×0.56	4×0.48 +2×0.30	a 6	7	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3151
CA, (Purple Top White Globe)	0.90	0.48	a 6	15	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3151
TX, (Purple Top White Globe)	4×0.90 +2×0.56	4×0.59 +2×0.37	6	7	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3152
TX, (Purple Top White Globe)	0.90	0.59	6	15	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3152
TX, (Purple Top White Globe)	4×0.90 +2×0.56	4×1.9 +2×1.2	a 6	7	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3154
TX, (Purple Top White Globe)	0.90	1.9	a 6	14	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3154
WA, (Purple Top)	4×0.90 +2×0.56	4×0.32 +2×0.20	6	7	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3155
WA, (Purple Top)	0.90	0.32	6	15	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-3155
GA, (Purple Globe	4×0.90 +2×0.56	4×0.31 +2×0.19	6	7	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-7130
GA, (Purple Globe)	0.90	0.31	6	15	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-7130
NJ, (Purple Top White Globe)	4×0.90 +2×0.56	4×0.32 +2×0.20	6	7	<0.05 (2)	<0.05, 0.07	0.18, 0.17	MP-TU-7132
NJ, (Purple Top White Globe)	0.90	0.32	6	15	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-TU-7132

a aerial application

Table 31. Residues of parathion-methyl and metabolites in artichokes (Green Globe variety) from foliar application of parathion-methyl in supervised trials in California, USA in 1988. Underlined residues are from treatments according to GAP. All 4 EC applications at 1.1 kg ai/ha. All 7 days PHI.

Appln.	Residues, mg/kg			Ref.
kg ai/hl	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
0.24	1.1, 0.87	<0.05 (2)	0.57, 0.58	MP-AR-3176
0.060	1.1, 1.2	<0.05 (2)	0.52, 0.57	MP-AR-3176
0.24	1.3, 1.0	<0.05 (2)	0.90, 0.92	MP-AR-3178
0.060	1.6, 0.87	<0.05 (2)	0.70, 0.54	MP-AR-3178

Table 32. Residues of parathion-methyl and metabolites in celery from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Florida 683)	0.56	0.15	2	15 15 22 22	1.7, 2.5 f 0.34, 0.40 1.1, 1.0 f 0.17, 0.29	<0.05 (2) f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.02 (2) f <0.10 (2)	MP-CY-3066
CA, 1988 (Florida 683)	1.1	0.30	2	15 15 22 22	2.5, 2.2 f 1.2, 1.3 2.1, 1.5 f 0.65, 0.28	<0.05 (2) f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.10 (2) f <0.10 (2)	MP-CY-3066
CA, 1988 (5270R)	0.56	0.29	a 2	15 15 22 22	1.3, 1.2 f 0.06, 0.06 0.29, 0.09 f 0.05, 0.20	<0.05 (2) f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.10 (2) f <0.10 (2)	MP-CY-3067
CA, 1988 (5270R)	1.1	0.59	a 2	15 15 22 22	1.5, 2.1 f 0.17, 0.06 1.2, 0.87 f 0.09, 0.07	0.07, 0.07 f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.10 (2) f <0.10 (2)	MP-CY-3067
CA, 1988 (Florida 683)	0.56	0.15	2	15 15 22 22	1.8, 2.0 f 0.81, 0.86 1.7, 1.6 f 0.69, 0.69	<0.05 (2) f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.10 (2) f <0.10 (2)	MP-CY-3068
CA, 1988 (Florida 683)	1.1	0.30	2	15 15 22 22	4.4, 3.8 f 1.1, 1.1 2.5, 2.3 f 1.7, 1.1	<0.05 (2) f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.10 (2) f <0.10 (2)	MP-CY-3068
CA, 1988 (5275)	0.56	0.22	2	15 15 22 22	1.3, 1,6 f 0.54, 0.28 0.98, 0.77 f 0.12, 0.10	<0.05 (2) f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.10 (2) f <0.10 (2)	MP-CY-3070
CA, 1988 (5275)	1.1	0.44	2	15 15 22 22	1.8, 0.98 f 0.41, 0.32 1.6, 1.3 f 0.20, 0.21	<0.05 (2) f <0.05 (2) <0.05 (2) f <0.05 (2)	<0.10 (2) f <0.10 (2) <0.10 (2) f <0.10 (2)	MP-CY-3070
FL, 1988 (#683)	1.1	0.40	2	15 22	3.2, 4.0 f 2.8, 1.9 f	<0.05 (2) f <0.05 (2) f	<0.10 (2) f <0.10 (2) f	MP-CY-7029
MI,1988 (Utah Tall 52-70R1MP)	1.1	0.57	2	15 22	4.7, 3.4 f 4.3, 2.4 f	<0.05 (2) f <0.05 (2) f	<0.10 (2) f 0.12, <0.10 f	MP-CY-7031
NY, 1988 (Florida 683)	1.1	0.48	2	15 22	3.2, 3.9 f 3.6, 4.4 f	<0.05 (2) f <0.05 (2) f	<0.10 0.13 f <0.10 (2) f	MP-CY-7033
NY, 1988 (Florida 683)	1.1	2.5	a 2	15 22	0.76, 0.87 f 0.84, 0.83 f	<0.05 (2) f <0.05 (2) f	0.10, <0.10 f <0.10 (2) f	MP-CY-7035

a aerial application, f stalks with foliage

Table 33. Residues of parathion-methyl and metabolites in maize from foliar application of parathion-methyl in supervised trials in the USA. All EC applications. All 12 days PHI.

State, year (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1989	1.1	0.37	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3169
TX, 1988 (Dekalb 689)	1.1	2.4	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3170
TX, 1988 (Dekalb 689)	1.1	1.5	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3171
TX, 1988 (Dekalb 689)	1.1	1.5	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3512
MO, 1989 (Funks G-4500)	1.1	0.60	6	<0.05	<0.05	<0.10	MP-CN-3524
GA, 1988 (Cargill Hybrid)	1.1	2.0	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7042
IL, 1988 (F/S 2368A)	1.1	0.69	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7043
MN, 1988 (Pioneer 3732)	1.1	0.48	6	0.09, 0.06	<0.05 (2)	<0.10 (2)	MP-CN-7044
VA, 1988 (SX383)	1.1	0.51	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7045
NE, 1988 (Funk's G-4440)	1.1	0.60	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7046
OH, 1988 (Pioneer 3324)	1.1	1.1	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7047
OH, 1988 (Pioneer 3324)	1.1	2.4	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-7048

a aerial application

Table 34. Residues of parathion-methyl and metabolites in rice from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

Country, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (L202)	0.89	1.2	a 6	15	<u>2.3</u>, <u>2.2</u>	0.17, 0.16	0.96, 0.96	MP-RI-3131
TX, 1988 (Lemont)	0.89	1.9	a 6	15	<u>0.18</u>, <u>0.19</u>	0.08, 0.09	0.32, 0.32	MP-RI-3132
CA, 1988 (M201)	0.88	0.47	6	16	<u>1.9</u>, <u>2.0</u>	0.10, 0.10	0.55, 0.56	MP-RI-3514
CA, 1988 (M201)	4.4	2.4	6	16	14	0.63	3.9	MP-RI-3514
TX, 1988 (Gulfmont)	0.88	0.53	6	15	<u>0.36</u>, <u>0.44</u>	0.18. 0.23	0.25, 0.27	MP-RI-3515
TX, 1988 (Gulfmont)	4.4	2.6	6	15	1.9	0.67	2.1	MP-RI-3515
AR, 1988 (V7817)	0.89	1.9	a 6	15	<u>0.27</u>, <u>0.25</u>	0.17, 0.15	0.52, 0.38	MP-RI-7109
LO, 1988 (Lemont)	0.89	0.95	a 6	15	<u>0.30</u>, <u>0.28</u>	0.12, 0.12	0.20, 0.18	MP-RI-7110

a aerial application

Table 35. Residues of parathion-methyl and metabolites in sorghum from foliar application of parathion-methyl in supervised trials in the USA. All EC applications. All 21 days PHI.

Country, year (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
TX, 1988 (TEY 75)	1.1	0.74	6	0.16, 1.0	<0.05, 0.07	0.05, 0.36	MP-SG-3173
TX, 1988 (Asgrow Topaz)	1.1	2.4	6	0.20, 0.36	<0.05 (2)	0.29, 0.47	MP-SG-3174
TX, 1988 (Asgrow Topaz)	1.1	12	a 6	0.08, 0.09	<0.05 (2)	0.24, 0.24	MP-SG-3175
MO, 1988 (Funk's G-623GBR)	1.1	0.56	6	0.22, 0.27	<0.05 (2)	0.22, 0.28	MP-SG-7111
MO, 1988 (Funk's G-623GBR)	1.1	5.1	a 6	0.19, 0.09	<0.05 (2)	0.15, 0.09	MP-SG-7112
NE, 1988 (NC + 271)	1.1	0.60	6	0.40, 0.36	<0.05 (2)	0.08, 0.07	MP-SG-7113

a aerial application

Table 36. Residues of parathion-methyl and metabolites in wheat and processed commodities from foliar EC applications of parathion-methyl in supervised trials in the USA and Hungary. Bait applications to barley and wheat in Germany are also included. Underlined residues are from treatments according to GAP.

CROP Country, year (Variety)	Application				PHI, days	Residues, mg/kg			Ref.
	Form	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
BARLEY									
Germany, 1973 (Dura)	Bait	0.18		1	116	<0.01			261/73
WHEAT									
Germany, 1973 (Diplomat)	Bait	0.18		1	124	<0.01			263/73
Germany, 1973 (Diplomat)	Bait	0.18		1	125	<0.01			265/75
Hungary, 1991		0.35	0.14	1	31	<0.02 (2)			
USA (MO, 1988 (Caldwell)	EC	1.4	0.53	6	13	0.78	<0.05	0.38	MP-WH-2103
USA (MO, 1988 (Caldwell)	EC	7.0	2.7	6	13	6.2 b 15 f 2.6, 1.5 m 4.4 rd 5.5 rh 11 s&g 20	0.13 b 0.19 f 0.05, 0.09 m 0.08 rd 0.10 rh 0.28 s&g 0.29	2.1 b 3.7 f 0.44, 0.64 m 1.2 rd 1.6 rh 2.9 s&g 3.8	MP-WH-2103
USA (CA), 1988 (Anza)	EC	4×1.4+2 ×0.84	4×0.75+ 2×0.45	6	14	3.2, 3.7	0.36, 0.39	0.68, 0.85	MP-WH-3157
USA (CA, 1988 (Anza)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.75+ 3×0.45+ 1×0.15	6	0	4.4, 3.5	0.17, 0.17	0.34, 0.28	MP-WH-3157
USA (CA), 1988 (Anza)	EC	1.4	0.75	6	14	4.5, 5.1	0.45, 0.49	0.87, 0.82	MP-WH-3157
USA (WA), 1989 (Rojo)	EC	1.4	0.75	6	14	0.82, 1.1	<0.05 (2)	0.29, 0.21	MP-WH-3159
USA (WA), 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×0.75+ 2×0.45	6	14	1.1, 1.0	0.09, 0.08	0.14, 0.25	MP-WH-3159
USA (WA), 1989 (Rojo)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.75+ 3×0.45+ 1×0.15	6	0	1.1, 1.1	<0.05 (2)	0.11, 0.13	MP-WH-3159
USA (TX), 1989 (NK-Pro 812)	EC	1.4	3.0	6	14	0.15, 0.13	<0.05 (2)	0.14, 0.14	MP-WH-3161
USA (TX), 1989 (NK-Pro 812)	EC	4×1.4+2 ×0.84	4×3.0+2 ×1.8	6	14	<0.05, 0.05	<0.05 (2)	0.05, 0.07	MP-WH-3161

CROP Country, year (Variety)	Application				PHI, days	Residues, mg/kg			Ref.
	Form	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
USA (TX), 1989 (NK-Pro 812)	EC	2×1.4+3 ×0.84+1 ×0.28	2×3.0+3 ×1.8+1× 0.60	6	0	0.07, 0.09	<0.05 (2)	0.06, 0.06	MP-WH-3161
USA (WA), 1989 (Rojo)	EC	1.4	1.5	a 6	14	0.33, 0.29	<0.05 (2)	0.14, 0.08	MP-WH-3181
USA (WA), 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	a 6	14	0.27, 0.48	<0.05, 0.05	0.20, 0.20	MP-WH-3181
USA (WA), 1989 (Rojo)	EC	2×1.4+3 ×0.84+1 ×0.28	2×1.5+3 ×0.90+1 ×0.30	a 6	0	0.28, 0.24	<0.05 (2)	0.06, 0.06	MP-WH-3181
USA (WA), 1989 (Rojo)	EC	1.4	0.75	6	14	0.88, 0.74	0.05, 0.05	0.17, 0.27	MP-WH-3520
USA (WA), 1989 (Rojo)	EC	7.0	3.7	6	14	9.8 b 19 f 2.8 m 4.9 rd 4.2 s&g 9.0	0.15 b 0.26 f 0.09 m 0.12 rd 0.14 s&g 0.24	1.1 b 2.9 f 0.89 m 1.0 rd 0.96 s&g 1.9	MP-WH-3520
USA (OH), 1988 (Becher)	EC	1.4	0.72	6	14	0.35, 0.32	<0.05 (2)	0.05, 0.18	MP-WH-7134
USA (OH), 1988 (Becher)	EC	4×1.4+2 ×0.84	4×0.72+ 2×0.44	6	14	0.29, 0.27	<0.05 (2)	0.09, 0.08	MP-WH-7134
USA (OH), 1988 (Becher)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.72+ 3×0.44+ 1×0.15	6	0	0.65, 0.51	0.08, 0.06	0.21, 0.22	MP-WH-7134
USA (VA), 1988 (Coker 797)	EC	1.4	0.64	6	14	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-WH-7136
USA (VA), 1988 (Coker 797)	EC	4×1.4+2 ×0.84	4×0.64+ 2×0.39	6	14	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-WH-7136
USA (VA), 1988 (Coker 797)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.64+ 3×0.39+ 1×0.13	6	0	1.5, 1.5	<0.05 (2)	0.06, 0.05	MP-WH-7136
USA (ND), 1988 (Marshall)	EC	1.4	1.5	6	14	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-WH-7138
USA (ND), 1988 (Marshall)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	6	14	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-WH-7138
USA (ND), 1988 (Marshall)	EC	2×1.4+3 ×0.84+1 ×0.28	2×1.5+3 ×0.90 +1×0.30	6	0	0.49, 0.25	<0.05 (2)	<0.05 (2)	MP-WH-7138
USA (KS), 1989 (Arkan)	EC	1.4	0.68	6	14	1.2, 1.6	<0.05 (2)	0.33, 0.36	MP-WH-7140
USA (KS), 1989 (Arkan)	EC	4×1.4+2 ×0.84	4×0.68+ 2×0.41	6	14	1.1, 0.83	0.05, <0.05	0.39, 0.36	MP-WH-7140
USA (KS), 1989 (Arkan)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.68+ 3×0.41+ 1×0.14	6	0	0.73, 0.93	0.05, 0.05	0.18, 0.20	MP-WH-7140
USA (KS), 1989 (Caldwell)	EC	5×1.4+1 ×1.4	5×3.0+1 ×0.67	a 6	14	0.22, 0.21	<0.05 (2)	0.11, 0.09	MP-WH-7142
USA (KS), 1989 (Caldwell)	EC	4×1.4+1 ×0.84+1 ×0.84	4×3.0+1 ×1.8+1× 0.40	a 6	14	0.21, 0.08	<0.05 (2)	0.09, 0.10	MP-WH-7142
USA (KS), 1989 (Caldwell)	EC	2×1.4+3 ×0.84+1 ×0.28	2×3.0+3 ×1.8+1× 0.13	a 6	0	1.4, 0.98	0.34, 0.28	0.38, 0.34	MP-WH-7142

a aerial application. b bran. f flour. rh rough (grain dust). m middlings (smaller sieving fraction than bran).
rd red dog (by-product of milling reduction to produce flour, ~1.5-2% of grain). s&g shorts (milled fraction of the middlings retained on the larger sieves) and germ.

Table 37. Residues of parathion-methyl and metabolites in cotton seed from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

Country, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (GC510)	8×3.4 +2×1.1	8×1.8 +2×0.60	10	0	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-CS-3052
CA, 1988 (GC510)	3.4	1.8	10	7	<ins><0.05</ins> (2)	<0.05 (2)	<0.05 (2)	MP-CS-3052
CA, 1988 (GC510)	8×3.4 +2×1.1	8×3.6 +2×1.2	a 10	0	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-CS-3054
CA, 1988 (GC510)	3.4	3.6	a 10	7	<ins><0.05</ins> (2)	<0.05 (2)	<0.05 (2)	MP-CS-3054
TX, 1988 (DPL41)	8×3.4 +2×1.1	8×3.6 +2×1.2	10	0	3.1, 4.5	0.11, 0.14	0.57, 0.81	MP-CS-3055
TX, 1988 (DPL41)	3.4	3.6	10	7	<ins>0.91</ins>, <ins>1.4</ins>	<0.05 (2)	0.44, 0.70	MP-CS-3055
TX, 1988 (DLP41)	8×3.4 +2×1.1	8×3.6 +2×1.2	a 10	0	2.2, 2.0	<0.05 (2)	0.50, 0.36	MP-CS-3057
TX, 1988 (DLP41)	3.4	3.6	a 10	7	<ins>1.2</ins>, <ins>0.90</ins>	<0.05 (2)	0.44, 0.35	MP-CS-3057

a aerial application

Table 38. Residues of parathion-methyl and metabolites in sunflower seed (Sigco Hybrid 465A) from foliar application of parathion-methyl in supervised trials in North Dakota, USA, 1988.. Underlined residues are from treatments according to GAP. All EC applications.

Application			PHI, days	Residues, mg/kg			Ref.
kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
1.1	0.60	3	30	<ins><0.05</ins> (4)	<0.05 (4)	<0.05 (4)	MP-SS-7128
1.1	3.0	a 3	30	<ins><0.05</ins> (2)	<0.05 (2)	<0.05 (2)	MP-SS-7129

a aerial application

Residues were measured in green and dry hops after parathion-methyl was applied as a foliar spray to hops in three States in trials in the USA (Cone *et al.*, 1992). Data are summarized in Table 39. Analytical recoveries for parathion-methyl (range 51-100%) and paraoxon-methyl (range 53-127%) were rather variable.

Table 39. Residues of parathion-methyl and paraoxon-methyl in hops from foliar application of parathion-methyl in supervised trials in the USA in 1990 (Cone *et al*., 1992). Underlined residues are from treatments according to GAP.

