MEVINPHOS (053)

EXPLANATION

Mevinphos was first evaluated toxicologically in 1965 and for residues in 1972. Since the ADI was established before 1976, it is included in the CCPR periodic review programme (ALINORM 89/24A, para 299; appendix V). The 1991 CCPR scheduled the review for 1996 JMPR on the basis of the availability of new residue and toxicological data (ALINORM 91/24A para 316; Appendix IV, para 11). The residue review was postponed to 1997 by the 1995 CCPR (ALINORM 95/24A, Appendix IV).

Studies on animal and plant metabolism and environmental fate, information on analytical methods and updated GAP, reports of supervised residue trials on vegetables, fruit, pulses and tobacco, and information on residues after storage and processing were supplied by the manufacturer.

Information on national MRLs and GAP and data from residue trials were supplied variously by the governments of The Netherlands, Australia, Norway and Thailand. The Netherlands also provided information on analytical methods and residues found in food monitoring. The government of Germany informed the Meeting that the use of mevinphos is not authorized in Germany.

IDENTITY

ISO common name: mevinphos

Chemical name

IUPAC: 2-methoxycarbonyl-1-methylvinyl dimethyl phosphate, methyl 3-(dimethoxyphosphinyloxy)but-2-enoate

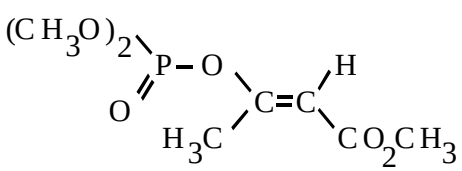
CA: methyl 3-[(dimethoxyphosphinyl)oxy]-2-butenoate

CAS No: 7786-34-7 ((*Z*)- + (*E*)- isomers)
338-45-4 ((*Z*)- isomer)
26718-65-0 ((*E*)- isomer, formerly 298-01-1)

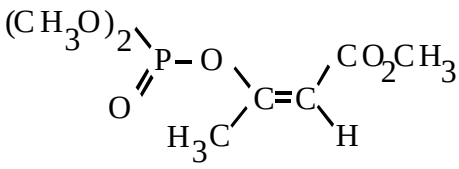
Synonyms: “Phosdrin” (trade name)

Structural formula:

(*E*)-mevinphos



(*Z*)-mevinphos



Molecular formula: $C_7H_{13}O_6P$
Molecular weight: 224.1

Physical and chemical properties

Pure active ingredient

Vapour pressure:	0.0029 mm Hg at 25°C ((*E*)- isomer)
	0.00074 mm Hg at 25°C ((*Z*)- isomer)
Octanol/water partition coefficient:	31.6 Log P_{ow} 1.50 ((*E*)- isomer)
	10.0 Log P_{ow} 1.00 ((*Z*)- isomer)
Henry's law constant:	1.99 x 10-6 m3 atm/mole at 25°C

Technical material

Composition:	(*E*)-mevinphos 63%
	(*Z*)-mevinphos 25%
	Impurities 12%
Colour:	Light yellow to orange
Physical state:	Liquid at 20°C
Density:	1.225 at 24.2°C
Odour:	Little or no odour at room temperature
Melting range:	Not applicable
Boiling point:	98.9-103.3°C at 0.03 mm Hg
Solubility:	Miscible in all the following
	Water
	Acetone
	Benzene
	Carbon tetrachloride
	Chloroform
	Ethanol
	Methanol
	Propan-1-ol
	Toluene
	Xylene
	Insoluble in hexane
pH:	3.2-3.5 (0.25% solution)
Stability	Stable for 40 months at ambient temperature in sealed bottle
	Metal and/or metal ions have no effect on the stability

Formulations

Mevinphos is formulated as an emulsifiable concentrate (EC) or soluble concentrate (SL). The following products are currently used.

Product name:	Phosdrin IPA4
Formulation type:	SL
Solvent:	isopropyl alcohol
(*E*)- isomer content:	31.5%
(*Z*)- isomer content:	12.5%

Product name:	Phosdrin 4EC
Formulation type:	EC
Solvent:	aromatic solvent
(*E*)- isomer content:	30.4%
(*Z*)- isomer content:	12.1%

Product name:	Phosdrin 1110g/l
Formulation type:	SL
Solvent:	water
(*E*)- isomer content:	63%
(*Z*)- isomer content:	25%

METABOLISM AND ENVIRONMENTAL FATE

Animal metabolism

Studies of animal metabolism have been conducted on rats, cows, goats and hens with unlabelled, ^{32}P-labelled and ^{14}C-labelled mevinphos. The results show that mevinphos is rapidly absorbed, metabolized and excreted. Neither mevinphos nor its metabolites accumulated in the tissues.

Rats. Male and female Sprague-Dawley rats were treated orally with single doses of [*vinyl*-1-^{14}C] mevinphos, 87% (*E*)- isomer, 11% (*Z*)- isomer, at 0.15 mg/kg bw and 1.5 mg/kg bw, and multiple doses of 0.15 mg/kg bw (15 days of unlabelled followed by one day of labelled mevinphos), and intravenously with a single dose of 0.15 mg/kg bw (Reddy *et al*., 1991).

With the single low oral dose (0.15 mg/kg) the exhaled $^{14}CO_2$ averaged 77.3% of the dose in males and 78.4% in females, with 60.2% and 64.9% of the dose respectively exhaled within the first 2 hours. Only trace amounts of ^{14}C were eliminated as other volatile compounds by both male and female rats. The excretion of radioactivity in the urine was 13.6% and 14.5% by males and females respectively in 24 hours, with 12.4% and 11.8 respectively excreted within 8 hours and only minimal amounts between 8 and 24 hours. Faecal elimination of radioactivity between 0 and 24 hours was low in both males and females (1.2% and 1.4%).

In the high (1.5 mg/kg) dose rats the elimination of radioactivity in the expired air averaged 61.5% in males and 61.9% in females, with 61.4% and 61.7% of the dose exhaled as ^{14}C, most of it within 6 hours (58% by both male and females). The excretion of radioactivity in the urine was higher than in the 0.15 mg/kg group, 23.3% and 23.5% by male and female rats respectively. Most of this was eliminated within 8 hours. Small amounts of radioactivity, representing 1.3% and 1% of the administered dose in males and females respectively, were recovered from the faeces within 24 hours.

The rats treated with the series of daily oral doses of 0.15 mg/kg excreted 75% and 77.5% (males and females respectively) in the expired air, similar proportions to the single oral low-dose group. Virtually all of this (75% and 77.4%) was exhaled as $^{14}CO_2$. The excretion of radioactivity in the urine in 24 hours was 16% and 19% of the dose by male and female rats respectively, and the faecal elimination 1% and 0.7%.

After the i.v. administration of 0.15 mg/kg of [^{14}C]mevinphos the elimination of radioactivity in the exhaled air was similar to that in the single and multiple low oral dosage groups; 71.3% and 71.1%

was exhaled as $^{14}CO_2$ by males and females respectively, with trace amounts as other volatile compounds (0.07% and 0.05%). The urinary excretion of ^{14}C was also similar to that in the oral low dosage groups and averaged 16.1% and 17.4% of the dose by male and female rats respectively in 24 hours, approximately 15% of it in 8 hours.

The distribution of radioactivity in the blood and tissues after 24 hours was found to be similar in all the groups. Its total recovery from the tissues ranged from 5.4% to 7.5%. In both male and female rats the highest concentrations in all groups were found in the skin (2.4-3.0% in males and 1.9-2.2% in females) and bone (0.8-1.2% in males and 0.7-1.2% in females) The RBC and plasma levels were 0.3-0.4% in males and 0.2-0.4% in females, and the fat of both males and females contained 0.4-0.6%. Very low amounts of radioactivity were recovered from the other tissues and carcass.

Three of the four major radioactive peaks or areas separated by HPLC or TLC of urine extracts were identified as the (*E*)- isomers of mevinphos, mevinphos acid and demethyl-mevinphos. The fourth, polar, concentration of ^{14}C was not identified and may have included several components.

A representative metabolic profile from urine from the singe oral high-dose group is shown in Table 1.

Table 1. Mevinphos and its metabolites in rat urine collected 0 to 8 hours after oral administration of [^{14}C]mevinphos.

	^{14}C in urine as % of administered dose	% of total ^{14}C in urine (mean of 2 or 3 rats) found as			
		M 1	M 2	M 3	M 4
Male	22.0	19.8	25.9	24.2	13.7
Female	21.9	21.1	26.7	29.1	9.9

M1: Unidentified HPLC peak.
M2: HPLC retention matched (*E*)-demethyl-mevinphos.
M3: HPLC retention matched (*E*)-mevinphos acid.
M4: HPLC retention matched (*E*)-mevinphos.

Cows. Twelve lactating cows were dosed for 12 weeks with unlabelled mevinphos (65% (*E*)-isomer, 34% (*Z*)- isomer) at levels equivalent to 0, 1, 5 and 20 ppm in the diet on a dry matter basis by capsule (Casida *et al*., 1958). Two other lactating cows were dosed by capsule with [^{32}P]-labelled mevinphos (57.7% (*E*)-isomer, 14.9% (*Z*)- isomer, 27% impurities). One cow received a single dose of 2.0 mg/kg bw and was maintained for 1 week to study the fate of the pesticide. The second cow was dosed with 1.0 mg/kg bw per day for a week.

The anticholinesterase activities in the milk, fat, liver, kidney, muscle, heart and brain of the cows receiving up to 20 ppm mevinphos for 12 weeks corresponded to less than 0.03 mg/kg mevinphos equivalents at all dose levels throughout the dosing period.

Milk from the cow which received the single dose of [^{32}P]mevinphos contained a maximum of 0.062 mg/kg mevinphos equivalents of organosoluble radioactive material at 6 hours after administration, which decreased to below 0.007 mg/kg after 96-108 hours.

Milk from the cow dosed for 7 days with [^{32}P]mevinphos contained about 0.05 mg/kg organosoluble radioactive material from 6 hours to 7 days after the first dose.

Excretion in the faeces and urine accounted for 77% of the single dose of [^{32}P]mevinphos. Over half of this was excreted in the urine within the first 12 hours. A similar initial excretion was found with the cow dosed for 7 days.

Goats. Two lactating goats were dosed by gelatine capsules with [*vinyl*-1-^{14}C]mevinphos, 85% (*E*)- and 15% (*Z*)- isomers, for 6 successive days at a level equivalent to 18.0 or 2.9 ppm in the feed (Craine, 1992). Milk was collected twice daily, in the morning before the daily dose and in the evening, 8 hours after dosing. The repeated treatment did not affect milk production. Urine was also collected as daytime fractions (for 8 hours after dosing) and night-time fractions (8 to 24 hours after dosing).

Mevinphos was absorbed from the gastro-intestinal tract and eliminated in the urine. The patterns of urinary elimination of the radioactivity were similar for the low and high doses.

In the low-dose goat, 18.5% of the dosed radioactivity appeared in the urine during the first 8 hours, but only 2.5% in the following 16 hours. This elimination pattern was repeated through the following dosing cycles. After the 6th dose, 19.8% was excreted in the daytime urine and 3.0% in the night-time. The urinary elimination of each dose was apparently complete within 24 hours of administration. The average proportion of each dose eliminated within 24 hours was 24.3% over the 6-day period.

In the high-dose goat a higher percentage of the dose was eliminated in the urine but the elimination pattern was similar to that in the low-dose goat. After the 6th dose, 32.7% appeared in the daytime urine and 6.9% in the night-time. The average proportion of the dose eliminated within 24 hours was 38.7% over the 6-day period.

The faeces were a minor route of elimination, with average proportions of 3.38% and 2.55% of each dose eliminated by the low- and high-dose goats respectively.

Radioactivity appeared in the milk at the first (evening) collection, 8 hours after the first dose, at levels of 0.47 and 3.84 mg/kg mevinphos equivalents in the low- and high-dose milks respectively. The following morning the levels had decreased to 0.21 and 0.52 mg/kg. The day/night elimination pattern persisted and the levels of eliminated radioactivity reached a plateau after the 4th dose (Table 2).

Measurable radioactive residues were found in the blood and tissues 24 hours after the last dose was administered, and a dose relationship was evident. The highest concentrations were in the liver and kidneys. At the low dose level the residue was highest in liver at 0.646 mg/kg and in kidney at 0.382 mg/kg. At the high dose level the residue in liver was 1.873 mg/kg and in kidney was 1.897 mg/kg. Lower residues were observed in fat (0.419 mg/kg) and muscle (0.176 mg/kg).

Analysis of the milk fraction showed that the radioactivity was associated with normal endogenous components, specifically fatty acids, lactose, casein and amino acids, and the radioactivity in fractions from the liver, kidneys and muscles was associated with fatty acids, cholesterol and amino acids. The radioactivity in the fatty tissue was associated with saturated and unsaturated fatty acids, glycerol and lactic acid.

Table 2. Concentration of ^{14}C in milk of treated goats.

Treatment day	^{14}C, mg/kg as mevinphos			
	Low-dose goat		High-dose goat	
	a.m. collection	p.m. collection	a.m. collection	p.m. collection
1	--	0.47	--	3.84
2	0.21	0.65	0.52	2.48
3	0.18	0.62	1.11	4.07
4	0.27	0.82	1.25	5.09
5	0.29	0.72	0.80	4.62
6	0.22	0.73	0.88	4.73
7	0.28	--	1.05	--

Table 3. Concentration of ^{14}C in the blood and tissues of treated goats 24 hours after last dose.