State	Application			PHI days	Residues, mg/kg		Ref
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	
WA	1.1		a 3	14	<0.02 g, <0.02 d	<0.05 g, <0.04 d	90:WA:015
WA	1.0	0.22	4	15	0.046 g, 0.99 d	0.067 g, 0.35 d	90:WA:015
WA	1.0	0.072	4	15	0.15 g, 0.36 d	0.044 g, 0.13 d	90:WA:015
WA	2.0	0.43	4	15	0.96 g, 2.7 d	0.21 g, 0.90 d	90:WA:015
WA	2.0	0.14	4	15	0.35 g, 1.2 d	0.11 g, 0.41 d	90:WA:015
OR	1.0	0.22	3	15	0.096 g, 0.49 d	<0.04 g, 0.17 d	90:OR:017
OR	1.0	0.072	3	15	0.12 g, 0.42 d	0.036 g, 0.16 d	90:OR:017
OR	2.0	0.43	3	15	0.39 g, 0.87 d	0.11 g, 0.32 d	90:OR:017
OR	2.0	0.14	3	15	0.28 g, 0.78 d	0.12 g, 0.29 d	90:OR:017
ID	1.0	0.22	3	15	0.18 g, 0.23 d	0.10 g, 0.18 d	90:ID:005
ID	1.0	0.072	3	15	0.18 g, 0.41 d	0.15 g, 0.19 d	90:ID:005
ID	2.0	0.43	3	15	0.17 g, 0.27 d	0.058 g, 0.23 d	90:ID:005
ID	2.0	0.14	3	15	0.25 g, 0.37 d	0.090 g, 0.25 d	90:ID:005

a aerial application, g green hops, d dry hops.

Table 40. Residues of parathion-methyl and metabolites in alfalfa seed from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC formulations.

Year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (Cuff-101)	1.4	0.37	2	83	<0.05 (2)	<0.05 (2)	0.08, <0.05	MP-AF-3001
CA, 1988 (Cuff-101)	1.4	0.75	a 1	85	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-AF-3003
WA, 1988 (La Rocca)	1.4	0.58	2	92	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-AF-3004
WA, 1988 (La Rocca)	1.4	1.0	a 2	92	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-AF-3006

Table 41. Residues of parathion-methyl and metabolites in clover forage from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications.

State, year (Variety)	Application	PHI, days	Residues, mg/kg	Ref.

	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1989	1.1	0.60	2	0 7 15 20 25	19, 30 0.19, 0.38 <0.05 (2) <0.05 (2) <0.05 (2)	0.08, 0.12 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.4, 2.0 1.6, 2.9 0.28, 0.24 0.17, 0.25 0.21, 0.11 c 0.59, 0.71 c 0.09, 0.09 c 0.06	MP-CL-3036
CA, 1989	1.4	0.75	2	0 7 15 20 25	39, 45 0.58, 0.49 0.06, 0.06 <0.05 (2) <0.05 (2)	0.24, 0.23 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.9, 1.6 3.2, 2.3 0.67, 0.49 0.38, 0.40 0.10, 0.10	MP-CL-3036
CA, 1989	1.1	0.60	a 2	0 7 15 20 25	46, 42 2.5, 3.4 0.19, 0.11 <0.05 (2) <0.05 (2)	0.33, 0.31 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.9, 2.3 2.8, 3.4 0.86, 0.54 0.27, 0.23 0.15, 0.11 c 0.16, 0.08	MP-CL-3038
CA, 1989	1.4	0.75	a 2	0 7 15 20 25	71, 67 4.8, 5.1 0.26, 0.30 0.07, <0.05 <0.05 (2)	0.56, 0.49 0.06, 0.06 <0.05 (2) <0.05 (2) <0.05 (2)	2.8, 2.5 3.9, 5.0 1.3, 1.3 0.53, 0.41 0.11, 0.11	MP-CL-3038
ID, 1988 (Arlington Red)	1.1	1.2	2	0 7 15 21 25	60, 28 0.55, 0.94 0.13, 0.07 <0.05 (2) <0.05 (2)	0.42, 0.18 0.06, 0.08 <0.05 (2) <0.05 (2) <0.05 (2)	5.7, 2.6 3.0, 0.77 0.69, 1.3 0.43, 0.38 0.31, 0.24 c 0.07, 0.09 c 0.09	MP-CL-3041
ID, 1988 (Arlington Red)	1.4	1.5	2	0 7 15 21 25	44, 35 0.61, 0.51 0.09, 0.16 0.07, <0.05 <0.05 (2)	0.18, 0.17 0.09, 0.09 <0.05 (2) <0.05 (2) <0.05 (2)	2.6, 2.4 2.3, 2.7 0.31, 0.76 0.74, 0.67 0.48, 0.36	MP-CL-3041
ID, 1988 (Arlington Red)	1.1	1.2	a 2	0 7 15 21 25	18, 4.1 0.05, 0.07 <0.05 (2) <0.05 (2) <0.05 (2)	0.12, <0.05 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.4, 0.59 1.2, 1.1 0.36, 0.43 0.12, 0.27 0.11, 0.13	MP-CL-3180
ID, 1988 (Arlington Red)	1.4	1.5	a 2	0 7	15, 14 0.08, 0.45	0.12, 0.12 <0.05 (2)	1.6, 1.3 1.1, 1.8	MP-CL-3180
MN, 1988 (Mammoth)	1.1	0.60	2	0 7 15 20 25	54, 49 9.9, 9.6 6.1, 6.5 2.4, 3.0 1.4, 0.86	0.36, 0.34 0.09, 0.07 <0.05 (2) <0.05 (2) <0.05 (2)	4.0, 4.3 4.1, 3.7 2.6, 2.7 1.2, 1.7 0.69, 0.48 c 0.28, 1.3	MP-CL-7036
MN, 1988 (Mammoth)	1.4	0.75	2	0 7 15 20 25	51, 46 13, 15 8.2, 8.1 3.6, 3.7 1.8, 1.3	0.30, 0.25 0.09, 0.10 0.06, 0.05 <0.05 (2) <0.05 (2)	4.5, 3.0 4.4, 5.3 3.7, 3.2 1.9, 2.1 1.0, 0.89	MP-CL-7036
NY, 1988	1.1	0.43	2	0 7 15 20 26	3.6, 3.5 0.62, 0.53 0.23, 0.18 0.08, 0.12 0.14, 0.13	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.1, 1.1 0.54, 0.52 0.52, 0.32 0.88, 0.67 0.33, 0.40 c 0.07	MP-CL-7038

State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
NY, 1988	1.4	0.53	2	0 7 15 20 26	7.8, 6.6 0.61, 0.63 0.31, 0.24 0.20, 0.24 0.13, 0.11	0.05, 0.05 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	2.3, 1.9 1.0, 0.91 0.61, 0.52 0.72, 0.67 0.31, 0.33	MP-CL-7038
WI, 1988 (Medium Red)	1.1	0.47	2	0 7 15 20 25	47, 53 7.2, 6.2 2.5, 2.8 1.4, 1.4 0.51, 0.74	0.21, 0.19 0.09, 0.06 <0.05 (2) <0.05 (2) <0.05 (2)	2.1, 2.9 4.3, 4.7 3.9, 3.1 3.6, 3.3 1.1, 1.8 c 0.17, 0.13 c 0.15, 0.39	MP-CL-7040
WI, 1988 (Medium Red)	1.4	0.59	2	0 7 15 20 25	69, 60 8.9, 9.1 2.2, 2.5 1.6, 1.3 0.32, 0.33	0.33, 0.26 0.11, 0.11 <0.05, 0.05 <0.05 (2) <0.05 (2)	-, 2.1 6.2, 9.0 4.2, 3.6 3.3, 3.3 0.69, 1.3	MP-CL-7040

a aerial application, c control sample

Table 42. Residues of parathion-methyl and metabolites in bean forage from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications at 1.7 kg ai/ha.

State, year (Variety)	Application kg ai/hl	Application No.	PHI, days	Residues, mg/kg Parathion-methyl	Residues, mg/kg Paraoxon-methyl	Residues, mg/kg Nitrophenol	Ref.
CA, 1988 (Baby White)	0.49	6	0	48, 50	0.59, 0.73	5.6, 4.6	MP-DB-3072
			7	2.2, 2.7	0.16, 0.08	4.2, 2.4	
			15	0.88, 0.82	0.07, <0.05	4.3, 5.3	
			21	0.66, 0.62	<0.05 (2)	4.1, 2.6	
			28	0.47, 0.38	<0.05 (2)	2.1, 1.5	
CA, 1988 (Red Kidney)	1.8	a 6	0	14, 9.3	0.41, 0.37	1.9, 1.2	MP-DB-3074
			7	0.55, 0.46	0.12, 0.08	1.3, 1.5	
			15	0.18, 0.14	<0.05 (2)	0.28, 0.76	
			21	0.06, 0.11	<0.05 (2)	0.45, 0.69	
			28	0.07, 0.09	<0.05 (2)	0.42, 0.57	
MI, 1988 (Seafarer Navy Bean)	0.78	6	0	11, 15	0.27, 0.34	2.9, 2.4	MP-DB-7001
			7	0.20, 0.33	<0.05 (2)	1.0, 1.3	
			15	<0.05, 0.14	<0.05 (2)	2.1, 1.7	
			21	0.10, 0.07	<0.05 (2)	2.0, 1.8	
			28	0.08, 0.07	<0.05 (2)	1.9, 6.7	
NB, 1988 (Pinto)	0.90	6	0	50, 47	0.27, 0.23	6.2, 5.0	MP-DB-7003
			7	0.69, 0.12	<0.05 (2)	4.7, 4.2	
			15	<0.05 (2)	<0.05 (2)	2.5, 3.4	
			21	<0.05 (2)	<0.05 (2)	2.5, 3.2	
			28	<0.05 (2)	<0.05 (2)	1.7, 1.2	
NB, 1988 (Pinto)	18	a 6	0	25, 18	0.13, 0.16	3.1, 5.3	MP-DB-7005
			7	0.61, 0.49	<0.05 (2)	5.4, 4.9	
			15	0.06, 0.08	<0.05 (2)	1.3, 1.9	
			21	<0.05 (2)	<0.05 (2)	1.8, 1.5	
			28	<0.05 (2)	<0.05 (2)	0.68, 1.2	
ND, 1988 (Topaz, Pinto)	1.8	6	0	32, 19	1.7, 0.48	1.2, 4.0	MP-DB-7006
			7	1.0, 3.0	0.06, 0.17	1.0, 2.1	
			15	0.75, 1.1	<0.05, 0.06	1.4, 1.3	
			21	0.31, 0.17	<0.05 (2)	0.69, 0.69	
			28	0.21, 0.13	<0.05 (2)	1.3, 0.80	

a aerial application

Table 43. Residues of parathion-methyl and metabolites in bean hay from foliar application of parathion-methyl in supervised trials in 1988 in the USA. Underlined residues are from treatments according to GAP. All EC applications. All 15 days PHI.

Country, year (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA (Baby White)	1.7	0.49	6	0.93, 0.94	0.06, 0.13	3.5, 4.9	MP-DB-3072
CA (Red Kidney)	1.7	1.8	a 6	3.5, 3.0	0.35, 0.30	0.33, 3.9	MP-DB-3074
MI (Seafarer Navy Bean)	1.7	0.78	6	0.25, 0.22	<0.05 (2)	1.3, 0.68	MP-DB-7001
NB (Pinto)	1.7	0.90	6	<0.05 (2)	<0.05, 0.07	5.2, 7.4	MP-DB-7003
NB (Pinto)	1.7	18	a 6	0.06, <0.05	<0.05 (2)	0.73, 5.3	MP-DB-7005
ND (Topaz, Pinto)	1.7	1.8	6	1.2, 1.4	0.05, 0.12	2.3, 2.4	MP-DB-7006

a aerial application

Table 44. Residues of parathion-methyl and metabolites in pea forage, vines and straw from foliar application of parathion-methyl in supervised trials in 1988 in the USA and in 1991 in Hungary. Underlined residues are from treatments according to GAP. All EC applications.

CROP Country or State, (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
PEAS, DRIED _ FORAGE								
DE (Alaska)	5×1.1 +1×0.56	5×0.38 +1×0.19	6	0 5 10 15 20 25	19, 24 6.6, 7.1 2.2, 2.0 3.6, 4.2 4.2, 2.1 3.2, 3.9	0.06, 0.07 0.07, 0.07 <0.05 (2) 0.06, 0.05 0.06, <0.05 0.05, 0.07	1.4, 1.4 0.07, 0.09 0.17, 0.16 0.56, 0.41 0.81, 0.90 0.94, 0.94	MP-PE-7089
DE (Alaska)	1.1	0.38	6	0 5 10 15 20 25	46, 41 11, 15 4.8, 4.8 7.6, 6.6 6.3, 6.0 5.5, 7.6	0.22, 0.17 0.09, 0.13 <0.05 (2) 0.09, 0.10 0.11, 0.10 0.09, 0.11	2.1, 2.1 0.14, 3.1 0.16, 0.19 1.8, 1.7 1.3, 1.1 1.7, 2.0	MP-PE-7089
MN (Alaska 146)	3×1.1 +1×0.56	3×0.60 +1×0.30	4	0 5 10 15 20 25	11, 14 0.69, 0.59 0.35, 0.30 0.37, 0.18 0.16, 0.17 0.33, 0.17	0.12, 0.09 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	2.1, 2.0 0.78, 0.16 0.42, 0.62 0.50, 0.49 0.34, 0.34 0.53, 0.35	MP-PE-7091
MN (Alaska 146)	1.1	0.60	4	0 5 10 15 20 25	17, 18 1.0, 1.0 0.35, 0.42 0.27, 0.27 0.34, 0.12 0.26, 0.35	0.12, 0.15 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.90, 0.80 1.0, 1.8 0.74, 0.61 0.52, 0.47 0.59, 0.28 0.48, 0.62	MP-PE-7091
ND (Trapper)	5×1.1 +1×0.56	5×1.2 +1×0.60	6	0 5 10 15 20 26	12, 8.8 4.7, 5.8 4.3, 4.7 3.2, 5.2 2.6, 3.2 0.47, 0.30	0.24, 0.21 0.17, 0.14 0.10, 0.11 0.09, 0.09 0.06, 0.06 <0.05 (2)	4.3, 3.5 3.8, 3.5 3.9, 4.6 4.2, 5.9 2.9, 3.9 0.22, 0.21	MP-PE-7093

CROP Country or State, (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
ND (Trapper)	1.1	1.2	6	0 5 10 15 20 26	23, 22 14, 8.1 8.5, 10 7.7, 9.5 5.5, 4.6 0.53, 0.82	0.39, 0.33 0.30, 0.24 0.15, 0.29 0.16, 0.21 0.10, 0.11 <0.05 (2)	4.6, 3.7 6.0, 4.1 4.5, 7.4 7.8, 9.2 5.7, 4.9 0.19, 0.29	MP-PE-7093
DE (Alaska)	1.1	2.4	a 6	0 5 10 15 20 25	5.4, <0.05 0.23, <0.05 0.58, 0.41 0.25, 0.26 0.20, 0.43 1.0, 0.25	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.7, <0.05 0.58, <0.05 0.39, 0.07 0.17, 0.05 0.16, 0.10 0.21, 0.14	MP-PE-7095
DE (Alaska)	5×1.1 +1×0.56	5×2.4 +1×1.2	a 6	0 5 10 15 20 25	53, 46 52, 58 15, 18 36, 58 13, 14 6.8, 6.2	0.17, 0.18 0.30, 0.35 0.18, 0.18 0.43, 0.52 0.08, 0.12 <0.05 (2)	4.1, 3.7 4.9, 5.5 2.2, 2.6 4.7, 7.0 2.6, 2.7 1.5, 1.8	MP-PE-7095
DE (Alaska)					3.1, <0.05 0.37, <0.05 0.48, <0.05 0.20, <0.05 0.20, <0.05 0.19, <0.05	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.1, 0.11 0.77, 0.07 0.39, 0.07 0.15, 0.17 0.14, 0.16 0.13, 0.19	MP-PE-7095
PEAS, SUCCULENT _ FORAGE								
Hungary	0.35	0.14	1	0 1 2 3 5 7 10 14	7.9, 7.7, 7.7 3.3, 3.2, 3.2 1.8, 1.6, 1.6 1.4, 1.1, 1.3 0.9, 0.85, 0.8 0.55, 0.3, 0.3 0.11, 0.08, 0.1 <0.02 (3)			
DE (Wando)	5×1.1 +1×0.56	5×0.38 +1×0.19	6	0 5 10 15 20 25	10, 13 5.4, 3.8 1.4, 1.5 2.9, 2.4 4.4, 3.4 4.9, 3.0	<0.05, 0.05 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.6, 1.6 2.6, 2.4 1.1, 3.0 2.0, 1.6 2.5, 2.5 2.7, 2.6	MP-PE-7096
DE (Wando)	1.1	0.38	6	0 5 10 15 20 25	25, 26 12, 7.9 3.3, 3.1 4.4, 2.5 4.2, 4.0 7.3, 8.2	0.12, 0.08 0.07, 0.06 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	2.2, 1.7 6.5, 3.1 3.6, 2.5 3.4, 2.0 2.3, 2.0 3.1, 4.1	MP-PE-7096
MN (Asgrow XPG 206)	3×1.1 +1×0.56	3×0.60 +1×0.30	4	0 5 10 15 20 25	2.1, 2.4 0.07, 0.20 <0.05, 0.06 0.15, 0.10 0.08, 0.11 0.07, 0.08	0.05, 0.08 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.3, 0.97 0.93, 1.2 0.61, 0.96 0.70, 0.66 0.47, 0.41 0.27, 0.26	MP-PE-7098
MN (Asgrow XPG 206)	1.1	0.60	4	0 5 10 15	4.2, 4.6 0.07, 0.11 <0.05, 0.06 <0.05 (2)	0.11, 0.09 <0.05 (2) <0.05 (2) <0.05 (2)	1.1, 1.2 0.57, 0.96 0.32, 0.72 0.50, 0.56	MP-PE-7098