Sample	**^{14}C as mevinphos, mg/kg**	
	Low-dose goat	High-dose goat
Blood	0.034	0.143
Heart	0.060	0.198
Kidney	0.128	0.636
Liver	0.187	0.826
Hindquarter muscle	0.050	0.126
Tenderloin muscle	0.040	0.095
Back fat	0.201	0.027
Omental fat	0.360	0.037

Hens. Laying hens (5 birds per group) were dosed by gelatin capsules with [*vinyl*-1-^{14}C]mevinphos, 85% (*E*)-, 15% (*Z*)- isomer, for 3 successive days at a level equivalent to 23 or 2.3 ppm in the feed (Craine, 1993).

The level of radioactivity in the excreta was fairly constant over the three-day collection period, and amounted to 23.0-29.6% and 38.5-43.1% of each daily dose for the birds in the low- and high-dose groups respectively.

Radioactivity was found in the whites of the eggs 24 hours after administration of the first dose, at 0.013 mg/kg mevinphos equivalent in the low-dose group and 0.019 mg/kg in the high-dose group, but was not detectable (<0.001 mg/kg) in the yolks at that time. The radioactivity in the whites increased with repeated dosing in both groups, and reached 0.087 and 0.876 mg/kg after the third treatment in the low- and high-dose groups respectively. Radioactivity was detected in the yolks after the second administration (0.007 and 0.017 mg/kg in the low- and high-dose groups respectively) and increased to 0.104 and 0.393 mg/kg after the third treatment.

Twenty four hours after the last dose measurable levels of ^{14}C were present in all tissues. The concentrations were highest in the liver and kidneys, with 0.646 mg/kg and 0.382 mg/kg respectively at the low dose and 1.873 mg/kg and 1.897 mg/kg respectively at the high dose. Lower residues were observed in the fat (0.419 mg/kg) and muscle (0.176 mg/kg).

Much of the radioactivity in the fat (99%), egg yolk (82%), liver (67%), kidneys (49%) and muscle (28%) could be extracted with hexane and, after saponification of the fats, was shown by HPLC to be due to incorporation into cholesterol, glycerol and long-chain fatty acids. This was confirmed by mass spectrometry. Aqueous methanol could extract additional radioactivity only from the kidneys (21%), liver

(13%) and muscle (9%). Analysis of these extracts by HPLC suggested the presence of mono- and disaccharides, with minor amounts of lactic acid and amino acids. The radioactive compounds were derivatized with BSTFA for form silyl derivatives and subjected to GC-MS which confirmed the presence of the sugars. The unextracted radioactivity could be solubilized either by protease enzymes or by hydrolysis with 6N HC1. Derivatization with butyl trifluoroacetate and analysis by HPLC suggested the incorporation of the radiolabel into amino acids, and this was confirmed by GC-MS. Neither mevinphos nor any metabolite which retained the P-O-C group was identified in any sample.

Plant metabolism

Studies have been conducted with lettuce, strawberries and turnips. The results showed that mevinphos is metabolized by two pathways in all these plants. A minor proportion is converted to mevinphos acid, whereas the major path involves the cleavage of the P-O-C group to form methyl acetoacetate. This then undergoes reduction to methyl 3-hydroxybutyrate, which was found conjugated to carbohydrates in plant tissues. The 3-hydroxybutyrate and acetoacetate can undergo hydrolysis to 3-hydroxybutyric acid and acetoacetic acid, which in turn can conjugate with carbohydrates.

Lettuce. Lettuce plants were grown in pots in the greenhouse. Six leaf lettuces were treated three times with (*vinyl*-1-^{14}C]mevinphos (82.4% (*E*)- isomer, 14.5% (*Z*)- isomer) at 0.95 kg/ha 19, 12 and 5 days before harvest. The applications were made by paint brush. Plant tops and soils were harvested 5 days after the last application (Velagaleti *et al*., 1992a). The TRR was 6.29 mg/kg mevinphos equivalents in the plant tops and 0.28 mg/kg in the soil at 0-7.6 cm depths.

One extraction with 50:50 acetonitrile/water followed by two more with 30:70 released a total of 96.7% of the TRR from the lettuce plants. The unextracted ^{14}C was not further characterized.

HPLC showed that most of the radioactivity in the extracts of the treated lettuce was due to two polar components (both 38.2% of the TRR, 2.4 mg/kg as mevinphos), (*E*)-mevinphos (6.4% of the TRR, 0.40 mg/kg), (*Z*)-mevinphos (9.8%, 0.62 mg/kg) and (*E*)-mevinphos acid (1.8%, 0.12 mg/kg). The last three components were characterized by HPLC co-chromatography with reference standards and confirmed by mass spectrometry.

Hydrolysis of the polar components and pectinase or pectinase + cellulase yielded methyl 3-hydroxybutyrate (50.1% of the TRR, 3.15 mg/kg), methyl acetoacetate (2.8%, 0.18 mg/kg), and a third component (12.7%, 0.80 mg/kg) characterized as 3-hydroxybutyric acid and/or acetoacetic acid by HPLC co-chromatography with reference standards. The esters were characterized by co-chromatography and their identities confirmed by mass spectrometry.

(*E*)-mevinphos was unstable under the conditions of enzymatic hydrolysis, but it was supposed that the identified metabolites were largely released from polar conjugates since the total radioactivity of the identified metabolites (65.6%) was almost equal to the total radioactivity of the two polar components (76.4%). The results of the chromatographic analysis of the lettuce extracts are shown in Table 4.

Table 4. Distribution of radioactivity in acetonitrile/water extracts of lettuce after application of [^{14}C]mevinphos.

Compound	Before enzyme treatment		After hydrolysis with pectinase + cellulase	
	% of TRR	mg/kg as mevinphos	% of TRR	mg/kg as mevinphos
E-mevinphos	6.4	0.40		
Z-mevinphos	9.8	0.62	9.9	0.62
E-mevinphos acid	1.8	0.12	2.1	0.13
Methyl acetoacetate			2.8	0.18
Methyl 3-hydroxybutyrate ester			50.1	3.15
Component 30 3-hydroxybutyric acid and/or acetoacetic acid[1]			12.7	0.80
Component 20	38.2	2.40		
Component 23	38.2	2.40		
Unknown			3.3	0.21
Others[2]	2.4	0.15	14.4	0.90
Total	96.8	6.09	95.2	5.99

[1]Component 30 and reference standards 3-hydroxybutyric acid and acetoacetic acid co-eluted in two different HPLC systems
[2]Scattered components and ^{14}C eluted in void volume

Strawberries. Strawberries grown in a field plot were treated three times with [*vinyl*-1-^{14}C]mevinphos (82.4% (*E*)-, 14.5% (*Z*)- isomer) at 0.95 kg/ha, 16, 9 and 2 days before harvest. The applications were made by CO_2-assisted backpack sprayer as a foliar broadcast (Velagaleti *et al*., 1992b). The harvested plants contained 2.17 mg/kg and 19.57 mg/kg mevinphos equivalent in the fruit and plant tops respectively.

More than 90% of the TRR was extracted from both fruit and plant tops by acetonitrile/water, with 3.6% and 6.6% of the TRR remaining in the fruit and tops respectively. The unextracted radioactivity was not further characterized.

HPLC analysis of the fruit (95.0% of the TRR, 2.06 mg/kg as mevinphos) demonstrated that approximately half of the extracted radioactive residue was unaltered mevinphos (34.5% of the TRR, 0.75 mg/kg as (*E*)-, and 11.1%, 0.24 mg/kg as (*Z*)-). The remaining half of the radioactivity was distributed mainly among three very polar components.

In the extract of the plant tops (95.8% of the TRR, 18.76 mg/kg), the metabolite profile was similar except that an additional polar component was present. Mevinphos represented 29% of the TRR (21.7%, 4.24 mg/kg as (*E*)-; 7.6%, 1.49 mg/kg as (*Z*)-), and 60% of the TRR was distributed among four polar components.

Pectinase hydrolysis of the conjugates present in the fruit released two major exocons, methyl 3-hydroxybutyrate (29.4% of the TRR, 0.64 mg/kg) and methyl acetoacetate (13.1%, 0.28 mg/kg), characterized by HPLC co-chromatography with reference standards. (*E*)-mevinphos acid (1.9% of the TRR, 0.04 mg/kg) was a minor hydrolysis product. Fourteen per cent of the TRR (0.31 mg/kg) was eluted as several minor polar components, none of which exceeded 3% (0.06 mg/kg). The results of hydrolysis by pectinase + cellulase were very similar to those produced by pectinase alone.

The polar components in the extracts of plant tops were also hydrolysed by pectinase, which released methyl 3-hydroxybutyrate (34.3% of the TRR, 6.7 mg/kg), methyl acetoacetate (6.6%, 1.28 mg/kg), (*E*)-mevinphos acid (2.3%, 0.44 mg/kg) and several minor components (14.8%, 2.9 mg/kg).

Pectinase did not completely hydrolyse the polar components: when the extract was treated with pectinase + cellulase one additional component which co-chromatographed with 3-hydroxybutyric acid and acetoacetic acid appeared.

The results show that the metabolic pathways of mevinphos in strawberry fruit and plant tops are essentially the same as in lettuce. The distribution of the compounds found in the fruit and tops after the application of [^{14}C]mevinphos is shown in Table 5.

Table 5. Distribution of radioactivity in acetonitrile/water extracts of strawberry fruit and plant tops after the application of [^{14}C]mevinphos.

Compound	Fruit				Plant tops			
	Before enzyme treatment		After hydrolysis with pectinase + cellulase		Before enzyme treatment		After hydrolysis with pectinase + cellulase	
	% of TRR	mg/kg[1]	% of TRR	mg/kg[1]	% of TRR	mg/kg[1]	% of TRR	mg/kg[1]
(E)-mevinphos	34.5	0.75	21.6	0.47	21.7	4.24	14.4	2.81
(Z)-mevinphos	11.1	0.24	9.6	0.21	7.6	1.49	10.0	1.95
(E)-mevinphos acid			2.0	0.04			1.8	0.35
methyl acetoacetate			14.0	0.30			9.3	1.83
methyl 3-hydroxybutyrate			29.9	0.65			35.8	7.01
Component 30, 3-hydroxybutyric acid and/or acetoacetic acid[2]							12.9	2.52
Component 18	13.3	0.29			8.9	1.74		
Component 20	4.2	0.09			3.0	0.58		
Component 23	27.1	0.59			32.9	6.43		
Component 27					15.5	3.03		
Others[3]	4.7	0.1	17.9	0.39	6.3	1.24	11.7	2.29
Total	94.9	2.06	95.0	2.06	95.8	18.76	95.9	18.77

[1]As mevinphos
[2]Component 30 and reference standards 3-hydroxybutyric acid and acetoacetic acid co-eluted in two different HPLC systems
[3]Scattered components and ^{14}C-eluted in void volume

Turnips. Field-grown turnips were treated three times with [*vinyl*-1-^{14}C]mevinphos (82.4% (*E*)-, 14.5% (*Z*)-) at 0.48 kg/ha 17, 10 and 3 days before harvest. The solution was applied directly to the foliage using laboratory sprayer units (Velagaleti *et al*., 1992c).

The turnip tubers contained 0.39 mg/kg and the tops 5.80 mg/kg mevinphos equivalent at harvest.

Acetonitrile/water extracted 89.3% of the TRR (5.18 mg/kg) from the plant tops and 7.4% (0.43 mg/kg) remained unextracted. The unextracted radioactivity was not characterized.

Acetonitrile/water extracted 70.8% of the TRR (0.28 mg/kg) from the tubers and an additional 13.5% (0.05 mg/kg) was released from the post-extraction solids by treatment with pectinase. Protease released a further 4.6% (0.02 mg/kg), bringing the total radioactivity extractable from the tubers to 88.9% of the TRR (0.35 mg/kg). Five per cent of the TRR (0.02 mg/kg) remained unextracted and was not further characterized.

HPLC analysis did not detect either (*E*)- or (*Z*)-mevinphos in the acetonitrile/water extract of the tubers, but 6.3% of the TRR (0.02 mg/kg) was accounted for by (*E*)-mevinphos acid. 3-Hydroxybutyric and acetoacetic acids and six other polar components were also detected. The radioactive material released by pectinase from the post-extraction solids showed only one HPLC peak representing 10.8% of the TRR (0.04 mg/kg), with 2.7% of the TRR (0.01 mg/kg) eluting in the void volume. The HPLC peak from the pectinase-released fraction had the same retention time as the main polar component found in the original acetonitrile/water extract.

The HPLC profile of the acetonitrile/water extract of the tubers was not significantly altered by mild acid/base or enzymatic hydrolysis, suggesting that there were no conjugates in the extracts, but harsher conditions of acid hydrolysis (1N or 5N HCl, ~100°C) caused partial hydrolysis and generated four components. This suggests that the radioactive components in the extracts may have included natural components such as proteins or carbohydrates.

In the acetonitrile/water extract of the plant tops, (*E*)-mevinphos (4.0% of the TRR, 0.23 mg/kg), (*Z*)-mevinphos (4.2%, 0.24 mg/kg) and (*E*)-mevinphos acid (2.0% of the TRR, 0.11 mg/kg) were identified by HPLC analysis. Most of the ^{14}C (76.0% of the TRR, 4.4 mg/kg) was associated with seven polar components, which were hydrolysed by pectinase or pectinase + cellulase.

Three exocons released by pectinase hydrolysis were methyl 3-hydroxybutyrate (42.8% of the TRR, 2.48 mg/kg), methyl acetoacetate (2.1%, 0.12 mg/kg) and (*E*)-mevinphos acid (5.6%, 0.32 mg/kg). Hydrolysis with pectinase + cellulase yielded several additional components, one of which was characterized as DL-3-hydroxybutyric acid and/or acetoacetic acid by co-chromatography. The other components were not identified but it was suggested that they were natural components in the turnip plant cells.