CROP Country or State, (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
				20 25	0.08, 0.06 0.05, <0.05	<0.05 (2) <0.05 (2)	0.76, 0.53 0.24, 0.20	
WI (Ego)	4×1.1 +1×0.56	4×0.56 +1×0.23	5	0 5 9 14 19 24	6.0, 5.0 <0.05, 0.06 0.06, <0.05 0.08, 0.05 <0.05 (2) <0.05 (2)	0.08, 0.07 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.78, 0.76 0.38, 0.32 0.29, 0.20 0.28, 0.22 0.18, 0.16 0.11, 0.11	MP-PE-7100
WI (Ego)	1.1	0.47	5	0 5 9 14 19 24	21, 20 0.14, 0.24 0.08, 0.12 0.13, 0.13 0.06, 0.08 0.09, 0.07	0.20, 0.18 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.5, 1.5 0.85, 0.69 0.34, 0.43 0.41, 0.32 0.35, 0.30 0.28, 0.22	MP-PE-7100
WI (9888F)	4×1.1 +1×0.56	4×2.9 +1×1.5	a 5	0 6 10 15 20 25	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.4, 1.5 0.21, 0.23 0.10, 0.18 0.17, 0.13 0.22, 0.18 0.05, <0.05	MP-PE-7102
WI (9888F)	1.1	2.9	a 5	0 6 10 15 20 25	<0.05, 0.13 <0.05 (2) <0.05 (2) <0.05 (2) <0.05, 0.05 <0.05 (2)	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.9, 1.6 0.19, 0.12 0.08, 0.11 0.13, 0.07 0.08, 0.28 0.05, <0.05	MP-PE-7102
PEAS, STRAW								
DE (Alaska)	5×1.1 +1×0.56	5×0.38 +1×0.19	6	10	2.1, 2.6	<0.05 (2)	0.36, 0.45	MP-PE-7089
DE (Alaska)	1.1	0.38	6	15	13, 11	0.12, 0.07	1.9, 1.6	MP-PE-7089
MN (Alaska 146)	3×1.1 +1×0.56	3×0.60 +1×0.30	4	10	1.1, 1.1	<0.05 (2)	1.2, 1.2	MP-PE-7091
MN (Alaska 146)	1.1	0.60	4	15	0.71, 0.67	<0.05 (2)	1.3, 1.0	MP-PE-7091
ND (Trapper)	5×1.1 +1×0.56	5×1.2 +1×0.60	6	10	3.1, 2.7	0.08, 0.07	2.8, 2.6	MP-PE-7093
ND (Trapper)	1.1	1.2	6	15	3.1, 3.5 c 0.25	0.06, 0.06 c <0.05	3.3, 3.4 c 0.62	MP-PE-7093
DE (Alaska)	1.1	2.4	a 6	10 15	0.80, 1.7 0.48, 0.43	<0.05 (2) <0.05 (2)	0.33, 0.27 0.19, 0.16	MP-PE-7095
DE (Alaska)	5×1.1 +1×0.56	5×2.4 +1×1.2	a 6	10	19, 27	0.17, 0.19	1.9, 2.4	MP-PE-7095
DE (Alaska)					0.90, 0.38 0.33	<0.05 (2) <0.05	0.41, 0.07 0.18	MP-PE-7095
PEAS, VINES								
DE (Wando)	5×1.1 +1×0.56	5×0.38 +1×0.19	6	10	1.6, 1.1	<0.05 (2)	1.5,1.8	MP-PE-7096
DE (Wando)	1.1	0.38	6	15	7.3, 6.8	<0.05 (2)	2.5, 1.6	MP-PE-7096
MN (Asgrow XPG 206)	3×1.1 +1×0.56	3×0.60 +1×0.30	4	10	0.13, 0.23	<0.05 (2)	1.4, 2.3	MP-PE-7098
MN (Asgrow XPG 206)	1.1	0.60	4	10	0.20, 0.15	<0.05 (2)	1.5,1.5	MP-PE-7098

CROP Country or State, (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
WI (Ego)	4×1.1 +1×0.56	4×0.56 +1×0.23	5	9	0.08, <0.05	<0.05 (2)	0.46, 0.36	MP-PE-7100
WI (Ego)	1.1	0.47	5	14	0.15, 0.17	<0.05 (2)	0.60, 0.55	MP-PE-7100
WI (9888F)	4×1.1 +1×0.56	4×2.9 +1×1.5	a 5	10	<0.05 (2)	<0.05 (2)	0.18, 0.22	MP-PE-7102
WI (9888F)	1.1	2.9	a 5	15	<0.05 (2)	<0.05 (2)	0.22, 0.31	MP-PE-7102

a aerial application, c control sample

Table 45. Residues of parathion-methyl and metabolites in maize fodder from foliar application of parathion-methyl in supervised trials in the USA. All EC applications. All 12 days PHI.

State, year (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1989	1.1	0.37	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-CN-3169
TX, 1988 (Dekalb 689)	1.1	2.4	a 6	0.96, 0.79	<0.05 (2)	0.40, 1.4	MP-CN-3170
TX, 1988 (Dekalb 689)	1.1	1.5	6	0.23, 0.28	<0.05 (2)	0.31, 0.25	MP-CN-3171
GA, 1988 (Cargill Hybrid)	1.1	2.0	6	1.2, 1.1	<0.05 (2)	0.83, 0.83	MP-CN-7042
IL, 1988 (F/S 2368A)	1.1	0.69	6	0.10, 0.07	<0.05 (2)	0.47, 0.35	MP-CN-7043
MN, 1988 (Pioneer 3732)	1.1	0.48	6	2.5, 5.5	0.08, 0.12	0.36, 1.2	MP-CN-7044
VA, 1988 (SX383)	1.1	0.51	6	<0.05 (2)	<0.05 (2)	<0.10, 0.13	MP-CN-7045
NE, 1988 (Funk's G-4440)	1.1	0.60	6	2.6, 4.5	0.49, 0.42	0.28, 0.35	MP-CN-7046
OH, 1988 (Pioneer 3324)	1.1	1.1	6	4.8, 20	0.13, 0.41	2.0, 5.4	MP-CN-7047
OH, 1988 (Pioneer 3324)	1.1	2.4	a 6	5.9, 3.3	0.21, <0.05	2.3, 0.92	MP-CN-7048

a aerial application

Table 46. Residues of parathion-methyl and metabolites in maize forage and silage from foliar application of parathion-methyl in supervised trials in the USA. All EC applications.

CROP State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
MAIZE FORAGE								
CA, 1989 (Pioneer 3780)	1.1	0.37	6	0 6 12 18 24	0.06, 0.07 <0.05 (2) <0.05 (2) 0.10, 0.55 <0.05 (2)	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.27, 0.49 0.18, 0.26 0.10, <0.10 <0.10 (2) <0.10 (2)	MP-CN-3043
TX, 1988 (Douglas-King DK4161)	1.1	2.4	6	0 6 12 18 24	25, 13 0.46, 0.14 0.68, 0.58 0.12, 0.08 <0.05 (2)	0.43, 0.22 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.9, 1.8 1.4, 0.66 0.63, 0.26 <0.10 (2) <0.10 (2)	MP-CN-3045
TX, 1988 (DK4161)	1.1	12	a 6	0 6	5.2, 5.12 0.32, 0.75	0.09, 0.10 <0.05 (2)	0.80, 0.56 0.39, 0.54	MP-CN-3183

CROP State, year (Variety)	Application			PHI, days	Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
				12 18 24	0.13, <0.05 0.13, 0.09 0.17, 0.14	<0.05 (2) <0.05 (2) <0.05 (2)	0.57, <0.10 <0.10 (2) 0.98, <0.10	
GA, 1988 (Cargill Hybrid)	1.1	2.0	6	0 6 12 18 24	91, 94 0.16, 2.5 0.05, <0.05 0.65, <0.05 <0.05 (2)	0.44, 0.57 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.5, 2.7 0.27, 0.50 0.41, <0.10 0.11, <0.10 <0.10, 0.34	MP-CN-7049
IL, 1988 (F/S 2368A)	1.1	0.69	6	0 6 12 18 24	19, 21 0.27, 0.22 <0.05 (2) <0.05 (2) <0.05 (2)	0.37, 0.49 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.4, 2.1 0.93, 0.75 0.19, 0.16 <0.10, 0.36 0.44, 0.18	MP-CN-7050
MN, 1988 (Pioneer 3732)	1.1	0.48	6	0 6 12 18 24	9.7, 8.8 0.84, 1.1 0.40, 0.24 0.40, 0.28 0.34, <0.05	3.5, 2.6 <0.05, 0.07 <0.05 (2) <0.05 (2) <0.05 (2)	0.75, 1.0 0.48, 0.64 0.40, 0.32 0.31, 0.26 0.60, <0.10	MP-CN-7051
VA, 1988 (SX383)	1.1	0.50	6	0 6 12 18 31	0.62, 0.54 0.12, 0.11 <0.05 (2) 0.07, <0.05 <0.05 (2)	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.26, 0.34 0.12, <0.10 <0.10 (2) <0.10 (2) 0.13, <0.10	MP-CN-7052
NE, 1988 ((Funk's G-444D)	1.1	0.60	6	0 6 12 18 24	9.9, 15 1.4, 0.98 55, 37 0.65, 0.19 0.22, 0.43	0.09, 0.06 <0.05 (2) 0.32, 0.11 <0.05 (2) <0.05 (2)	0.71, 1.4 0.61, 0.29 5.8, 0.13 4.2, 1.8 <0.10 (2)	MP-CN-7053
OH, 1988 (Pioneer 3324)	1.1	1.1	6	0 6 12 18 24	8.9, 9.2 0.25, 0.27 0.18, 0.16 0.18, 0.17 0.18, 0.20	0.17, 0.22 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	2.1, 1.6 0.45, 0.27 <0.10, 0.30 0.33, 0.31 0.20, 0.24	MP-CN-7054
OH, 1988 (Pioneer 3324)	1.1	2.4	a 6	0 6 12 18 24	2.0, 3.3 0.37, 0.46 0.06, <0.05 0.14, 0.11 0.12, 0.12	0.06, 0.08 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.16, 0.19 0.21, 0.40 0.11, 0.14 <0.10 (2) <0.10 (2)	MP-CN-7055
MAIZE SILAGE								
CA, 1989 (Pioneer 3780)	1.1	0.37	6	12	0.07, <0.05	<0.05 (2)	0.29, 0.22	MP-CN-3043
TX, 1988 (Douglas-King DK4161)	1.1	2.4	6	12	0.13, 0.54	<0.05 (2)	0.12, 0.61	MP-CN-3045
TX, 1988 (DK4161)	1.1	12	a 6	12	<0.05, 0.14	<0.05 (2)	0.21, 0.44	MP-CN-3183

a aerial application

Table 47. Residues of parathion-methyl and metabolites in sweet corn forage and fodder from foliar application of parathion-methyl in supervised trials in the USA. All EC applications.

CROP State, year (Variety)	Application	PHI, days	Residues, mg/kg	Ref.

	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
FODDER								
CA, 1989	1.1	0.37	6	3	0.15, 0.11	<0.05 (2)	0.33, 0.24	MP-CN-3047
CA, 1989 (Jubilee)	1.1	1.3	a 6	3	1.2, 0.38	0.06, <0.05	0.42, 0.18	MP-CN-3049
TX, 1988 (Funk's Sweet G-90)	1.1	12	a 6	3	0.84, 1.2	0.06, 0.11	0.44, 0.96	MP-CN-3050
WA, 1989 (Jubilee)	1.1	1.2	a 6	3	<0.05, 0.11	<0.05 (2)	0.51, 0.57	MP-CN-3185
FL, 1988 (Merit)	1.1	0.37	6	3	2.2, 1.2	0.08, 0.07	0.89, 2.9	MP-CN-7056
NY, 1988 (Jubilee)	1.1	2.5	6	3	0.55, 0.44	<0.05 (2)	<0.10, 1.7	MP-CN-7057
WI, 1988 (Commander)	1.1	3.0	a 6	3	2.0, 1.1	0.13, 0.10	1.5, 1.1	MP-CN-7058

FORAGE								
CA, 1989	1.1	0.37	6	0 6 12 18 24	0.13, 0.22 0.11, 0.10 0.06, <0.05 <0.05, 0.09 <0.05, 0.09	<0.05 (2) <0.05 (2) <0.05 (2) <0.05, 0.07 <0.05 (2)	0.63, 0.73 0.36, 0.39 0.34, 0.20 0.13, 0.22 0.17, 0.33	MP-CN-3047
CA, 1989 (Jubilee)	1.1	1.3	a 6	0 6 12 18 24	0.25, 0.21 1.1, 0.66 0.55, 0.58 0.18, 0.21 0.10, 0.11	<0.05 (2) 0.19, 0.36 0.18, <0.05 <0.05, 0.09 <0.05 (2)	0.16, 0.11 1.0, 0.49 0.56, 0.53 0.25, 0.20 0.10, 0.16	MP-CN-3049
TX, 1988 (Funk's Sweet G-90)	1.1	12	a 6	0 6 12 18 24	9.4, 3.2 1.1, 1.4 0.19, 0.32 <0.05 (2) 0.08, 0.12	0.25, 0.06 0.08, 0.09 <0.05 (2) <0.05 (2) <0.05 (2)	2.5, 1.2 1.2, 1.1 0.40, 0.12 0.27, 0.12 <0.10, 0.12	MP-CN-3050
WA, 1989 (Jubilee)	1.1	1.2	a 6	0 6 12 18 24	<0.05 (2) 0.13, <0.05 <0.05 (2) <0.05 (2) <0.05 (2)	<0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.30, 0.13 0.36, 0.40 0.39, 0.10 0.16, <0.10 <0.10 (2)	MP-CN-3185
FL, 1988 (Merit)	1.1	0.37	6	0 6 12 18 24	18, 17 0.96, 1.0 0.26, 0.39 0.32, 0.25 0.10, 0.08	0.20, 0.27 0.18, 0.13 <0.05 (2) <0.05 (2) <0.05 (2)	4.9, 5.6 4.8, 7.3 2.6, 1.8 2.2, 2.2 0.46, 0.34	MP-CN-7056
NY, 1988 (Jubilee)	1.1	2.5	6	0 6 12 18 24	3.6, 2.3 0.16, 0.05 <0.05 (2) <0.05 (2) <0.05 (2)	0.09, 0.07 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.40, 0.22 0.36, 0.19 <0.10 (2) <0.10 (2) 0.11, 0.11	MP-CN-7057
WI, 1988 (Commander)	1.1	3.0	a 6	0 6 12 18 24	18, 18 0.56, 0.56 0.29, 0.23 0.14, 0.17 <0.05 (2)	0.39, 0.42 0.13, 0.17 <0.05 (2) <0.05 (2) <0.05 (2)	1.9, 2.0 0.93, 0.82 0.83, 1.2 0.18, 0.23 0.52, 0.77	MP-CN-7058

a aerial application

Table 48. Residues of parathion-methyl and metabolites in rice straw from foliar application of parathion-methyl in supervised trials in the USA. Underlined residues are from treatments according to GAP. All EC applications. All 15 days PHI.

CROP Country, year (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA, 1988 (L202)	0.89	1.2	a 6	7.5, 7.3	0.15, 0.11	4.9, 4.5	MP-RI-3131
TX, 1988 (Lemont)	0.89	1.9	a 6	<0.05 (2)	<0.05 (2)	1.2, 1.2	MP-RI-3132
AR, 1988 (V7817)	0.89	1.9	a 6	0.06, <0.05	<0.05 (2)	1.4, 1.2	MP-RI-7109
LO, 1988 (Lemont)	0.89	0.95	a 6	0.20, 0.13	0.05, <0.05	2.0, 1.8	MP-RI-7110

a aerial application

Table 49. Residues of parathion-methyl and metabolites in sorghum forage from foliar

application of parathion-methyl in supervised trials in the USA. All EC applications at 1.1 kg ai/ha.

Year (Variety)			PHI, days	Residues, mg/kg			Ref.
	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
TX, 1988 (TEY 75)	0.74	6	0 7 14 21 28 35	10, 7.2 1.3, 0.56 0.29, 0.58 1.3, 0.62 0.12, 0.15 0.16, 0.10	0.31, 0.21 0.06, <0.05 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.60, 0.42 0.28, 0.21 0.15, 0.17 0.11, 0.14 0.05, 0.07 0.07, 0.06	MP-SG-3133
MO, 1988 (Funk's G-623GBR)	0.42	6	0 7 14 21 28 35	10, 10 0.38, 0.66 0.09, 0.07 0.13, 0.11 <0.05 (2) 0.11, 0.07	0.25, 0.28 <0.05, 0.05 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	0.93, 0.51 0.54, 0.62 0.24, 0.29 0.37, 0.45 0.62, 0.49 0.62, 0.49	MP-SG-7114
MO, 1988 (Funk's G-623GBR)	5.1	a 6	0 7 14 21 28 35	6.5, 9.3 0.27, 0.29 0.14, 0.17 0.26, 0.24 0.09, 0.23 0.23, 0.09	0.15, 0.22 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.2, 0.90 0.72, 0.64 0.32, 0.13 0.19, 0.24 0.35, 0.30 0.38, 0.40	MP-SG-7115
NE, 1988 (NC + 271)	0.60	6	0 7 14 21 28 35	14, 20 1.0, 1.8 0.48, 0.69 0.32, 0.35 0.35, 0.33 0.18, 0.17	0.12, 0.16 <0.05, 0.05 <0.05 (2) <0.05 (2) <0.05 (2) <0.05 (2)	1.2, 2.0 0.94, 1.2 0.44, 0.76 0.39, 0.38 0.40, 0.30 0.24, 0.28	MP-SG-7116

a aerial application

Table 50. Residues of parathion-methyl and metabolites in sorghum fodder, hay and silage from foliar application of parathion-methyl in supervised trials in the USA. All EC applications at 1.1 kg ai/ha.

CROP State, year (Variety)	Application		PHI, days	Residues, mg/kg			Ref.
	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
FODDER							
TX, 1988 (TEY 75)	0.74	6	21	0.83, 0.61	0.05, <0.05	0.63, 0.51	MP-SG-3173
TX, 1988 (Asgrow Topaz)	2.4	6	21	0.84, 1.2	0.06, 0.05	2.2, 2.0	MP-SG-3174
TX, 1988 (Asgrow Topaz)	12	a 6	21	0.08, <0.05	<0.05 (2)	0.44, 0.36	MP-SG-3175
MO, 1988 (Funk's G-623GBR)	0.56	6	21	0.16, 0.33	<0.05 (2)	0.33, 0.39	MP-SG-7111
MO, 1988 (Funk's G-623GBR)	5.1	a 6	22	0.25, 0.21	<0.05 (2)	0.47, 0.52	MP-SG-7112
NE, 1988 (NC + 271)	0.60	6	21	1.7, 2.3	0.14, 0.15	1.7, 1.5	MP-SG-7113
HAY							
TX, 1988 (TEY 75)	0.74	6	21	0.53, 0.29	<0.05 (2)	0.15, 0.18	MP-SG-3133
MO, 1988 (Funk's G-623GBR)	0.42	6	21	0.07, 0.09	<0.05 (2)	0.75, 0.53	MP-SG-7114
MO, 1988 (Funk's G-623GBR)	5.1	a 6	21	0.30, 0.10	<0.05 (2)	0.71, 0.42	MP-SG-7115
NE, 1988 (NC + 271)	0.60	6	21	0.64, 0.64	<0.05 (2)	1.6, 2.0	MP-SG-7116
SILAGE							
TX, 1988 (TEY 75)	0.74	6	21	0.10, 0.13	<0.05 (2)	0.11, 0.07	MP-SG-3133
MO, 1988 (Funk's G-623GBR)	0.42	6	21	0.17, 0.13	<0.05 (2)	0.53, 0.31	MP-SG-7114
MO, 1988 (Funk's G-623GBR)	5.1	a 6	21	0.27, 0.11	<0.05 (2)	0.21, 0.18	MP-SG-7115
NE, 1988 (NC + 271)	0.60	6	21	0.26, 0.24	<0.05 (2)	0.24, 0.15	MP-SG-7116

a aerial application

Table 51. Residues of parathion-methyl and metabolites in wheat forage, hay and straw, and barley straw, from foliar application of parathion-methyl in supervised trials in the USA, Germany and Hungary. Underlined residues are from treatments according to GAP.

CROP Country (State of USA), year (Variety)	Application	PHI, days	Residues, mg/kg	Ref.

	Form	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
WHEAT FORAGE									
WA, 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×0.75+2 ×0.45	6	0 7 14 21 28	10, 12 1.4, 0.83 0.46, 0.34 0.13, 0.12 0.13, 0.07	0.64, 0.77 0.39, 0.30 0.21, 0.22 0.09, 0.10 0.10, 0.05	3.9, 3.7 2.4, 1.4 2.0, 2.0 1.4, 0.92 0.16, 0.07	MP-WH-3165
WA, 1989 (Rojo)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.75+3 ×0.45+1 ×0.15	6	0	1.5, 2.5	0.30, 0.36	0.10, 0.10	MP-WH-3165
WA, 1989 (Rojo)	EC	2×1.4+3 ×0.84+1 ×0.28	2×1.5+3 ×0.90+1 ×0.30	a 6	0	3.5, 4.8	0.76, 0.70	1.4, 2.2	MP-WH-3182
WA, 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	a 6	0 7 14 21 28	1.1, 9.4 1.1, 1.0 0.24, 0.19 0.09, 0.28 0.19, 0.14	0.33, 0.69 0.33, 0.30 0.12, 0.14 0.10, 0.18 0.12, 0.10	1.9, 3.3 2.5, 1.9 2.2, 1.8 2.1, 2.9 2.6, 1.7	MP-WH-3182
OH, 1988 (Becker)	EC	4×1.4+2 ×0.84	4×0.72+2 ×0.44	6	0 7 14 21 28	11, 8.3 0.51, 0.57 0.68, 0.97 0.26, 0.25 0.25, 0.28	0.60, 0.50 0.17, 0.19 0.15, 0.17 0.10, 0.09 0.05, 0.06	2.4, 1.8 1.6, 1.3 0.64, 0.64 0.35, 0.32 0.33, 0.72	MP-WH-7143
OH, 1988 (Becker)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.72+3 ×0.44+1 ×0.15	6	0	3.8, 4.0	0.31, 0.33	2.4, 1.7	MP-WH-7143
ND, 1988 (Marshall)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	6	0 7 14 21 28	13, 13 0.68, 0.35 0.19, 0.17 0.11, 0.13 0.06, 0.06	0.50, 0.58 0.10, 0.08 0.06, 0.05 <0.05 (2) <0.05 (2)	1.1, 1.5 0.99, 0.60 0.80, 0.79 0.32, 0.38 0.39, 0.28	MP-WH-7145
ND, 1988 (Marshall)	EC	2×1.4+3 ×0.84+1 ×0.28	2×1.5+3 ×0.90+1 ×0.30	6	0	3.4, 3.2	0.33, 0.22	0.40, 0.34	MP-WH-7145
KS, 1989 (Arkan)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.69+3 ×0.41+1 ×0.14	6	0	2.3, 6.0	0.18, 0.30	0.83, 0.69	MP-WH-7147
KS, 1989 (Arkan)	EC	4×1.4+2 ×0.84	4×0.69+2 ×0.41	6	0 7 14 21 28	13, 7.5 2.4, 3.5 1.2, 1.5 0.40, 0.21 0.23, 0.29	0.63, 0.34 0.28, 0.27 0.17, 0.19 <0.05 (2) <0.05 (2)	1.7, 0.98 2.4, 2.8 1.6, 1.1 0.59, 0.49 0.34, 0.45	MP-WH-7147
KS, 1989 (Caldwell)	EC	2×1.4+3 ×0.84+1 ×0.28	2×3.0+3 ×1.8+1× 0.60	a 6	0	7.5, 7.1	0.32, 0.31	0.61, 0.37	MP-WH-7149
KS, 1989 (Caldwell)	EC	4×1.4+2 ×0.84	4×3.0+2 ×1.8	a 6	0 7 14 21 28	5.4, 6.5 0.35, 0.23 0.12, 0.07 <0.05, 0.07 0.07, 0.05	0.27, 0.29 0.07, 0.06 <0.05 (2) <0.05 (2) <0.05 (2)	0.14, 0.60 0.43, 0.40 0.69, 0.34 0.35, 0.22 0.12, 0.20	MP-WH-7149
WHEAT HAY									
WA, 1989 (Rojo)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.75+3 ×0.45+1 ×0.15	6	0	3.4, 3.8	3.4, 2.4	1.4, 2.1	MP-WH-3165
WA, 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×0.75+2 ×0.45	6	14	0.36, 1.2	0.18, 1.1	2.5, 5.0	MP-WH-3165
WA, 1989 (Rojo)	EC	2×1.4+3 ×0.84+1	2×1.5+3 ×0.90+1	a 6	0	3.1, 2.3	0.35, 0.24	1.3, 1.1	MP-WH-3182

CROP Country (State of USA), year (Variety)	Application				PHI, days	Residues, mg/kg			Ref.
	Form	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
		×0.28	×0.30						
WA, 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	a 6	14	0.33, 0.29	0.15, 0.11	2.0, 1.1	MP-WH-3182
OH, 1988 (Becker)	EC	4×1.4+2 ×0.84	4×0.72+2 ×0.44	6	14	0.32, 1.0	0.13, 0.23	0.63, 0.93	MP-WH-7143
OH, 1988 (Becker)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.72+3 ×0.44+1 ×0.15	6	0	3.8, 3.7	0.54, 0.58	1.4, 1.3	MP-WH-7143
ND, 1988 (Marshall)	EC	2×1.4+3 ×0.84+1 ×0.28	2×1.5+3 ×0.90+1 ×0.30	6	0	4.7, 3.9	0.19, 0.21	0.51, 0.92	MP-WH-7145
ND, 1988 (Marshall)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	6	14	0.17, 0.15	0.06, 0.06	0.92, 0.72	MP-WH-7145
KS, 1989 (Arkan)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.69+3 ×0.41+1 ×0.14	6	0	3.1, 2.9	0.29, 0.28	1.8, 1.6	MP-WH-7147
KS, 1989 (Arkan)	EC	4×1.4+2 ×0.84	4×0.69+2 ×0.41	6	14	0.98, 0.83	0.12, 0.09	1.4, 1.5	MP-WH-7147
KS, 1989 (Caldwell)	EC	2×1.4+3 ×0.84+1 ×0.28	2×3.0+3 ×1.8+1× 0.60	a 6	0	4.5, 3.8	0.50, 0.38	0.73, 0.75	MP-WH-7149
KS, 1989 (Caldwell)	EC	4×1.4+2 ×0.84	4×3.0+2 ×1.8	a 6	14	0.10, 0.07	<0.05 (2)	0.70, 1.1	MP-WH-7149
BARLEY STRAW									
Germany, 1973 (Dura)	Bait	0.18		1	116	<0.01			262/73
WHEAT STRAW									
Germany, 1973 (Diplomat)	Bait	0.18		1	124	<0.01			264/73
Germany, 1973 (Diplomat)	Bait	0.18		1	125	<0.01			266/73
Hungary, 1991		0.35	0.14	1	0 1 2 3 5 7 10 14	4.2, 4.6, 4.4 1.3, 1.1, 1.7 0.77, 0.85, 0.91 0.26, 0.35, 0.39 0.1, 0.08, 0.13 <0.02 (3) <0.02 (3) <0.02 (3)			
USA (CA, 1988 (Anza)	EC	4×1.4+2 ×0.84	4×0.75+2 ×0.45	6	14	3.1, 3.7	0.31, 0.37	3.8, 2.5	MP-WH-3157
USA (CA, 1988 (Anza)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.75+3 ×0.45+1 ×0.15	6	0	5.0, 4.0	0.22, 0.16	0.66, 0.57	MP-WH-3157
USA (CA, 1988 (Anza)	EC	1.4	0.75	6	14	4.5, 3.4	0.59, 0.28	4.4, 4.7	MP-WH-3157
USA (WA, 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×0.75+2 ×0.45	6	14	2.6, 2.2	0.16, 0.12	0.46, 0.45	MP-WH-3159
USA (WA, 1989 (Rojo)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.75+3 ×0.45+1 ×0.15	6	0	9.7, 7.4	0.16, 0.15	0.46, 0.21	MP-WH-3159
USA (WA, 1989 (Rojo)	EC	1.4	0.75	6	14	3.5, 2.8	0.18, 0.13	0.46, 0.43	MP-WH-3159

CROP Country (State of USA), year (Variety)	Application				PHI, days	Residues, mg/kg			Ref.
	Form	kg ai/ha	kg ai/hl	No.		Parathion-methyl	Paraoxon-methyl	Nitrophenol	
USA (TX, 1989 (NK-Pro 812)	EC	2×1.4+3 ×0.84+1 ×0.28	2×3.0+3 ×1.8+1× 0.60	6	0	3.8, 2.8	0.08, 0.05	1.5, 1.2	MP-WH-3161
USA (TX, 1989 (NK-Pro 812)	EC	4×1.4+2 ×0.84	4×3.0+2 ×1.8	6	14	0.27, 0.34	<0.05 (2)	1.1, 0.73	MP-WH-3161
USA (TX, 1989 (NK-Pro 812)	EC	1.4	3.0	6	14	1.2, 0.95	0.06, <0.05	3.0, 2.5	MP-WH-3161
USA (WA, 1989 (Rojo)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	a 6	14	0.30, 0.55	0.06, 0.11	1.6, 1.9	MP-WH-3181
USA (WA, 1989 (Rojo)	EC	2×1.4+3 ×0.84+1 ×0.28	2×1.5+3 ×0.90+1 ×0.30	a 6	0	1.9, 2.5	0.15, 0.17	0.51, 0.46	MP-WH-3181
USA (WA, 1989 (Rojo)	EC	1.4	1.5	a 6	14	1.8, 1.2	0.15, 0.18	1.3, 0.51	MP-WH-3181
USA (OH, 1988 (Becher)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.72+3 ×0.44+1 ×0.15	6	0	1.2, 1.8	<0.05 (2)	0.73, 0.73	MP-WH-7134
USA (OH, 1988 (Becher)	EC	1.4	0.72	6	14	1.0, 0.88	0.11, 0.09	0.57, 0.51	MP-WH-7134
USA (OH, 1988 (Becher)	EC	4×1.4+2 ×0.84	4×0.72+2 ×0.44	6	14	0.74, 0.79	0.09, 0.11	0.51, 0.63	MP-WH-7134
USA (VA, 1988 (Coker 797)	EC	1.4	0.64	6	14	<0.05 (2)	<0.05 (2)	<0.05 (2)	MP-WH-7136
USA (VA, 1988 (Coker 797)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.64+3 ×0.39+1 ×0.13	6	0	12, 21	0.14, 0.24	0.26, 0.58	MP-WH-7136
USA (VA, 1988 (Coker 797)	EC	4×1.4+2 ×0.84	4×0.64+2 ×0.39	6	14	0.13, <0.05	<0.05 (2)	<0.05 (2)	MP-WH-7136
USA (ND, 1988 (Marshall)	EC	2×1.4+3 ×0.84+1 ×0.28	2×1.5+3 ×0.90+1 ×0.30	6	0	3.5, 2.7	0.26, 0.17	1.6, 0.94	MP-WH-7138
USA (ND, 1988 (Marshall)	EC	4×1.4+2 ×0.84	4×1.5+2 ×0.90	6	14	0.28, 0.09	<0.05 (2)	0.87, 0.86	MP-WH-7138
USA (ND, 1988 (Marshall)	EC	1.4	1.5	6	14	0.16, 0.10	<0.05 (2)	1.1, 1.1	MP-WH-7138
USA (KS, 1989 (Arkan)	EC	4×1.4+2 ×0.84	4×0.68+2 ×0.41	6	14	4.0, 5.7	0.11, 0.17	1.4, 1.5	MP-WH-7140
USA (KS, 1989 (Arkan)	EC	1.4	0.68	6	14	11, 10	0.26, 0.23	3.1, 1.7	MP-WH-7140
USA (KS, 1989 (Arkan)	EC	2×1.4+3 ×0.84+1 ×0.28	2×0.68+3 ×0.41+1 ×0.14	6	0	13, 14	0.24, 0.32	1.4, 1.9	MP-WH-7140
USA (KS, 1989 (Caldwell)	EC	4×1.4+1 ×0.84+1 ×0.84	4×3.0+1 ×1.8+1× 0.40	a 6	14	0.65, 0.85	0.05, 0.08	1.2, 1.7	MP-WH-7142
USA (KS, 1989 (Caldwell)	EC	2×1.4+3 ×0.84+1 ×0.28	2×3.0+3 ×1.8+1× 0.13	a 6	0	0.49, 0.74	<0.05, 0.05	0.33, 0.45	MP-WH-7142
USA (KS, 1989 (Caldwell)	EC	5×1.4+1 ×1.4	5×3.0+1 ×0.67	a 6	14	0.77, 1.6	<0.05, 0.10	0.65, 0.98	MP-WH-7142

a aerial application

Table 52. Residues of parathion-methyl and metabolites in bluegrass hay from foliar application of parathion-methyl in supervised trials in the USA in 1988. Underlined residues are from treatments according to GAP. All EC applications. All 15 days PHI.

State (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA	0.89	0.47	3	0.31, 0.22	0.13, 0.19	4.6, 3.4 c 0.09	MP-BL-3013
CA	0.89	0.47	a 3	0.64, 0.58	0.06, 0.09	3.2, 3.4 c 0.63	MP-BL-3016
MO	0.87	0.46	6	0.21, 0.17	0.10, 0.11	1.1, 1.1 c 0.19	MP-BL-7062
MO	0.89	3.4	a 6	0.09, 0.12	0.09, 0.10	0.90, 0.85 c 0.25	MP-BL-7063
PA (Merit/Nasau/Baron)	0.89	0.36	6	0.97, 1.0	0.12, 0.11	4.8, 4.4 c 0.16	MP-BL-7064

a aerial application c control sample

Table 53. Residues of parathion-methyl and metabolites in Bermuda grass hay from foliar application of parathion-methyl in supervised trials in the USA in 1988. Underlined residues are from treatments according to GAP. All EC applications. All 15 days PHI.

State, (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA	0.89	0.47	3	1.4, 0.63	0.06, <0.05	2.8, 2.1 c 0.59	MP-BE-3009
CA	0.89	0.47	a 3	0.54, 0.49	<0.05 (2)	2.5, 3.0 c 0.75	MP-BE-3012
GA (Coastal)	0.86	1.4	6	1.4, 1.6	<0.05 (2)	0.80, 0.69 c 0.31	MP-BE-7059
GA (Coastal)	0.87	0.92	a 6	0.49, 0.96	<0.05 (2)	0.89, 1.0 c 0.43	MP-BE-7060
SC (Coastal)	0.89	2.4	6	0.63, 0.66	<0.05 (2)	3.0, 2.7 c 0.53	MP-BE-7061

a aerial application, c control sample

Table 54. Residues of parathion-methyl and metabolites in fescue hay from foliar application of parathion-methyl in supervised trials in the USA in 1988. Underlined residues are from treatments according to GAP. All EC applications. All 15 days PHI.

State (Variety)	Application			Residues, mg/kg			Ref.
	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
CA	0.89	0.47	3	0.34, 0.50	0.06, 0.09	5.8, 6.4 c 0.38	MP-BO-3017
CA	0.89	0.47	a 3	0.23, 0.25	<0.05 (2)	3.9, 4.2 c 0.35	MP-BO-3020
MO (Jaguar)	0.87	0.46	6	0.11, 0.19 c 0.07	0.05, 0.07	0.52, 0.55 c 0.14	MP-BO-7065
MO (Jaguar)	0.89	2.7	a 6	0.05, <0.05 c 0.10	0.08, <0.05	0.52, 0.29	MP-BO-7066
PA (Tall and fine)	0.87	0.35	6	2.5, 2.5	0.32, 0.35	5.3, 5.2 c 0.13	MP-BO-7067

a aerial application, c control sample

Table 55. Residues of parathion-methyl and metabolites in sugar beet fodder (sugar beet leaves or tops) from foliar application of parathion-methyl in supervised trials in the USA in 1988. Underlined residues are from treatments according to GAP. All EC applications. All 60 days PHI.

State (Variety)	Application	Residues, mg/kg	Ref.

	kg ai/ha	kg ai/hl	No.	Parathion-methyl	Paraoxon-methyl	Nitrophenol	
ID (WS 88)	0.42	0.23	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3144
CA (SS-NB2)	0.42	0.23	6	<0.05 (2)	<0.05 (2)	0.16, 0.18	MP-SB-3146
CA (SS-NB2)	0.42	0.23	a 6	<0.05 (2)	<0.05 (2)	0.21, 0.26	MP-SB-3148
ID (WS 88)	0.42	0.45	a 6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-3186
MN (Ultramono)	0.42	0.22	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-7124
ND (ACS ACH 176)	0.43	0.45	6	<0.05 (2)	<0.05 (2)	<0.10 (2)	MP-SB-7126

a aerial application

FATE OF RESIDUES IN STORAGE AND PROCESSING

In processing

Information was made available to the Meeting on the fate of parathion-methyl during the processing of maize, cotton seed, potatoes, sugar beet, snap beans, soya beans, rice, and wheat.

Maize crops were treated with 6 foliar applications of parathion-methyl at the exaggerated rate of 5.6 kg ai/ha, and grain was harvested 12 days after the final application for processing (LeRoy, 1990f). Portions of the grain (approx 170 kg each) were dry- or wet-milled. The milling processes are summarized in Figure 1.

Residues of parathion-methyl were not detectable in the maize from one trial (Texas), and no residues appeared in any of the processed fractions (Table 56). In the other trial (Missouri) parathion-methyl was fairly evenly distributed through most fractions, with residues lower than in the original grain except in crude oil from the wet milling process where they were marginally higher than in the grain. Parathion-methyl residues were not detected in the starch. No paraoxon-methyl or nitrophenol was formed from parathion-methyl during processing.

Oil was refined by mixing crude oil with an amount of sodium hydroxide solution calculated to neutralise the free fatty acids for 15 minutes at 20-24°C, then for 12 minutes at 63-67°C. The refined oil was allowed to settle at 60-65°C for one hour, refrigerated overnight, then decanted and filtered. The fraction settling to the bottom of the refrigerated tube was the soapstock.