The distribution of the compounds found in turnip tubers and tops is shown in Table 6.

It can be seen that the metabolism of mevinphos in a range of plants follows the same pathway.

Table 6. Distribution of radioactivity in acetonitrile/water extracts of turnip tubers and tops after application of [^{14}C]mevinphos.

Compound	Tubers		Plant tops			
	Before enzyme treatment		Before enzyme treatment		After hydrolysis with pectinase + cellulase	
	% of TRR	mg/kg[1]	% of TRR	mg/kg[1]	% of TRR	mg/kg[1]
(*E*)-mevinphos			4.0	0.23		
(*Z*)-mevinphos			4.2	0.24	0.9	0.05
(*E*)-mevinphos acid	6.3	0.02	2.0	0.11	6.1	0.35
methyl acetoacetate					2.9	0.17
methyl 3-hydroxybutyrate					40.1	2.32
Component 30 3-hydroxybutyric acid and/or acetoacetic acid[2]	7.2	0.03	6.7	0.39	6.1	0.36
Component 17	3.0	0.01	1.4	0.08		
Component 20	11.9	0.05	13	0.75		
Component 23	28.6	0.11	36.9	2.14		
Component 26			4.5	0.26		
Component 28	3.8	0.01	10.9	0.63		
Component 33	1.4	0.01				

Compound	Tubers		Plant tops			
	Before enzyme treatment		Before enzyme treatment		After hydrolysis with pectinase + cellulase	
	% of TRR	mg/kg[1]	% of TRR	mg/kg[1]	% of TRR	mg/kg[1]
Component 43	1.1	<0.01				
Component 47			2.6	0.15		
Component 49					1.5	0.08
Component 51					1.5	0.09
Component X					8.6	0.50
Component Y					5.0	0.29
Others[3]	7.4	0.03	3.1	0.18	17.5	1.01
Total	70.8	0.28	89.3	5.18	90.0	5.22

[1]As mevinphos
[2]Component 30 and reference standards 3-hydroxybutyric acid and acetoacetic acid co-eluted in two different HPLC systems
[3]Scattered components and ^{14}C-eluted in void volume

The proposed routes of metabolism in plants are shown in Figure 1.

Environmental fate in soil

Adsorption and desorption

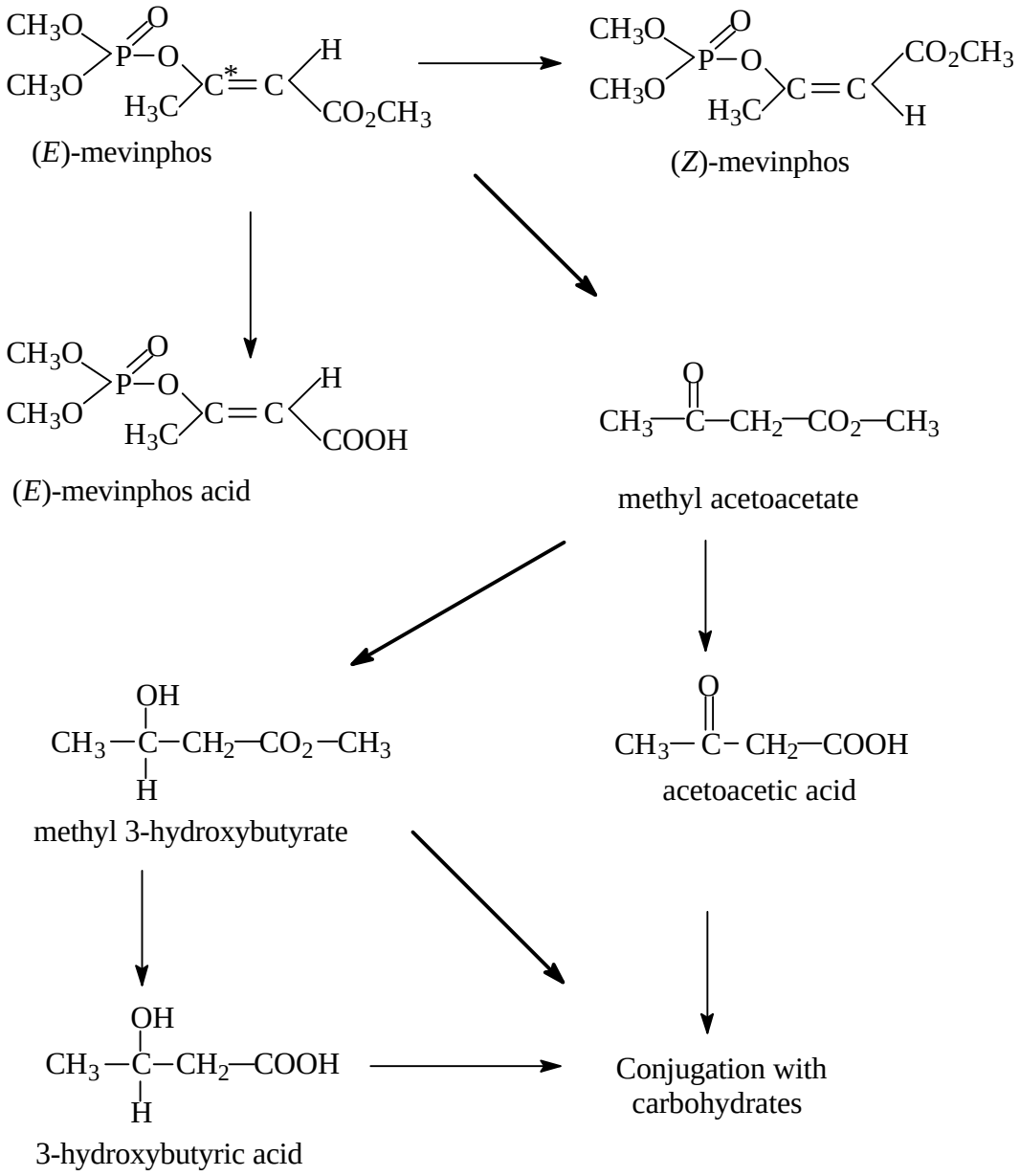
Aqueous solutions of [^{14}C]mevinphos (the proportions of (*E*)- and (*Z*)- isomers were not reported) in 0.01 M $CaCl_2$ were equilibrated with four soils and Freundlich constants were determined (Warren, 1987). The concentrations of test material in the aqueous phase were measured by liquid scintillation counting. The results are shown in Table 7.

Table 7. Soil adsorption and desorption coefficients of mevinphos.

	% Organic carbon[1]	Adsorption			Desorption		
		Kd	Koc[2]	n	Kd	Koc[2]	n
Sandy loam	0.50	0.392	78.4	1.00	1.32	264	0.949
Silt loam	1.0	0.862	86.2	1.02	1.40	140	1.03
Loam	1.5	0.607	40.5	1.02	1.16	77.3	1.03
Clay loam	2.45	1.92	78.4	1.03	3.53	144	1.05

[1]% organic carbon = % organic matter/2.0
[2]$K_{oc} = (K_d \times 100) / \%$ organic carbon

Figure 1. Proposed metabolic pathways of mevinphos in plants.



Degradation under aerobic conditions

Reynolds (1994, 1995) examined degradation under aerobic conditions in the laboratory. The (*E*)- and (*Z*)-isomers of [*vinyl*-1-^{14}C]mevinphos were incubated separately with sandy loam soil at 1.1 mg/kg on a dry weight basis at 25 ± 1°C in the dark. The moisture content of the soil was adjusted to about 75% field moisture capacity initially. The radiochemical purities were >95.3% for the (*E*)- isomer and >96.9% for the (*Z*)- isomer.

Soil and alkaline trap fluid were collected intervals up to 14 days. Soil samples were extracted successively with methanol/dichloromethane and acetonitrile/acidic water. Both extracts and the bound residues were analysed by HPLC (reversed-phase for the organic extracts). Initially 99.15% of the (*E*)- and 97.12% of the (*Z*)- isomer radioactivity was extracted into methanol/dichloromethane. The percentage extracted from the soil had decreased to 2.92% and 11.50% of the total applied radioactivity for the (*E*)- and (Z)- isomers respectively after 12 hours, and 1.62 and 3.99% after 14 days.

The levels of radioactivity detected in the extracted soil increased from 1.04-1.10% initially to a maximum of 65-68% at 24 hours, then began to decrease. At the end of the experimental period (14 days), the levels were 25.5 and 46.9% of the applied radioactivity for the (*E*)- and (Z)- isomers respectively, while the evolved acidic volatiles, including $^{14}CO_2$, accounted for 66.2% and 44.6% respectively.

(*E*)-mevinphos accounted for 97.97% of the ^{14}C initially, but for less than 50% after 1.5 hours, for only 8.46% after 3 hours and only 1.4% after 12 hours. Up to eight degradation products were observed at various times. The main product in the organic extract after 0.75 and 1.5 hours co-eluted with the methyl acetoacetate reference standard on both reversed-phase and ion-exchange HPLC. Low levels of other metabolites were observed at later intervals, but none exceeded 4.82%. The radioactivity extracted by acetonitrile/acidic water amounted to 15.02% of the total applied after 1.5 hours, but had decreased to 2.16% after 3 hours. Characterization of the bound residues from the 1.5-hour sample showed 14.20%, 2.14% and 3.07% of the applied ^{14}C to be associated with fulvic acid, humic acid and humins respectively.

(*Z*)-mevinphos accounted for 94.88% of the applied ^{14}C at time 0, 55% at 3 hours and 10.23% at 12 hours. A total of six degradation products was observed. One, which was confirmed as methyl acetoacetate by both reverse-phase and ion-exchange HPLC, was detected at each sampling interval and ranged from 1.07% of the total applied radioactivity at zero time to 0.12% at 14 days. Another component which had a very short retention time increased gradually throughout the experiment and reached a maximum of 2.83% of the applied radioactivity. Low levels of other products were observed, but none exceeded 0.75%. The radioactivity extracted by acetonitrile/acidic water accounted for 3.22-4.44% of the total applied at 3 and 6 hours and 1.89% at 12 hours. In the bound residues after 3 hours 23.21-23.76% 1.41-1.48% and 3.60-3.98% of the applied ^{14}C was incorporated into fulvic acid, humic acid and humins respectively.

Mevinphos was rapidly degraded under aerobic conditions with an average half-life of 1.21 and 3.83 hours for the (*E*)- and (*Z*)- isomers respectively. Methyl acetoacetate was a major product of the (*E*)-isomer, but only a minor one of the (*Z*)- isomer. The conversion of (*E*)- to (*Z*)-mevinphos and vice versa was not a significant pathway. Both isomers of mevinphos bound quickly to the soil constituents, especially to fulvic acid. The formation of CO_2 was also very rapid and the soil-bound residues were ultimately mineralized and converted to CO_2. The distribution of radioactivity in the analytical fractions is shown in Table 8.

Table 8. Distribution of radioactivity in soil fractions at intervals after treatment with [^{14}C]-mevinphos.

Fraction	% of applied ^{14}C in fraction at									
	0	0.75 h	1.5 h	3 h	6 h	12 h	24 h	3 days	7 days	14 days
(*E*)-mevinphos										
Extracted	99.15	80.39	65.86	11.78	5.90	2.92	2.07	2.52	6.92	1.62
Unextracted	1.10	16.36	34.44	67.95	63.38	64.77	64.60	43.00	42.47	25.54
Foam plug	NA	NA	NA	NA	NA	NA	NA	0.20	0.15	NA
KOH	NA	0.50	1.96	19.11	23.30	31.08	33.73	43.94	69.11	66.23

Total	100.25	97.25	102.26	98.84	92.57	98.76	100.39	89.66	118.64	93.39
(*Z*)-mevinphos										
Extracted	97.12	88.27	70.28	56.93	36.67	11.50	6.21	3.16	3.19	3.99
Unextracted	1.04	16.34	24.43	32.40	53.37	65.32	67.93	53.24	47.27	46.89
KOH	NA	0.96	2.76	5.70	12.00	21.55	25.54	42.35	46.03	44.57
Total	98.16	105.56	97.46	95.03	102.04	98.37	99.68	98.75	96.49	95.45

Volatility from soil

The volatility of mevinphos from the surface of a sandy loam soil was examined in vaporization chambers (Lasinger, 1994). The surface of sandy loam soil was treated with [*vinyl*-1-^{14}C]mevinphos (68% (E)-, 29% (Z)-) at the rate of 0.99 kg ai/ha. The soil moisture was adjusted 75% field moisture capacity at the beginning of the study, the air flow rate was 30 ml/minute with a relative humidity of 75%, and the temperature was maintained at 25°C throughout the experimental period. The air leaving the chamber passed through a polyurethane foam plug to trap volatile material other than $^{14}CO_2$, then through an alkaline trap. The traps were sampled after 3, 6, 24, 48, 72 and 168 hours, and the soil after 168 hours. An average of 43.3% of the applied ^{14}C was recovered as volatile material after 7 days (1.1%, trapped in the polyurethane foam plug, was shown to be methyl acetoacetate and the remainder trapped in the alkaline solution to be carbon dioxide).

At the end of the incubation period the soil was extracted with a mixture of methanol and dichloromethane. The extract contained 2.5% of the applied ^{14}C (1.2% in a mixture of acetoacetic acid, *O*-demethyl-mevinphos, acetoacetic acid and 3-hydroxybutyric acid and 8 minor compounds accounting for 1.3%). The remaining 56% of the applied radioactivity was bound to the soil.