Table 56. Residues of parathion-methyl and metabolites in maize and processed fractions (LeRoy, 1990f). Maize had received 6 foliar applications of parathion-methyl in trials in Texas (MP-CN-3512) and Missouri (MP-CN-3524) at the exaggerated rate of 5 kg ai/ha, with the final application 12 days before harvest.

Commodity	Residues, mg/kg					
	Parathion-methyl		Paraoxon-methyl		Nitrophenol	
	MP-CN-3512	MP-CN-3524	MP-CN-3512	MP-CN-3524	MP-CN-3512	MP-CN-3524
Maize grain	<0.05 <0.05	0.58	<0.05 <0.05	<0.05	<0.10 <0.05	<0.10
DRY MILLING						
Coarse meal	<0.05	0.27	<0.05	<0.05	<0.10	<0.10
Flour	<0.05	0.24	<0.05	<0.05	<0.10	<0.10
Meal	<0.05	0.26	<0.05	<0.05	<0.10	<0.10
Large grits	<0.05	0.12	<0.05	<0.05	<0.10	<0.10
Medium grits	<0.05	0.11	<0.05	<0.05	<0.10	<0.10
Small grits	<0.05	0.43	<0.05	<0.05	<0.10	<0.10
Crude oil	<0.05	0.18	<0.05	<0.05	<0.10	<0.10
Refined oil	<0.05	0.15	<0.05	<0.05	<0.10	<0.10
WET MILLING						
Crude oil	<0.05	0.77	<0.05	<0.05	<0.10	<0.10
Refined oil	<0.05	0.60	<0.05	<0.05	<0.10	<0.10
Starch	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10

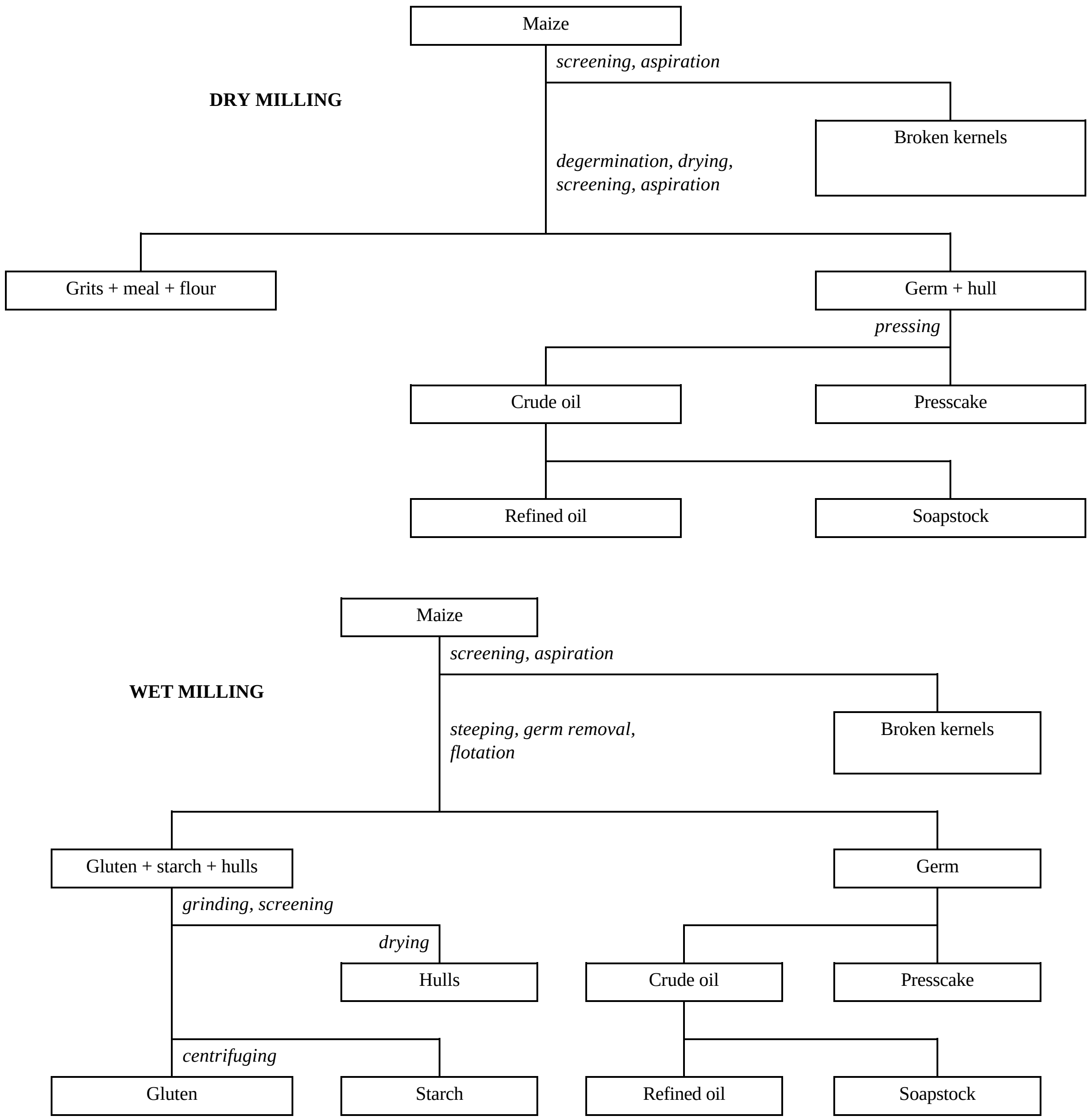

Figure 1. Maize processing.

Cotton crops were treated with exaggerated rates of parathion-methyl (6×6.7 kg ai/ha, 10×17 kg ai/ha), and the crops were harvested 7 days after the final applications for processing in the USA in 1988 (LeRoy, 1990g). Portions of the cotton seed (approx 10 kg) were milled according to the process summarized in Figure 2.

The partitioning of the residues into the various fractions was different in the two trials, but residues of parathion-methyl in the processed commodities were always lower than in the raw seed. Very little, if any, paraoxon-methyl was formed during processing.

Table 57. Residues of parathion-methyl and metabolites in cotton seed and processed fractions (LeRoy, 1990g). Cotton was treated at 6.7 kg ai/ha and 17 kg ai/ha in trials in California (MP-CS-3522) and Texas (MP-CS-3523) respectively.

Commodity	Residues, mg/kg					
	Parathion-methyl		Paraoxon-methyl		Nitrophenol	
	MP-CS-3522	MP-CS-3523	MP-CS-3522	MP-CS-3523	MP-CS-3522	MP-CS-3523
Cotton seed	14	4.1	0.12	0.21	1.7	0.98
Hulls	5.7	2.0	<0.05	<0.05	0.94	2.0
Meal	0.53	0.51	<0.05	<0.05	0.33	0.67
Crude oil	11	0.30	<0.05	<0.05	0.16	<0.05
Refined oil	8.2	0.28	0.05	<0.05	0.06	<0.05
Soapstock	0.19	0.09	0.14	<0.05	0.54	0.09

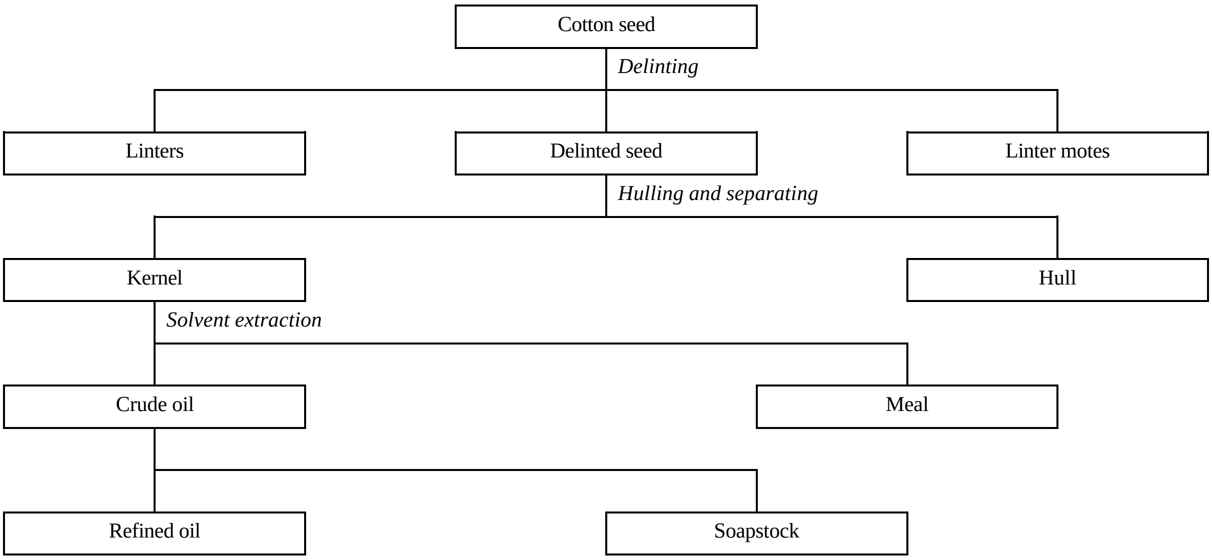

Figure 2. Cotton processing.

<u>Potato</u> crops in California and Idaho were treated with parathion-methyl at exaggerated rates and harvested 5 days after the final application for processing into chips, flakes and granules (Cañez 1989d). No parathion-methyl, paraoxon-methyl or nitrophenol was detectable in the tubers or the processed products (Table 58).

Table 58. Residues of parathion-methyl and metabolites in potatoes and processed fractions (Cañez, 1989d). Parathion-methyl was applied to potato crops at exaggerated rates (6×3.4 kg ai/ha in California MP-PO-3501, 6×8.4 kg ai/ha in Idaho MP-PO-3502) with harvest 5 days after the final application for processing.

Commodity	Residues, mg/kg					
	Parathion-methyl		Paraoxon-methyl		Nitrophenol	
	MP-PO-3501	MP-PO-3502	MP-PO-3501	MP-PO-3502	MP-PO-3501	MP-PO-3502
Tuber	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Chips	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Dried peel (flakes)	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Flakes	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Granules	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Wet peel (flake)	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10

Sugar beet crops in California and Idaho were treated with parathion-methyl at exaggerated rates (6 applications at 2.1 kg ai/ha) and harvested 20 days after the final application for processing into molasses and refined sugar (Cañez 1990k). No parathion-methyl, paraoxon-methyl or nitrophenol was detectable in the sugar beet root or the processed fractions (Table 59).

Table 59. Residues of parathion-methyl and metabolites in sugar beet and processed fractions (Cañez, 1990k). Parathion-methyl was applied at an exaggerated rate (6×2.1 kg ai/ha) to sugar beet crops in California (MP-SB-3503) and Idaho (MP-SB-3504), with harvest 20 days after the final application for processing.

Commodity	Residues, mg/kg					
	Parathion-methyl		Paraoxon-methyl		Nitrophenol	
	MP-SB-3503	MP-SB-3504	MP-SB-3503	MP-SB-3504	MP-SB-3503	MP-SB-3504
Sugar beet root	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Dehydrated pulp	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Molasses	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10
Refined sugar	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10

Parathion-methyl was sprayed on snap bean crops at exaggerated rates for processing (LeRoy 1990a). Neither parathion-methyl nor paraoxon-methyl was detectable in the cut pods or cannery waste, but nitrophenol was found in both and at a higher level in cannery waste (Table 60).

Table 60. Residues of parathion-methyl and metabolites in snap beans and processed fractions (LeRoy, 1990a). Parathion-methyl was applied at an exaggerated rate (6×3.4 and 6×7.8 kg ai/ha) to snap bean crops in California (MP-LB-3508) and Oregon (MP-LB-3509), with harvest 21 days after the final application for processing.

Commodity	Residues, mg/kg					
	Parathion-methyl		Paraoxon-methyl		Nitrophenol	
	MP-SB-3508	MP-SB-3509	MP-SB-3508	MP-SB-3509	MP-SB-3508	MP-SB-3509
Cut pod	<0.05	<0.05	<0.05	<0.05	1.1	1.5
Cannery waste	<0.05	0.06	<0.05	<0.05	2.3	2.3

<u>Soya bean</u> crops in Iowa and Missouri were treated with parathion-methyl at exaggerated rates (2 applications at 2.8 kg ai/ha) and harvested 15 days after the final application for processing into meal and oil (Cañez, 1990l). In the Missouri trial no parathion-methyl, paraoxon-methyl or nitrophenol was detectable in the soya bean seed, meal or oil (Table 61). In the Iowa trial parathion-methyl was concentrated from the seed to the oil by a factor of 4-5. Paraoxon-methyl was not detected. Nitrophenol was found in the seed, hulls and meal at similar levels.

Table 61. Residues of parathion-methyl and metabolites in soya beans and processed fractions (Cañez, 1990l). Parathion-methyl was applied at an exaggerated rate (2×2.8 kg ai/ha) to soya crops in Iowa (MP-SY-2101) and Missouri (MP-SY-2102), with harvest 15 days after the final application for processing.

Commodity	Residues, mg/kg					
	Parathion-methyl		Paraoxon-methyl		Nitrophenol	
	MP-SY-2101	MP-SY-2102	MP-SY-2101	MP-SY-2102	MP-SY-2101	MP-SY-2102
Soya bean seed, dry	0.15	<0.05	<0.05	<0.05	0.15	<0.05
Hulls	0.12	<0.05	<0.05	<0.05	0.12	<0.05
Meal	<0.05	<0.05	<0.05	<0.05	0.19	<0.05
Crude oil	0.71	<0.10	<0.10	<0.10	<0.10	<0.10
Refined oil	0.57	<0.10	<0.10	<0.10	<0.10	<0.10

<u>Rice</u> crops in California and Texas were sprayed with parathion-methyl at 5 times the maximum recommended label rate with 6 foliar applications at approximately 7-day intervals and harvested for processing 15 or 16 days after the final application (LeRoy 1990b). Samples of rice (approximately 10 kg in the Californian trial and 22 kg in the Texas trial) were sent for milling according to the scheme in Fig 3. Residues in the milled commodities are reported in Table 62. The initial drying reduced moisture levels in the rice from 28% (Californian trial) and 16% (Texas trial) to 11% for milling.

Parathion-methyl levels were reduced by factors of 15-25 in the production of polished rice from this rice. Much of the residue remained with the hulls. Residue levels in rice bran were similar to those in the grain. Paraoxon-methyl levels in polished rice were reduced below the limit of determination (0.05 mg/kg).

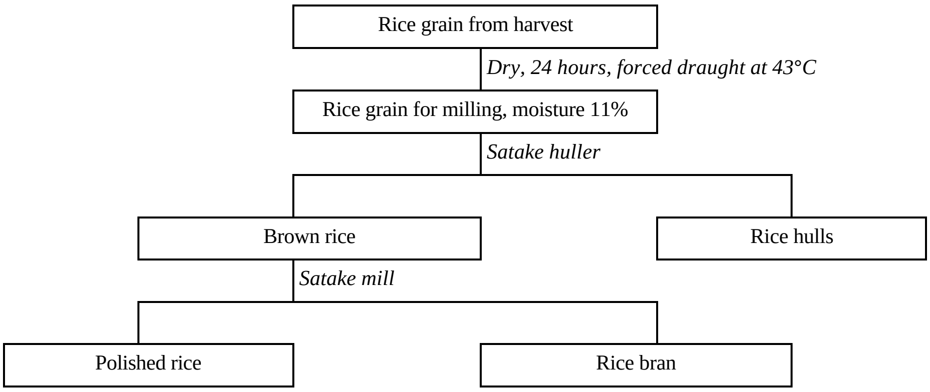

Figure 3. Rice processing (LeRoy, 1990b).

Table 62. Residues of parathion-methyl and metabolites in rice and processed fractions (LeRoy, 1990b). Parathion-methyl was applied at an exaggerated rate (6×4.4 kg ai/ha) to rice crops in California (MP-RI-3514) and Texas (MP-RI-3515) with harvest 16 and 15 days after the final application for processing.

Commodity	Residues, mg/kg					
	Parathion-methyl		Paraoxon-methyl		Nitrophenol	
	MP-RI-3514	MP-RI-3515	MP-RI-3514	MP-RI-3515	MP-RI-3514	MP-RI-3515
Rice grain for milling	14	1.9	0.63	0.67	3.9	2.1
Brown rice	2.7	0.45	<0.05	<0.05	1.1	0.99
Rice hulls	72	9.3	3.5	3.6	13	4.2
Rice bran	11	2.0	0.13	0.11	2.1	3.5
Polished rice	0.52	0.13	<0.05	<0.05	0.63	0.63

Wheat crops in Missouri (MP-WH-2103) and Washington (MP-WH-3520) were treated with exaggerated rates of parathion-methyl (6×7.0 kg ai/ha) and harvested 13-14 days after the final application for milling. The results are summarized in Table 36.

Parathion-methyl residue levels in bran were about twice and in flour about one third of those in the wheat. Paraoxon-methyl residues were low in the grain and, as expected, were higher in bran and lower in flour. Nitrophenol levels in bran were roughly twice those in the grain but were reduced in flour.

Residues in the edible portion of food commodities

Parathion-methyl residues were not detected (<0.05 mg/kg) in apples treated 28 days earlier, or in apple sauce or juice made from them (Table 13).

Parathion-methyl residues were not detected (<0.01 mg/kg) in grapes treated 35 days earlier, or in the wine or must (Table 13).

Residues of parathion-methyl were not detected (<0.05 mg/kg) in cabbages with or without wrapper leaves (Table 15). The oxon was detected in samples which included the wrapper leaves in 7 of the 16 trials, but not in any sample where wrapper leaves were removed.

In 7 of the 8 trials on head lettuce parathion-methyl residues were not detected (<0.05 mg/kg) in samples with or without wrapper leaves (Table 18). In the remaining trial they were higher in the samples with wrapper leaves. Paraoxon-methyl was not detected in any of the samples.

When celery was trimmed to leave only stalks without foliage, parathion-methyl levels were reduced to 28% (mean) of the levels in celery with foliage (Table 32). Paraoxon-methyl residues were not detected.

No residues of parathion-methyl, paraoxon-methyl or nitrophenol were detectable in the tubers of potatoes treated with parathion-methyl at exaggerated application rates, or in the chips, flakes and granules produced from them.

Molasses and refined sugar prepared from sugar beet treated with exaggerated rates of parathion-methyl contained no detectable residues (<0.05 mg/kg) of parathion-methyl or paraoxon-methyl.

In milling trials parathion-methyl residues in bran were about twice, and in flour about a third of those in the wheat. Paraoxon-methyl levels in the wheat were low, with those in the flour lower and in bran higher than in the grain.