The study shows that mevinphos does not volatilize from a soil surface but becomes completely degraded with roughly half being mineralized to carbon dioxide and the remaining degradation products mainly bound to the soil.

Field dissipation

A study was carried out to examine the mobility, degradation and dissipation of mevinphos in the soil under field conditions (Leech, 1990). Six applications of mevinphos were made to a plot growing lettuce at 7-day intervals at a rate of 0.91 kg ai/ha. The soil was sandy loam with a low organic matter content. Soil samples were taken before, just after, and 2 days after each of the six treatments, then 1, 3, 7 and 14 days and 1, 2 and 4 months after the final treatment.

Residues of both isomers of mevinphos were found sporadically in the 0-15 cm layer of the soil up to 0.08 mg/kg, but were generally below the limit of determination (0.01 mg/kg). Owing to the low residues and rapid degradation of the test compound, half-lives were difficult to determine, but were apparently less than four days for both isomers.

The results also showed that the mobility of both isomers in soil is minimal. Residues of (*E*)- and (*Z*)-mevinphos were detected in the 0-15 cm layer in only a few instances and re-analysis of these samples detected no residues, indicating that the use of mevinphos in sandy soils with a low organic matter content, which is the "worst case" for potential groundwater contamination, does not present any risk. This is mainly due to the rapid degradation of both mevinphos isomers in the top 15 cm of the soil which prevents further leaching.

Residues in rotational crops

In a rotational crop study (Ryan, 1995) bare sandy loam soil was treated with a single application of [*vinyl*-1-^{14}C]mevinphos, 68% (*E*)-, 29% (*Z*)- at 0.99 kg/ha. Lettuce, sugar beet and sorghum were planted 32 days after the application. The lettuce and sugar beet were grown to maturity and harvested. The sorghum was sampled at the immature forage stage and then grown to maturity for final harvest. The harvested crops were analysed by combustion and liquid scintillation counting to determine the total radioactive residues. All samples contained <0.01 mg/kg mevinphos equivalents.

Environmental fate in water/sediment systems

Photodegradation in water

The (*E*)- and (*Z*)- isomers of [*vinyl*-1-^{14}C]mevinphos were incubated in sterile aqueous solutions, buffered at pH 5 in 0.01M sodium acetate, under artificial sunlight at 25.0 ± 1.0 °C. (Cohen, 1994a) The concentrations were 11.29 mg/l of the (*E*)- and 9.84 mg/l of the (*Z*)-, with the same solutions incubated without irradiation as controls. Samples were analysed by LSC and radio-HPLC.

The half-lives of the test compounds were determined by linear regression analysis of the log of concentration as a function of time. The results are shown in Table 9.

Table 9. Photolytic degradation half-life (days) of mevinphos.

Isomer	Irradiated	Dark control	Net rate of photolysis
(*E*)-	14.9	32.8	27.2
(*Z*)-	20.0	71.0	27.8

Both isomers isomerized. The conversion after 480 hours exposure amounted to 29.1% and 34.4% of the initial radioactivity for (*E*)- to (*Z*)- and (*Z*)- to (*E*)- respectively.

The irradiated (*E*)- isomer produced *O*-demethyl-mevinphos, an unknown, and methyl acetoacetate, which represented 13.2, 15.3 and 2.7% respectively of the initial radioactivity after 480 hours of exposure. No (*Z*)- isomer was produced in the dark control, but *O*-demethyl-mevinphos and methyl acetoacetate were identified, and represented 18.7 and 17.9% of the initial radioactivity after 480 hours.

The irradiated (*Z*)- isomer also yielded *O*-demethyl-mevinphos and the same unknown representing 11.6 and 7.3% of the initial radioactivity after 480 hours. No (*E*)- isomer was produced in the control, but *O*-demethyl-mevinphos and methyl acetoacetate were again identified, at levels equivalent to 12.6 and 0.9% of the initial radioactivity after 480 hours.

The proposed degradation pathways are shown in Figure 2.

Hydrolysis

A thirty-day study of the hydrolysis of (*E*)- and (*Z*)-mevinphos in sterile aqueous buffered solutions at pH 5, 7 and 9 was conducted at 25 ± 1°C. The rate of hydrolysis of both isomers increased with pH. The (*E*)-isomer at pH 9 produced *O*-demethyl-mevinphos, acetoacetic acid, acetone and (*E*)-mevinphos acid, whereas (*Z*)-mevinphos yielded only *O*-demethyl-mevinphos, acetoacetic acid and acetone in the same buffer. Both isomers at pH 5 and pH 7 were hydrolysed to give only *O*-demethylmevinphos as a major product. The overall hydrolysis rate of the (*E*)- isomer was found to be approximately twice that of the

(*Z*)-. The half-lives of (*E*)-mevinphos at pH 5, 7 and 9 were 50.8, 29.2 and 2.8 days respectively; and the corresponding values for the (*Z*)- isomer were 84.6, 62.7 and 7.5 days.

METHODS OF RESIDUE ANALYSIS

Analytical methods

Before 1970 residues of mevinphos were determined mainly by enzymatic methods, but GLC methods have been used since the early 1970s. Enzymatic methods could not separate the (*E*)- and (*Z*)- isomers and, since the *(E*)- isomer is a stronger inhibitor of acetylcholinesterase than the (*Z*)- and the (*Z*)- isomer is generally more persistent than the (*E*)- in or on crops, enzymatic methods do not reliably determine either the individual isomers or their sum.