In a maize processing trial, residue levels in meal, flour, grits and dry-milled oil were _ to ½ those in the grain. Levels in the oil produced by wet milling were of the same order as in the grain. Paraoxon-methyl was not detected (<0.05 mg/kg) in the grain or the processed fractions.

Parathion-methyl levels were reduced by a factor of 15-25 in the production of polished rice. Residues in rice bran were similar to those in the grain. Paraoxon-methyl levels in polished rice were below the limit of determination (0.05 mg/kg).

Parathion-methyl was concentrated from soya bean seed to oil by a factor of 4-5, and was not detected in the meal. Paraoxon-methyl was not detected in seed, meal or oil.

Parathion-methyl residues in cotton seed meal were 4-12% of those in the cotton seed in two milling trials. Levels in the oil were reduced to 79% and 7%. Paraoxon-methyl residues were low in the seed and generally not detected (<0.05 mg/kg) in the meal or oil.

RESIDUES IN FOOD IN COMMERCE OR AT CONSUMPTION

Daily dietary intakes of parathion-methyl were reported to GEMS/Food by Guatemala, Japan, Thailand and the USA (Jelinek, 1992). The USA reported dietary intakes of less than 0.002 ì g/kg bw/day, and parathion-methyl was not detected in the diets in Japan and Thailand. It was found in only one of the four studies in Guatemala.

The USA reported the parathion-methyl dietary intake based on total diet analyses to be <0.0005% of the WHO ADI of 20 ì g/kg bw/day (FDA, 1993).

The estimated daily intake of parathion-methyl in a 1992 Australian Market Basket Survey was 0.021-0.079 ì g/kg bw/day for population groups with a range of diets (Stenhouse, 1992).

Australia reported that in the National Residue Survey for July 1988 to June 1992, 1870 samples of fruit and vegetables had been monitored for parathion-methyl. Residues were not detected (<0.1 mg/kg) in 1845 (98.7%) of the samples examined. Residues were detected only in apples and broccoli.

NATIONAL MAXIMUM RESIDUE LIMITS

Country	MRL, mg/kg	Commodity
Australia	1	cotton seed, fruit, vegetables
	0.05	cotton seed oil, meat, milk, milk products
Austria[1]	1	citrus fruit
	0.2	fruits except citrus, vegetables
	0.1	other plant commodities
Belgium	0.2	fruit, tea, vegetables
	0 (<0.05)	other plant commodities
Brazil	1	peanut
	0.7	cotton seed
	0.5	bulb vegetables, cereals, legume vegetables, potato, vegetables
	0.2	fruit except coconut
	0.1	soya
	0.01	coffee
Chile[1]	1	vegetables
	0.2	fruit, tomato
	0.05*	beet, sugar
Cyprus	0.5	apple, artichoke, avocado, cabbage, carrot, cauliflower, celery, cucumber, leafy vegetables, legume vegetables, olive, onion, peach, pear, plum, potato, spinach, tomato
Denmark	0.2	berries and small fruits, Brussels sprouts, cabbage, cauliflower, citrus fruit, fruiting vegetables, leafy vegetables, legume vegetables, pome fruit, root vegetables except carrots, stem vegetables, stone fruit, tropical fruit
European Community	0.2	fruit, vegetables
Finland[1]	0.2	all plant commodities
France[1]	0.2	brassica crops, cucumber, fruit, melon except watermelon, tea, tomato, vegetables
	0.05	beetroot, cotton seed oil
	0.05*	sugar beet, dry hops
Germany[1]	1	citrus fruit
	0.2	citrus fruit juice, fruits except citrus, vegetables
	0.1	other plant commodities
Greece[1]	0.2	all plant commodities
Hungary	0.5	apricot, red currant, garden peas, other plant commodities, raspberry
	0.2	cereals, cucumber, melon, other fruits, pumpkin, soya, sunflower
India[2]	1	vegetables
	0.2	fruit
Israel	1	artichoke, bean, lettuce, root vegetables, tuber vegetables
	0.2	brassica crops, celery, sweet pepper, tomato
	0.1	cotton seed, other plant commodities, potato
Italy[1]	0.2	fruit, olive, vegetables
	0.1	sugar beet, legume forage, oil seeds, potato, tobacco

Country	MRL, mg/kg	Commodity
Japan	1	artichoke, asparagus, aubergine, barley, broad bean, Adzuki bean, green kidney bean, great burdock, Chinese cabbage, carrot, celery, chicory, garland chrysanthemum, collard, corn, cotton seed, garden cress, dasheen, endive, garlic, ginger, snake gourd, horseradish, konnyaku, lettuce, watermelon, mushroom, black mustard, spinach mustard, okra, onion, Welsh onion, other cereals, other cucurbits, other vegetables, leaf parsley, parsnip, garden pea, green garden pea, peanut, pumpkin, Japanese radish root, rice, black salsify, shallot, soya green, spinach, sweet pepper, birdsfoot trefoil, edible turnip root, wheat, yam
	0.2	apple, apricot, apricot Japanese, avocado, banana, blackberry, blueberry, broccoli, cabbage, cauliflower, cherry, crowberry, cucumber, date, grape, grapefruit, guava, Japanese hackberry, kiwi, lemon, lime, loquat, mandarin, mango, melon, melon cantaloupe, nectarine, orange, Japanese summer orange, other berry fruits, other citrus fruits, other fruits, other oilseed, papaya, passion fruit, peach, pear, oriental pear, persimmon, pineapple, plum, quince, rape seed, raspberry, strawberry, sunflower, tea, tomato
	0.1	almond, walnut, pecan nut, potato, safflower, soya, sugar cane, sweet potato
	0.05	sugar beet, hops
Luxembourg[1]	0.2	fruit, vegetables
	0.1	other plant commodities
Malaysia	0.2	broccoli, Brussels sprouts, cabbage, red cabbage, Chinese cabbage, cauliflower, collard, cucumber, fruit, curly kale, melon, melon cantaloupe, tea, tomato
	0.05	sugar beet, cotton seed oil, dry hops
Mexico	1.25	alfalfa
	1	apple, apricot, artichoke, aubergine, avocado, barley, bean, broccoli, Brussels sprouts, cabbage, capsicum (chilli pepper), carrot, cauliflower, celery, Swiss chard, corn, cucumber, garlic, grape, grapefruit, grassland, lemon, sweet lemon, lettuce, mandarin, mango, melon, nectarine, oat, okra, onion, orange, chickpea, peach, peanut, pear, pineapple, plum, pumpkin, quince, radish, rape, rice, sorghum, spinach, strawberry, tomato, wheat, zucchini
	0.75	cotton
	0.1	guava, nuts, potato, safflower, soya, sugar cane, sweet potato
Netherlands	0.2	fruit, tea, vegetables
	0.05	other plant commodity products
	0 (<0.02)	other plant commodities
New Zealand	0.5	fruit, vegetables
Portugal[1]	0.2	fruit, vegetables
Spain	0.2	fruit, vegetables except potatoes
	0.1	other plant commodities, potato
Sweden	0.5	citrus fruit
	0.1	fruits except citrus, vegetables
Taiwan	0.5	rice
Turkey	0.2	netted (musk) melon, watermelon
	0.1	cherry, cucumber, lettuce, peach, plum, sweet pepper, tomato
UK	0.2	citrus fruit
USA[3]	5	alfalfa hay, birdsfoot trefoil hay
	3	almond hull, sorghum fodder, sorghum forage
	1.25	fresh alfalfa, birdsfoot trefoil
	1	apple, apricot, artichoke, aubergine, avocado, barley, bean, beets, beets tops or leaves, blackberry, blueberry, boysenberry, brassica crops, broccoli, Brussels sprouts, cabbage, carrot, cauliflower, celery, cherry, citrus fruit, clover collard, corn forage, cranberry, black currant, red currant, date, dewberry, endive, fig, garlic, gooseberry, gourd, grape, grass, guava, hazel nut, hops, kohlrabi, leafy vegetables, lentils, lettuce, mango, melon, mustard, nectarine, oat, okra, olive, onion, leaf parsley, green parsnip, root parsnip, garden pea, garden pea forage, peach, peanut, pear, cayenne pepper, pineapple, plum, pumpkin, quince, radish root, radish top or leaves, raspberry, rice, rutabaga root, rutabaga top or leaves, soya hay, spinach, summer squash, strawberry, sweet pepper, tomato, edible turnip, edible turnip tops or leaves, vetch, wheat
	0.75	cotton seed
	0.2	clusterbean, mustard seed, rape seed, sunflower seed
	0.1	soya
	0.1[4]	almond, sugar beet, sugar beet leaves or tops, hazel nut, walnut, pecan nut, potato, safflower seed, sorghum, sugar cane, sugar cane fodder, sugar cane forage, sweet potato

[1] parathion-methyl and paraoxon-methyl

[2] sum of parathion-methyl and its oxygen analogue, expressed as parathion-methyl
[3] parathion or methyl homologue
[4] negligible residue

APPRAISAL

Parathion-methyl was initially scheduled for evaluation in the CCPR periodic review programme in 1991 but was postponed, awaiting a comprehensive set of US studies and clarification of US GAP. Information was made available to the Meeting from national governments (Australia, Germany, The Netherlands, Thailand and the USA) and two manufacturers.

Metabolism studies on a lactating goat and laying hens were made available for review. The goat was dosed with the equivalent of 6 ppm parathion-methyl in the feed for 3 days. In the goat neither parathion-methyl nor paraoxon-methyl were present in extracts of milk, kidney, liver, muscle or fat. Identified metabolites were mostly formed by loss of a methyl group or reduction of the nitro group.

In the hens, dosed for 1 or 3 days with the equivalent of 6 ppm parathion-methyl in the feed, parathion-methyl was identified in the kidney, gizzard, heart and fat. Metabolites with the nitro group reduced to amino were present in the liver. Nitrophenol and its sulphate were identified in the eggs. Nitrophenol was found in all tissues except muscle.

Very little ^{14}C was translocated to the tubers when radiolabelled parathion-methyl ([^{14}C]phenyl) was applied to potato plants. Nitrophenol was the major metabolite. Parathion-methyl was identified as a minor component of the residue, constituting 4% and 0.6% of the total ^{14}C residue in the tubers 5 and 21 days after treatment.

Nitrophenol and parathion-methyl were the major components identified in cotton seed from a plant treated with radiolabelled parathion-methyl ([^{14}C]phenyl). Parathion-methyl was the major component in cotton leaves. Paraoxon-methyl was not detected.

Nitrophenol and parathion-methyl were the major identified components of the residue in lettuce treated with radiolabelled parathion-methyl.

Residue analysis for parathion-methyl, paraoxon-methyl and nitrophenol relied on extraction of plant material with acidic methanol, followed by solvent partition clean-up. Parathion-methyl and paraoxon-methyl were then determined by GLC, with detection by an FPD in the phosphorus mode. Nitrophenol levels were measured by HPLC. The validated LOD for most substrates for the three compounds was 0.05 mg/kg.

Information on frozen storage stability was made available to the Meeting on many commodities: bean seed and pod, dry bean seed, bluegrass hay, cabbage, celery, clover forage, hops, lettuce, maize, maize fodder, maize forage, mustard greens, onions, succulent pea forage, pea straw, dry peas, succulent pea pods and seed, soya bean seed, sunflower, turnip roots, turnip tops, wheat, wheat forage, and wheat straw. Parathion-methyl was stable under the storage conditions; paraoxon-methyl was mostly stable, but losses could occur in the long-term storage of lettuce, hops and sunflower seeds.

Residue trials on apples and pears according to the German use pattern showed that parathion-methyl residues were not detected (<0.05 mg/kg) at the official PHI (28 days) and even at 14 days. However, a total of 2 trials on apples and 2 on pears was insufficient for the Meeting to estimate maximum residue levels.

Four trials according to GAP on 4 varieties of grapes in Germany in 1990 produced no detectable residues (<0.01 mg/kg) at the official PHI (35 days), but also at 28 days. The trials from Thailand could not be evaluated because information on relevant GAP was not available. The Meeting was unable to estimate a maximum residue level because the number of trials was too limited for a major crop.

Trial data for green onions and bulb onions were made available, but the application rate in all trials but one was double the GAP rate in the USA. The Meeting was unable to make recommendations for green or bulb onions.

Trials on cabbage and broccoli were considered together. US GAP for broccoli is the same as for cabbage.

Parathion-methyl residues were not detected in cabbage with or without wrapper leaves in a series of US trials according to GAP. The Meeting noted the analytical problems experienced in four trials from California where the LOD for parathion-methyl in samples including wrapper leaves was 0.5 mg/kg. In these trials oxydemeton-methyl had been applied to the crop as part of the normal insect control regime, and caused interference in the GLC analysis for parathion-methyl. US GAP requires a 21-days PHI for a final application rate of 1.1-1.7 kg ai/ha, and 7 days if the final application rate is 0.56 kg ai/ha.

Residues were not detected (<0.05 mg/kg) in 10 broccoli trials in accordance with US GAP. In two other trials residues of 0.05, 0.06 and 0.10 mg/kg were reported. The Meeting noted that paraoxon-methyl levels were of the same order as parathion-methyl levels in one broccoli trial.

The Meeting estimated maximum residue levels for cabbage and broccoli of 0.2 mg/kg parathion-methyl.

Sweet corn trials could not be evaluated because no GAP for sweet corn was available.

In reviewing the data on head lettuce, leaf lettuce and turnip greens, the Meeting noted that residue levels on the crops from most of the trials were below the LOD (0.05 mg/kg). However, trials in California on each of these crops produced much higher residues (1-2 mg/kg).

In 7 US trials on head lettuce, residues were not detected (<0.05 mg/kg) on lettuce with or without wrapper leaves when parathion-methyl was used according to GAP. In an eighth trial (from California) residues around 1 mg/kg were reported. Parathion-methyl was not detected (<0.05 mg/kg) in 5 of the 8 US trials on leaf lettuce. In 2 trials residues of 0.11 and 0.23 mg/kg were reported, and in the remaining trial (from California), 1.6 mg/kg. The Meeting was informed that all of the California trials, on both leaf and head lettuce, produced samples that were of small size and not of commercial quality. The interval between the final application and harvest was in December 1988 when prevailing conditions were cold and dry, which may explain the lack of normal growth. The Meeting decided to disregard the lettuce trials in California, because the lettuces were not representative of the commodity in commercial trade. There remained 5 valid trials on head lettuce and 6 on leaf lettuce.

The Meeting estimated a maximum residue level of 0.05* mg/kg for head lettuce and 0.5 mg/kg for leaf lettuce.

In 10 of the 14 trials on mustard greens parathion-methyl residues were not detected (<0.05 mg/kg). The highest residue was 0.51 mg/kg. US GAP requires a 21-day PHI if the final application rate is 1.1-1.7 kg ai/ha, and 7 days if the final application rate is 0.56 kg ai/ha. The Meeting estimated a maximum residue level of 0.5 mg/kg for mustard greens.

Parathion-methyl was not detected (<0.05 mg/kg) in 6 US trials on turnip greens according to GAP, but in a seventh trial (from California) residues of 1.8 mg/kg were reported. In 7 trials with a modified use pattern (final application 0.56 kg ai/ha with 7-day PHI) which is not GAP, residues from one Californian trial were 3.8 mg/kg, substantially higher than in the other 6 trials (<0.05 mg/kg to 0.91 mg/kg), supporting the validity of the residue found in the Californian trial which was according to GAP. The Meeting agreed that this residue was not an outlier and estimated a maximum residue level of 2 mg/kg for turnip greens.

In 8 of the US trials on spinach parathion-methyl was not detected (<0.05 mg/kg). In 5 of the remaining trials residues ranged from 0.05 to 0.09 mg/kg, and in the final one 0.30 mg/kg was recorded. US GAP requires a 21-day PHI for a final application rate of 1.1 kg ai/ha, and 15 days if the final application rate is 0.56 kg ai/ha. The Meeting estimated a maximum residue level of 0.5 mg/kg for spinach.

Snap beans and lima beans were considered together as they provided mutual support. Parathion-methyl was not detected (<0.05 mg/kg) in snap beans (whole pods) in 9 US trials according to GAP, nor in succulent whole pods of lima beans in 4 US trials. The Meeting estimated maximum residue levels for common beans and lima beans of 0.05* mg/kg as being a practical limit of determination.

In a series of US trials on dry beans residues were not detected (<0.05 mg/kg) 15 days after the application of parathion-methyl at 1.7 kg ai/ha. US GAP requires a 21-day PHI, but because residues were undetectable the Meeting was able to evaluate the data. The Meeting estimated a maximum residue level for dry beans of 0.05* mg/kg as being a practical limit of determination.

Parathion-methyl residues in dry peas ranged from not detected (<0.05 mg/kg) to 0.18 mg/kg in 8 US trials according to GAP. US GAP requires a 15-day PHI if the final application rate is 1.1 kg ai/ha, and 7 days if it is 0.56 kg ai/ha. The Meeting estimated a maximum residue level of 0.2 mg/kg for dry peas.

Residues were not detected (<0.05 mg/kg) in 5 of the 8 US trials on peas in pod. In the two Delaware trials residues of 0.21 and 0.68 mg/kg were recorded. The Meeting estimated a maximum residue level of 1 mg/kg for garden peas (young pods).

Data from 10 trials on soya beans in the USA could not be evaluated because the trial conditions did not match US GAP.

Residue levels between 0.2 and 0.8 mg/kg were consistently produced in a series of US trials on carrots. The Meeting estimated a maximum residue level of 1 mg/kg for carrots.

Even with exaggerated application rates parathion-methyl residues were not detected (<0.05 mg/kg) in potatoes in a series of US trials in 5 States. The Meeting estimated a maximum residue level for potatoes of 0.05* mg/kg as being a practical limit of determination.

In sugar beet also, exaggerated application rates of parathion-methyl did not produce detectable residues. The Meeting estimated a maximum residue level for sugar beet of 0.05* mg/kg as being a practical limit of determination.

In all 7 US trials on turnips where parathion-methyl was used according to GAP residues were not detected (<0.05 mg/kg). The Meeting estimated a maximum residue level for turnips of 0.05* mg/kg as being a practical limit of determination.

The application of parathion-methyl at 1.1 kg ai/ha to artichokes resulted in residues 7 days after the final application of 0.8 to 1.6 mg/kg in the 4 US trials. The Meeting estimated a maximum residue level of 2 mg/kg for artichokes.

Residue data were available for celery with and without foliage. Residue levels on celery stalks were somewhat lower than on the whole plant but the MRL is estimated on the commodity including foliage. In the 12 trials a number of residue values were reported in the 4-5 mg/kg range. The Meeting estimated a maximum residue level of 5 mg/kg for celery.

Supervised trials on maize from the USA could not be evaluated because the application rate in the trials was twice that permitted in US GAP.

Parathion-methyl residues in rice ranged from 0.2 to 2.3 mg/kg in 6 US trials where parathion-methyl was applied according to US GAP. Paraoxon-methyl residues in the same trials were in the range 0.08 to 0.23 mg/kg. The Meeting estimated a maximum residue level of 3 mg/kg for rice.

No information on GAP was available to evaluate supervised trials on sorghum from the USA.

Parathion-methyl residues in wheat ranged from undetectable (<0.05 mg/kg) to 5.1 mg/kg in a large series of supervised trials in the wheat-growing states of the USA. In the trials according to GAP many residues were undetectable, but more were in the 0.2-0.5 mg/kg range. Paraoxon-methyl residues were undetectable (<0.05 mg/kg) in most of the samples but ranged up to 0.49 mg/kg, which was found in the sample with the highest parathion-methyl residue. The Meeting estimated a maximum residue level of 5 mg/kg for wheat.

The highest residues in cotton seed were 1.2 and 1.4 mg/kg when parathion-methyl was used on cotton according to US GAP, but residues in cotton seed from 2 trials were undetectable (<0.05 mg/kg). The residues from one cotton variety in California appeared to be quite at variance with the residues from another variety in Texas. The Meeting considered that a total of four trials according to GAP were insufficient to make a recommendation.

Only 2 trials were available for the use of parathion-methyl on sunflower; residues in the sunflower seed were not detected (<0.05 mg/kg) as expected because of the long PHI, 30 days. However, the Meeting considered that 2 trials were insufficient to make a recommendation.

Residue data for green hops and dry hops were made available to the Meeting from a series of trials on parathion-methyl in 3 States of the USA. Parathion-methyl residues in green hops in trials according to GAP ranged up to 0.18 mg/kg, while in the dry hops the highest residues were 0.42, 0.49 and 0.99 mg/kg. The highest paraoxon-methyl residues in green and dry hops were 0.15 and 0.35 mg/kg respectively. The Meeting estimated a maximum residue level of 1 mg/kg for dry hops. The current CXL for dry hops, 0.05* mg/kg, was recommended for withdrawal by the 1992 JMPR.

Parathion-methyl residues were not detected (<0.05 mg/kg) in alfalfa seed in 4 US trials according to GAP. No MRL recommendation was made because alfalfa seed is not a listed Codex commodity.

Of the 7 supervised trials on clover forage according to US GAP, 5 appeared to be of one population with residues in the range <0.05 to 0.23 mg/kg while residues from the other two trials were in the range 2.5 to 6.5 mg/kg. All trials appeared to be valid. The Meeting estimated a maximum residue level of 10 mg/kg for clover.

The Meeting was provided with data from 6 supervised trials on bean forage according to US GAP. Parathion-methyl residue levels ranged from <0.05 to 0.66 mg/kg. Data for bean hay could not be evaluated because the interval between the final application and harvest was 15 days whereas the official PHI is 21 days for a 1.7 kg ai/ha application. The Meeting estimated a maximum residue level of 1 mg/kg for bean forage.

Extensive data were provided on parathion-methyl residues on pea forage from trials on dried peas and succulent peas. Residues were measured at 10, 15, 20 and 25 days after the final application, and in a number of cases residues were similar after these different intervals. The 112 valid results cover a very wide range, from <0.05 to 58 mg/kg.

The data appeared to consist of more than one population with 63 values up to 0.5 mg/kg and 43 values above 2 mg/kg. the Meeting noted that there had been contamination of some samples from the Delaware trials, which had provided the highest values. Further, although the PHIs for beans and peas are different, residues on forage should generally be similar for the same application rates, but residues on the pea forage were much higher. The Meeting noted that the US tolerance for garden pea forage is 1 mg/kg, and was reluctant to proceed with a recommendation before an explanation for the divergent data and the reasons for the US tolerance were sought. The data on pea straw and pea vines would also be considered when this further information could be reviewed.

Supervised trials on maize fodder and forage could not be evaluated because the application rate in the trials was higher than US GAP. Similarly, trials on sweet corn fodder and forage could not be evaluated because there is no current GAP for sweet corn and the application rates in the trial exceeded GAP application rates for maize.

In one trial on rice straw residues were recorded at 7.5 mg/kg, while in the other 3 trials residues were only up to 0.2 mg/kg. The Meeting estimated a maximum residue level of 10 mg/kg for rice straw and fodder. The estimate is supported by the estimate for wheat straw and fodder.

The results of trials on sorghum forage, fodder, hay and silage could not be evaluated because no GAP was available.

The highest parathion-methyl residues in wheat forage (6 US trials according to GAP), wheat hay (6 US trials according to GAP) and wheat straw (17 US trials according to GAP) were 1.5, 1.2 and 11 mg/kg respectively. Wheat forage is the part of the wheat plant above the ground. It has a typical moisture content of 75%. Wheat hay is produced by allowing the cut forage to dry for several days in the field after cutting and has a typical moisture content of 12%. Wheat straw (typical moisture 12%) is the remaining part of the wheat plant after the grain has been removed (threshed). The Meeting estimated a maximum residue level of 10 mg/kg for wheat straw and fodder.

Bluegrass hay, Bermuda grass hay and fescue hay were considered together. Residue data from 5 US trials on each under the same use conditions covered the same general range. The highest reported parathion-methyl residues in the three were 1.0, 1.6 and 2.5 mg/kg respectively. The Meeting estimated a maximum residue level of 5 mg/kg for the hay or fodder of grasses.

Parathion-methyl residues were undetectable (<0.05 mg/kg) in sugar beet fodder 60 days after the final application in 6 US trials. The Meeting estimated a maximum residue level for sugar beet leaves or tops of 0.05* mg/kg as being a practical limit of determination.

The metabolism studies on a lactating goat and laying hens suggest that parathion-methyl residues in animal tissues, milk and eggs will be low compared with residues in animal feed. The metabolism studies were not adequate to recommend MRLs for residues of parathion-methyl in animal commodities derived from residues in animal feeds. Animal transfer studies are needed before MRLs for animal commodities can be recommended.

Processing studies on maize, cotton seed, potatoes, sugar beet, snap beans, soya beans, rice and wheat were made available to the Meeting. In potatoes, sugar beet and snap beans, even exaggerated application rates did not produce detectable residues in the raw agricultural commodities. Parathion-methyl residues tended to be concentrated in the bran and oil fractions of processed commodities. Residue levels in flour and polished rice were less than in the raw grains. Processing did not apparently convert parathion-methyl to paraoxon-methyl.

Parathion-methyl levels were reduced by a factor of 4-5 in the production of brown rice (husked rice) from harvested rice grain. Much of the residue was retained by the rice hulls. Paraoxon-methyl levels in the brown rice were reduced below the LOD (0.05 mg/kg). Parathion-methyl levels were reduced further in the production of polished rice. On the basis of the residue reduction factor from the processing study and the estimated maximum residue level of 3 mg/kg for rice, the Meeting estimated a maximum residue level of 1 mg/kg for husked rice.

In wheat milling, parathion-methyl levels in bran were 1.9-2.4 times the level in the wheat, while levels in flour were close to 0.3 times the wheat levels. On the basis of the residue concentration factor for bran and the estimated maximum residue level of 5 mg/kg for wheat, the Meeting estimated a maximum residue level of 10 mg/kg for wheat bran.

The Meeting agreed that the residue should continue to be defined as parathion-methyl only. Paraoxon-methyl is usually a minor part of the residue and in many cases is not detectable. Paraoxon-methyl residue levels can be similar to parathion-methyl levels but usually only when residues are very low. Paraoxon-methyl need not be determined for monitoring pesticide use practices, but should preferably be determined when total diet studies are conducted.

Nitrophenol residues appear to be more persistent than those of parathion-methyl, and often exceed the parathion-methyl levels. Nitrophenol is not useful for monitoring use practices because it also arises from parathion.

RECOMMENDATIONS

The residue levels shown below are recommended for use as MRLs.

Definition of the residue: parathion-methyl.

Commodity		Recommended MRL (mg/kg)		PHI on which based, days
CCN	Name	New	Previous	
VS 0620	Artichoke, Globe	2	-	7
AL 1030	Bean forage (green)	1	-	21
VD 0071	Beans (dry)	0.05*	-	15
VB 0400	Broccoli	0.2	0.2[1]	7, 21
VB 0041	Cabbages, Head	0.2	0.2[1]	10, 21
VR 0577	Carrot	1	-	15
VS 0624	Celery	5	-	15, 22
AL 1023	Clover	10	-	15
VP 0526	Common bean (pods and/or immature seeds)	0.05*	-	21
VP 0528	Garden pea (young pods)	1	-	10, 15
AS 0162	Hay or fodder (dry) of grasses	5	-	15
DH 1100	Hops, dry	1	0.05*[2]	15
VL 0482	Lettuce, Head	0.05*	-	21
VL 0483	Lettuce, Leaf	0.5	-	21
VP 0534	Lima bean (young pods and/or immature beans)	0.05*	-	21
VL 0485	Mustard greens	0.5	-	10, 21
VD 0072	Peas (dry)	0.2	-	10, 15
VR 0589	Potato	0.05*	-	5
GC 0649	Rice	3	-	15
CM 0649	Rice, husked	1	-	
AS 0649	Rice straw and fodder, dry	10	-	15
VL 0502	Spinach	0.5	-	15, 21
VR 0596	Sugar beet	0.05*	0.05*[2]	20
AV 0596	Sugar beet leaves or tops	0.05*	-	60
VR 0506	Turnip, Garden	0.05*	-	15
VL 0506	Turnip greens	2	-	21
GC 0654	Wheat	5	-	15
CM 0654	Wheat bran, unprocessed	10	-	
AS 0654	Wheat straw and fodder, dry	10	-	14

* at or about the limit of determination [1]CXL for brassica recommended for withdrawal by 1992 JMPR
[2]CXL recommended for withdrawal by 1992 JMPR

FURTHER WORK OR INFORMATION

Desirable

1. Animal transfer studies.

REFERENCES

Blass, W. 1990. Modification of Method 00039/I44 (grapes, apples, apple sauce, pears). Method 00039/M003. Bayer AG, Germany. Unpublished.

Cañez, V.M. 1989a. The magnitude of methyl parathion residues on mustard greens. Project PAL-MP-MG (includes MP-MG-3101, MP-MG-3103, MP-MG-3104, MP-MG-3106, MP-MG-7080, MP-MG-7082, MP-MG-7084). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1989b. The magnitude of methyl parathion residues on bluegrass. Project PAL-MP-BL (includes MP-BL-3013, MP-BL-3016, MP-BL-7062, MP-BL-7063, MP-BL-7064). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1989c. The magnitude of methyl parathion residues on Bermuda grass. Project PAL-MP-BE (includes MP-BE-3009, MP-BE-3012, MP-BE-7059, MP-BE-7060, MP-BE-7061). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1989d. The magnitude of methyl parathion residues on potato and potato processed commodities. Study PAL-MP-PO (includes MP-PO-3122, MP-PO-3124, MP-PO-3125, MP-PO-3501, MP-PO-3502, MP-PO-7103, MP-PO-7105, MP-PO-7107). Pan-Agricultural Laboratories Inc, USA. Unpublished.

Cañez, V.M. 1989e. The magnitude of methyl parathion residues on fescue. Project PAL-MP-BO (includes MP-BO-3017, MP-BO-3020, MP-BO-7065, MP-BO-7066, MP-BO-7067). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1989f. The magnitude of methyl parathion residues on sunflower. Project PAL-MP-SS (includes MP-SS-7128, MP-SS-7129). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1989g. The magnitude of methyl parathion residues on spinach. Project PAL-MP-SP (includes MP-SP-3136, MP-SP-3138, MP-SP-3139, MP-SP-3141, MP-SP-3143, MP-SP-3187, MP-SP-7123). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990a. The magnitude of methyl parathion residues on dry beans. Project PAL-MP-DB (includes MP-DB-3072, MP-DB-3074, MP-DB-7001, MP-DB-7003, MP-DB-7005, MP-DB-7006). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990b. The magnitude of methyl parathion residues on broccoli. Project PAL-MP-BR (includes MP-BR-3021, MP-BR-3023, MP-BR-3024, MP-BR-3026, MP-BR-3028, MP-BR-3029). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990c. The magnitude of methyl parathion residues on green and bulb onions. Project PAL-MP-ON (includes MP-ON-3107, MP-ON-3108, MP-ON-3109, MP-ON-3110, MP-ON-3111, MP-ON-3112, MP-ON-3114, MP-ON-3115, MP-ON-7086, MP-ON-7087, MP-ON-7088). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990d. The magnitude of methyl parathion residues on sorghum. Project PAL-MP-SG (includes MP-

SG-3133, MP-SG-3173, MP-SG-3174, MP-SG-3175, MP-SG-7111, MP-SG-7112, MP-SG-7113, MP-SG-7114, MP-SG-7115, MP-SG-7116). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990e. The magnitude of methyl parathion residues on cabbage. Project PAL-MP-CB (includes MP-CB-3031, MP-CB-3033, MP-CB-3034, MP-CB-7018, MP-CB-7020, MP-CB-7022, MP-CB-7024, MP-CB-7025). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990f. The magnitude of methyl parathion residues on clover forage. Project PAL-MP-CL-F (includes MP-CL-3036, MP-CL-3038, MP-CL-3041, MP-CL-3180, MP-CL-7036, MP-CL-7038, MP-CL-7040). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990g. The magnitude of methyl parathion residues on lima beans. Project PAL-MP-LB (includes MP-LB-3081, MP-LB-3083, MP-LB-7008, MP-LB-7010). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990h. The magnitude of methyl parathion residues on carrot. Project PAL-MP-CT (includes MP-CT-3058, MP-CT-3060, MP-CT-3061, MP-CT-3063, MP-CT-3064, MP-CT-7027). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990i. The magnitude of methyl parathion residues on soya bean. Project PAL-MP-SY (includes MP-SY-7117, MP-SY-7118, MP-SY-7119, MP-SY-7120, MP-SY-7121, MP-SY-7122). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990j. The magnitude of methyl parathion residues on cottonseed. Project PAL-MP-CS (includes MP-CS-3052, MP-CS-3054, MP-CS-3055, MP-CS-3057). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990k. The magnitude of methyl parathion residues on sugarbeet and sugarbeet processed commodities. Study PAL-MP-SB (includes MP-SB-3144, MP-SB-3146, MP-SB-3148, MP-SB-3186, MP-SB-3503, MP-SB-3504, MP-SB-7124, MP-SB-7126). Pan-Agricultural Laboratories Inc, USA. Unpublished.

Cañez, V.M. 1990l. The magnitude of methyl parathion residues on soya bean and soya bean processed commodities. Study PAL-MP-SY-P (includes MP-SY-2101, MP-SY-2102). Pan-Agricultural Laboratories Inc, USA. Unpublished.

Cañez, V.M. 1990m. The magnitude of methyl parathion residues on head and leaf lettuce. Project PAL-MP-LE (includes MP-LE-3089, MP-LE-3091, MP-LE-3092, MP-LE-3093, MP-LE-3094, MP-LE-3095, MP-LE-3097, MP-LE-3098, MP-LE-3099, MP-LE-7068, MP-LE-7070, MP-LE-7072, MP-LE-7074, MP-LE-7076, MP-LE-7078). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990n. The magnitude of methyl parathion residues on succulent and dried peas. Project PAL-MP-PE (includes MP-PE-7089, MP-PE-7091, MP-PE-7093, MP-PE-7095, MP-PE-7096, MP-PE-7098, MP-PE-7100, MP-PE-7102). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990o. The magnitude of methyl parathion residues on alfalfa seed. Project PAL-MP-AF (includes MP-AF-3001, MP-AF-3003, MP-AF-3004, MP-AF-3006). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990p. The magnitude of methyl parathion residues on turnip. Amended report. Project PAL-MP-TU (includes MP-TU-3149, MP-TU-3151, MP-TU-3152, MP-TU-3154, MP-TU-3155, MP-TU-7130, MP-TU-7132). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990q. The magnitude of methyl parathion residues on rice. Project PAL-MP-RI (includes MP-RI-3131, MP-RI-3132, MP-RI-7109, MP-RI-7110). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990r. The magnitude of methyl parathion residues on celery. Amended report. Project PAL-MP-CY (includes MP-CY-3066, MP-CY-3067, MP-CY-3068, MP-CY-3070, MP-CY-7029, MP-CY-7031, MP-CY-7033, MP-CY-7035). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cañez, V.M. 1990s. The magnitude of methyl parathion residues on artichoke. Amended report. Project PAL-MP-AR (includes MP-AR-3176, MP-AR-3178). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Cone, W., Anderson, D. and Dorschner, K. 1992. Methyl parathion in hops. Minor use pesticide project PR 4142, trials 90:WA:015, 90:OR:017, 90:ID:005. Washington State Department of Agriculture, USA. Unpublished.

Davis, C.W. 1992. Storage stability of methyl parathion and its metabolite residues in various matrices. ADC Report 1114-12. Analytical Development Corporation, USA. Unpublished.

FDA. 1993. FDA Monitoring Program. *J. Assoc. Off. Analyt. Chem. Internat.* 76, 127A-148A.

Gillard, D.F. 1989. The determination of methyl parathion and its principal metabolites, methyl paraoxon and p-nitrophenol residues in crops by gas chromatography and high performance liquid method. Study HAS A031.001. Huntingdon Analytical Services, USA. Unpublished.

Gillard, D.F. 1992. Storage stability of methyl parathion and its metabolite residues in various matrices. HAS Study A031.002. Huntington Analytical Services, USA. Unpublished.

Jelinek, C.F. 1992. Assessment of dietary intake of chemical contaminants. Joint UNEP/FAO/WHO Food Contamination Monitoring and Assessment Programme (GEMS/Food). Document WHO/HPP/FOS/92.6 UNEP/GEMS/92.F2.

Jones, P.A. and Jellinek, S.D. 1990a. The magnitude of methyl parathion residues in green and bulb onions. Project PAL-MP-ON (includes MP-ON-3113). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

Jones, P.A. and Jellinek, S.D. 1990b. The magnitude of methyl parathion residues on lettuce. Study MP-LE-3192. Pan-Agricultural Laboratories, Inc. USA. Unpublished.

LeRoy, R.L. 1990a. The magnitude of methyl parathion residues on snap bean and snap bean processed commodities. Study PAL-MP-LB (includes MP-LB-3084, MP-LB-3086, MP-LB-3087, MP-LB-3508, MP-LB-3509, MP-LB-7011, MP-LB-7013, MP-LB-7015, MP-LB-7016). Pan-Agricultural Laboratories Inc, USA. Unpublished.

LeRoy, R.L. 1990b. The magnitude of methyl parathion residues on rice processed commodities. Study PAL-MP-RI-P (includes MP-RI-3514, MP-RI-3515). Pan-Agricultural Laboratories Inc, USA. Unpublished.

LeRoy, R.L. 1990c. The magnitude of methyl parathion residues on field corn. Amended report. Project PAL-MP-CN (includes MP-CN-3043, MP-CN-3045, MP-CN-3169, MP-CN-3170, MP-CN-3171, MP-CN-3183, MP-CN-3512, MP-CN-3524, MP-CN-7042, MP-CN-7043, MP-CN-7044, MP-CN-7045, MP-CN-7046, MP-CN-7047, MP-CN-7048, MP-CN-7049, MP-CN-7050, MP-CN-7051, MP-CN-7052, MP-CN-7053, MP-CN-7054, MP-CN-7055). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

LeRoy, R.L. 1990d. The magnitude of methyl parathion residues on sweet corn. Project PAL-MP-CN (includes MP-CN-3050, MP-CN-3185, MP-CN-7056, MP-CN-7057, MP-CN-7058). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

LeRoy, R.L. 1990e. The magnitude of methyl parathion residues on sweet corn. Amended report. Project PAL-MP-CN (includes MP-CN-3047, MP-CN-3049, MP-CN-3050, MP-CN-3185, MP-CN-7056, MP-CN-7057, MP-CN-7058). Pan-Agricultural Laboratories, Inc. USA. Unpublished.

LeRoy, R.L. 1990f. The magnitude of methyl parathion residues on field corn processed commodities. Study PAL-MP-CN-P (includes MP-CN-3512, MP-CN-3524). Pan-Agricultural Laboratories Inc, USA. Unpublished.

LeRoy, R.L. 1990g. The magnitude of methyl parathion residues on cottonseed and cottonseed processed commodities. Study PAL-MP-CS-P (includes MP-CS-3522, MP-CS-3523). Pan-Agricultural Laboratories Inc, USA. Unpublished.

LeRoy, R.L. 1990h. The magnitude of methyl parathion residues on wheat and wheat processed commodities. Study PAL-MP-WH-P (includes MP-WH-2103, MP-WH-3157, MP-WH-3159, MP-WH-3161, MP-WH-3165, MP-WH-3181, MP-WH-3182, MP-WH-3520, MP-WH-7134, MP-WH-7136, MP-WH-7138, MP-WH-7140, MP-WH-7142, MP-WH-7143, MP-WH-7145, MP-WH-7147, MP-WH-7149). Pan-Agricultural Laboratories Inc, USA.

Unpublished.

Linke, P. 1988. [14]C-methylparathion: metabolism in lettuce (bound residues). Bayer-PF Report 3032. Project M 1730235-1. Bayer AG, Germany. Unpublished.

Linke, P. and Brauner, A. 1988. Parathion-methyl: metabolism in potatoes. Bayer-PF report 3049, laboratory project M 173 0 193-4. Bayer AG, Germany. Unpublished.

Linke, P., Bornatsch, A., Brauner, A. and Neitzel, H. 1988. Metabolism of [phenyl-UL-[14]C]parathion-methyl in cotton seeds and leaves. Bayer-PF Report 3037. Project M 1730198-9, M 1730215-9, M 173043-8. Bayer AG, Germany. Unpublished.

Möllhoff, E. 1968. Contribution to the question of residues and their determination in plants treated with ®E 605 and ®Agritox. Method 00032/I 104; English translation from: Pflanzenschutz-Nachrichten Bayer 21/1968, 3, pp 348-351. Bayer AG, Germany.

Möllhoff, E. 1969/72/74. Parathion-methyl: gas chromatographic determination in soil, fruit, cereals, vegetables, tea. DFG-method 88-B (Bayer internal method I44/00039), original German version from Rückstandsanalytik von Pflanzenschutzmitteln, Verlag Chemie GmbH, Weinheim/Bergstr., Germany.

Ritter, A. 1988. [14]C-parathion-methyl: plant metabolism study with lettuce in the greenhouse in accordance with the EPA pesticide assessment guidelines. RCC project 092114. RCC Umweltchemie AG, Switzerland. Unpublished.

Schmidt, B. 1992a. Synopsis and evaluation of the residue behaviour of ME 605 wettable powder in pome fruit (apples and pears). Report PF-3710 (includes 0645-90, 0646-90, 0647-90, 0648-90). Bayer AG, Germany. Unpublished.

Schmidt, B. 1992b. Synopsis and evaluation of the residue behaviour of ME 605 wettable powder in grapes. Report PF-3704 (includes 0649-90, 0650-90, 0651-90, 0652-90). Bayer AG, Germany. Unpublished.

Seym, M. 1991. Modification of method 00039/I44 (grapes). Method 00039/M004. Bayer AG, Germany. Unpublished.

Stenhouse, F. 1992 Australian Market Basket Survey. National Food Authority. Australian Government Publishing Service, Canberra, Australia.

Van Dijk, A. 1988a. [14]C-Parathion-methyl: metabolism, absorption, distribution and excretion after repeated oral administration to laying hens. RCC project 091798. RCC Umweltchemie AG, Switzerland. Unpublished.

Van Dijk, A. 1988b. [14]C-Parathion-methyl: metabolism, absorption, distribution and excretion after repeated oral administration to a lactating goat. RCC project 091585. RCC Umweltchemie AG, Switzerland. Unpublished.

Wassell, W.D. and Gilles, C. 1991. Storage stability of methyl parathion and its metabolite residues in various matrices. Amended report. Studies 88-019-01A to 88-019-01E. Biospherics Inc., USA. Unpublished.

Worthing, C.R. (ed). 1987. The Pesticide Manual. Eighth edition. British Crop Protection Council, UK.

Cross-index of report numbers, study numbers and references.

Reports and studies are listed in numerical and alphabetical order, and each is linked to a reference.

0645-90 Schmidt 1992a
0646-90 Schmidt 1992a
0647-90 Schmidt 1992a
0648-90 Schmidt 1992a
0649-90 Schmidt 1992b
0650-90 Schmidt 1992b
0651-90 Schmidt 1992b
0652-90 Schmidt 1992b
091585 Van Dijk 1988b
091798 Van Dijk 1988a
092114 Ritter 1988
1114-12 Davis 1992
3032 Linke 1988
3037 Linke *et al* 1988
3049 Linke and Brauner 1988
88-019-01 Wassell and Gilles 1991
90:ID:005 Cone *et al* 1992
90:OR:017 Cone *et al* 1992
90:WA:015 Cone *et al* 1992
A031.001 Gillard 1989
A031.002 Gillard 1992
KvW 259 Dornseiffen and Enzler 1987
KvW 260 Dornseiffen *et al* 1987
M1730193-4 Linke and Brauner 1988
M1730198-9 Linke *et al* 1988
M1730215-9 Linke *et al* 1988
M1730235-1 Linke 1988
M173043-8 Linke *et al* 1988
MP-AF-3001 Cañez 1990o
MP-AF-3003 Cañez 1990o
MP-AF-3004 Cañez 1990o
MP-AF-3006 Cañez 1990o
MP-AR-3176 Cañez 1990s
MP-AR-3178 Cañez 1990s
MP-BE-3009 Cañez 1989c
MP-BE-3012 Cañez 1989c
MP-BE-7059 Cañez 1989c
MP-BE-7060 Cañez 1989c
MP-BE-7061 Cañez 1989c
MP-BL-3013 Cañez 1989b
MP-BL-3016 Cañez 1989b
MP-BL-7062 Cañez 1989b
MP-BL-7063 Cañez 1989b
MP-BL-7064 Cañez 1989b
MP-BO-3017 Cañez 1989e
MP-BO-3020 Cañez 1989e
MP-BO-7065 Cañez 1989e
MP-BO-7066 Cañez 1989e
MP-BO-7067 Cañez 1989e
MP-BR-3021 Cañez 1990b
MP-BR-3023 Cañez 1990b
MP-BR-3024 Cañez 1990b
MP-BR-3026 Cañez 1990b
MP-BR-3028 Cañez 1990b
MP-BR-3029 Cañez 1990b
MP-CB-3031 Cañez 1990e
MP-CB-3033 Cañez 1990e
MP-CB-3034 Cañez 1990e
MP-CB-7018 Cañez 1990e
MP-CB-7020 Cañez 1990e
MP-CB-7022 Cañez 1990e
MP-CB-7024 Cañez 1990e
MP-CB-7025 Cañez 1990e
MP-CL-3036 Cañez 1990f
MP-CL-3038 Cañez 1990f
MP-CL-3041 Cañez 1990f
MP-CL-3180 Cañez 1990f
MP-CL-7036 Cañez 1990f
MP-CL-7038 Cañez 1990f
MP-CL-7040 Cañez 1990f
MP-CN-3043 LeRoy 1990c
MP-CN-3045 LeRoy 1990c
MP-CN-3047 LeRoy 1990e
MP-CN-3049 LeRoy 1990e
MP-CN-3050 LeRoy 1990d
MP-CN-3050 LeRoy 1990e
MP-CN-3169 LeRoy 1990c
MP-CN-3170 LeRoy 1990c
MP-CN-3171 LeRoy 1990c
MP-CN-3183 LeRoy 1990c
MP-CN-3185 LeRoy 1990d
MP-CN-3185 LeRoy 1990e
MP-CN-3512 LeRoy 1990c
MP-CN-3512 LeRoy 1990f
MP-CN-3524 LeRoy 1990c
MP-CN-3524 LeRoy 1990f
MP-CN-7042 LeRoy 1990c
MP-CN-7043 LeRoy 1990c
MP-CN-7044 LeRoy 1990c
MP-CN-7045 LeRoy 1990c
MP-CN-7046 LeRoy 1990c
MP-CN-7047 LeRoy 1990c
MP-CN-7048 LeRoy 1990c
MP-CN-7049 LeRoy 1990c
MP-CN-7050 LeRoy 1990c
MP-CN-7051 LeRoy 1990c
MP-CN-7052 LeRoy 1990c
MP-CN-7053 LeRoy 1990c
MP-CN-7054 LeRoy 1990c
MP-CN-7055 LeRoy 1990c
MP-CN-7056 LeRoy 1990d
MP-CN-7056 LeRoy 1990e
MP-CN-7057 LeRoy 1990d
MP-CN-7057 LeRoy 1990e
MP-CN-7058 LeRoy 1990d
MP-CN-7058 LeRoy 1990e
MP-CS-3052 Cañez 1990j
MP-CS-3054 Cañez 1990j
MP-CS-3055 Cañez 1990j
MP-CS-3057 Cañez 1990j
MP-CS-3522 LeRoy 1990g
MP-CS-3523 LeRoy 1990g
MP-CT-3058 Cañez 1990h
MP-CT-3060 Cañez 1990h
MP-CT-3061 Cañez 1990h
MP-CT-3063 Cañez 1990h
MP-CT-3064 Cañez 1990h
MP-CT-7027 Cañez 1990h
MP-CY-3066 Cañez 1990r
MP-CY-3067 Cañez 1990r
MP-CY-3068 Cañez 1990r
MP-CY-3070 Cañez 1990r
MP-CY-7029 Cañez 1990r
MP-CY-7031 Cañez 1990r
MP-CY-7033 Cañez 1990r
MP-CY-7035 Cañez 1990r
MP-DB-3072 Cañez 1990a
MP-DB-3074 Cañez 1990a
MP-DB-7001 Cañez 1990a
MP-DB-7003 Cañez 1990a
MP-DB-7005 Cañez 1990a
MP-DB-7006 Cañez 1990a
MP-LB-3081 Cañez 1990g
MP-LB-3083 Cañez 1990g
MP-LB-3084 LeRoy 1990a
MP-LB-3086 LeRoy 1990a
MP-LB-3087 LeRoy 1990a
MP-LB-3508 LeRoy 1990a
MP-LB-3509 LeRoy 1990a
MP-LB-7008 Cañez 1990g
MP-LB-7010 Cañez 1990g
MP-LB-7011 LeRoy 1990a
MP-LB-7013 LeRoy 1990a
MP-LB-7015 LeRoy 1990a
MP-LB-7016 LeRoy 1990a
MP-LE-3089 Cañez 1990m
MP-LE-3091 Cañez 1990m
MP-LE-3092 Cañez 1990m
MP-LE-3093 Cañez 1990m
MP-LE-3094 Cañez 1990m
MP-LE-3095 Cañez 1990m
MP-LE-3097 Cañez 1990m
MP-LE-3098 Cañez 1990m
MP-LE-3099 Cañez 1990m
MP-LE-3192 Jones and Jellinek 1990b
MP-LE-7068 Cañez 1990m
MP-LE-7070 Cañez 1990m
MP-LE-7072 Cañez 1990m
MP-LE-7074 Cañez 1990m
MP-LE-7076 Cañez 1990m
MP-LE-7078 Cañez 1990m
MP-MG-3101 Cañez 1989a
MP-MG-3103 Cañez 1989a
MP-MG-3104 Cañez 1989a
MP-MG-3106 Cañez 1989a
MP-MG-7080 Cañez 1989a
MP-MG-7082 Cañez 1989a
MP-MG-7084 Cañez 1989a
MP-ON-3107 Cañez 1990c
MP-ON-3108 Cañez 1990c
MP-ON-3109 Cañez 1990c

MP-ON-3110 Cañez 1990c
MP-ON-3111 Cañez 1990c
MP-ON-3112 Cañez 1990c
MP-ON-3113 Jones and Jellinek 1990a
MP-ON-3114 Cañez 1990c
MP-ON-3115 Cañez 1990c
MP-ON-7086 Cañez 1990c
MP-ON-7087 Cañez 1990c
MP-ON-7088 Cañez 1990c
MP-PE-7089 Cañez 1990n
MP-PE-7091 Cañez 1990n
MP-PE-7093 Cañez 1990n
MP-PE-7095 Cañez 1990n
MP-PE-7096 Cañez 1990n
MP-PE-7098 Cañez 1990n
MP-PE-7100 Cañez 1990n
MP-PE-7102 Cañez 1990n
MP-PO-3122 Cañez 1989d
MP-PO-3124 Cañez 1989d
MP-PO-3125 Cañez 1989d
MP-PO-3501 Cañez 1989d
MP-PO-3502 Cañez 1989d
MP-PO-7103 Cañez 1989d
MP-PO-7105 Cañez 1989d
MP-PO-7107 Cañez 1989d
MP-RI-3131 Cañez 1990q
MP-RI-3132 Cañez 1990q
MP-RI-3514 LeRoy 1990b
MP-RI-3515 LeRoy 1990b
MP-RI-7109 Cañez 1990q
MP-RI-7110 Cañez 1990q
MP-SB-3144 Cañez 1990k
MP-SB-3146 Cañez 1990k
MP-SB-3148 Cañez 1990k
MP-SB-3186 Cañez 1990k
MP-SB-3503 Cañez 1990k
MP-SB-3504 Cañez 1990k
MP-SB-7124 Cañez 1990k
MP-SB-7126 Cañez 1990k
MP-SG-3133 Cañez 1990d
MP-SG-3173 Cañez 1990d
MP-SG-3174 Cañez 1990d
MP-SG-3175 Cañez 1990d
MP-SG-7111 Cañez 1990d
MP-SG-7112 Cañez 1990d
MP-SG-7113 Cañez 1990d
MP-SG-7114 Cañez 1990d
MP-SG-7115 Cañez 1990d
MP-SG-7116 Cañez 1990d
MP-SP-3136 Cañez 1989g
MP-SP-3138 Cañez 1989g
MP-SP-3139 Cañez 1989g
MP-SP-3141 Cañez 1989g
MP-SP-3143 Cañez 1989g
MP-SP-3187 Cañez 1989g
MP-SP-7123 Cañez 1989g
MP-SS-7128 Cañez 1989f
MP-SS-7129 Cañez 1989f
MP-SY-2101 Cañez 1990l
MP-SY-2102 Cañez 1990l
MP-SY-7117 Cañez 1990i
MP-SY-7118 Cañez 1990i
MP-SY-7119 Cañez 1990i
MP-SY-7120 Cañez 1990i
MP-SY-7121 Cañez 1990i
MP-SY-7122 Cañez 1990i
MP-TU-3149 Cañez 1990p
MP-TU-3151 Cañez 1990p
MP-TU-3152 Cañez 1990p
MP-TU-3154 Cañez 1990p
MP-TU-3155 Cañez 1990p
MP-TU-7130 Cañez 1990p
MP-TU-7132 Cañez 1990p
MP-WH-2103 LeRoy 1990h
MP-WH-3157 LeRoy 1990h
MP-WH-3159 LeRoy 1990h
MP-WH-3161 LeRoy 1990h
MP-WH-3165 LeRoy 1990h
MP-WH-3181 LeRoy 1990h
MP-WH-3182 LeRoy 1990h
MP-WH-3520 LeRoy 1990h
MP-WH-7134 LeRoy 1990h
MP-WH-7136 LeRoy 1990h
MP-WH-7138 LeRoy 1990h
MP-WH-7140 LeRoy 1990h
MP-WH-7142 LeRoy 1990h
MP-WH-7143 LeRoy 1990h
MP-WH-7145 LeRoy 1990h
MP-WH-7147 LeRoy 1990h
MP-WH-7149 LeRoy 1990h
PAL-MP-AF Cañez 1990o
PAL-MP-AR Cañez 1990s
PAL-MP-BE Cañez 1989c
PAL-MP-BL Cañez 1989b
PAL-MP-BO Cañez 1989e
PAL-MP-BR Cañez 1990b
PAL-MP-CB Cañez 1990e
PAL-MP-CL-F Cañez 1990f
PAL-MP-CN LeRoy 1990c
PAL-MP-CN LeRoy 1990d
PAL-MP-CN LeRoy 1990e
PAL-MP-CN-P LeRoy 1990f
PAL-MP-CS Cañez 1990j
PAL-MP-CS-P LeRoy 1990g
PAL-MP-CT Cañez 1990h
PAL-MP-CY Cañez 1990r
PAL-MP-DB Cañez 1990a
PAL-MP-LB Cañez 1990g
PAL-MP-LB LeRoy 1990a
PAL-MP-LE Cañez 1990m
PAL-MP-MG Cañez 1989a
PAL-MP-ON Cañez 1990c
PAL-MP-ON Jones and Jellinek 1990a
PAL-MP-PE Cañez 1990n
PAL-MP-PO Cañez 1989d
PAL-MP-RI Cañez 1990q
PAL-MP-RI-P LeRoy 1990b
PAL-MP-SB Cañez 1990k
PAL-MP-SG Cañez 1990d
PAL-MP-SP Cañez 1989g
PAL-MP-SS Cañez 1989f
PAL-MP-SY Cañez 1990i
PAL-MP-SY-P Cañez 1990l
PAL-MP-TU Cañez 1990p
PAL-MP-WH-P LeRoy 1990h
PF-3704 Schmidt 1992b
PF-3710 Schmidt 1992a
PR 4142 Cone *et al* 1992