Enzymatic methods

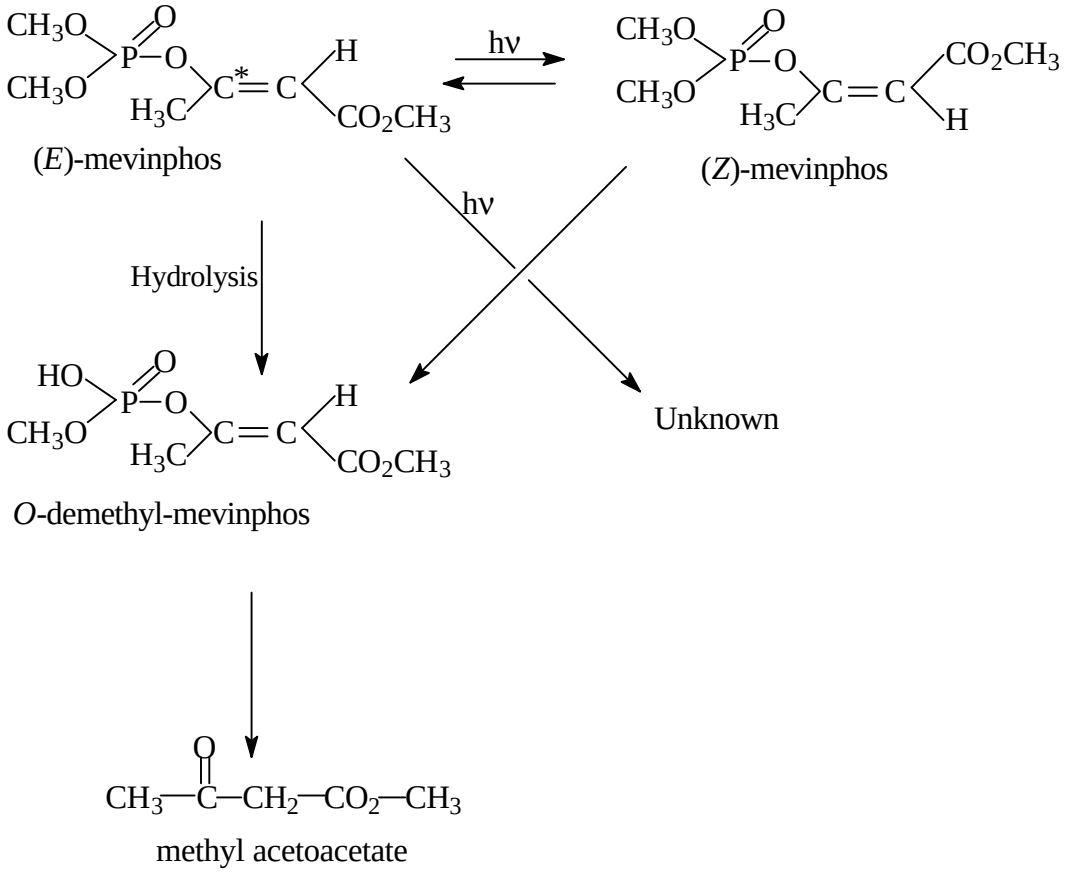
The following procedure is typical. Samples are extracted by blending with chloroform (crops) or by soxhlet extraction with petroleum ether (animal tissues), and an aliquot equivalent to 10 g of sample is concentrated to 4 ml. To this is added 8 ml of n-hexane and 0.5 ml of 6% paraffin wax in hexane, followed by 10 ml of water. After thorough mixing the organic solvent is evaporated in a stream of air, the remaining solution is shaken with 3 ml of hexane, and the organic solvent completely evaporated. The aqueous phase is diluted to give an estimated mevinphos concentration of 0.05 to 0.20 mg/l and 1.0 ml is incubated with 4-8 units of acetylcholinesterase and 1.0 ml of 0.06 M acetylcholine in buffer for 60 minutes. Incubation is stopped by adding 4.0 ml of 1 M alkaline hydroxylamine solution, then 2 ml of hydrochloric acid and 2 ml of ferric chloride reagent are added with vigorous mixing. After chilling in an ice-water bath for 5 minutes the mixture is centrifuged, the supernatant is transferred to a spectrophotometer cell, and the absorbance at 540 nm is measured with reference to distilled water. After correction for the blank the mevinphos residue is read from a standard curve.

The LOD is of the order of 0.02 mg/kg for crops and 0.1 mg/kg for animal tissues. Recoveries generally ranged from 80 to 110% at 0.1 mg/kg.

GLC methods

Mevinphos has been determined by GLC with flame-photometric detection sine the 1970s. Since the FPD has a specific response to phosphorus or sulfur, a wide range of crops with low fat content could be analysed without clean-up, and this has been done in most of the supervised trials. If the sample has a large amount of fat or interference is seen on chromatograms a liquid-liquid chromatographic clean-up procedure is employed. A typical procedure is as follows.

Figure 2. Proposed photodegradation pathways of mevinphos.



The chopped or ground sample (~ 100g) is macerated for several minutes with about 200 ml of chloroform or dichloromethane and 50g anhydrous sodium sulfate. If the sample has a low moisture content (e.g. grain), it is moistened with water before adding the organic solvent. After filtration, if necessary through an anhydrous sodium sulfate, the extract is injected into the gas chromatograph directly or after concentration.

If necessary, the extract is cleaned up as follows. The solvent in an aliquot of the extract equivalent to 2-3 g of sample is exchanged for n-hexane or petroleum spirit by repeatedly concentrating the solution in a stream of dry air and adding fresh solvent. This hexane extract may be suitable for injection. If not, 4 g of brickdust (Silocel C22, 60-100 mesh, containing 45% water) is packed into a chromatography column with petroleum spirit. After running off the excess petroleum spirit, 3 ml of extract is introduced and the column is eluted with 7 ml of petroleum spirit, which is discarded, then with chloroform. The first 10 ml of the chloroform fraction is collected and concentrated to 1 ml in a stream of clean air. This solution is ready for injection. In general the limit of determination was 0.01 mg/kg, with recoveries of 80-110% of both (*E*)- and (*Z*)- isomers.

In a study designed to validate typical enforcement methods for the determination of mevinphos residues in crop samples "aged" mevinphos residues derived from the study of lettuce metabolism were analysed by the methods specified in the Food and Drug Administration's Pesticide Analytical Manual (PAM II) and the Multiresidue Method (MRM).

The ^{14}C in the metabolism samples was also measured to determine the total recovery of the aged residues carried through each analytical procedure. The results showed that 16% of the total radioactivity was extracted and quantified as mevinphos by the PAM II method while only approximately 7.6% of the TRR was extracted by the MRM method. While these values appear to be low, the metabolism study showed that the mevinphos present in the metabolism samples accounted for only 16.2% of the total radioactive residue in the lettuce. The concentrations of (*E*)- and (*Z*)-mevinphos were 0.47 and 0.60 mg/kg by the PAM II method and 0.22 and 0.32 mg/kg respectively by the MRM method, while the metabolism results showed respective concentrations of 0.40 and 0.62 mg/kg. Thus the PAM II method provided a more accurate measurement of the mevinphos concentration than the MRM, although the methods showed concentrations of mevinphos of the game order, supporting their use for enforcement.

Official methods of analysis in The Netherlands

Non-fatty foods are extracted with one of several organic solvents and the residue is determined by GLC with NP or ion trap detection without clean-up. The reported LOD for lettuce was 0.05 mg/kg with recoveries of 88-94% at 0.09 and 0.43 mg/kg fortification levels with an NPD and 96% at 0.12 and 0.58 mg/kg with an ion trap.

Fatty foods are extracted with an organic solvent and cleaned up by GPC. The determination is by GLC as before. The reported LOD was 0.01-0.04 mg/kg and recoveries were 65-105% (information from the government of The Netherlands).

Stability of pesticide residues in stored analytical samples

Studies of the stability of mevinphos residues in analytical samples were carried out with the metabolism studies on lettuce, strawberries and turnips. The results, shown in Table 10, showed that both isomers of mevinphos are stable in a variety of crops under frozen conditions (~ −20 °C) for periods of about 10 months (Velagaleti *et al*., 1992a,b,c).

Lettuce harvested 5 days after of the last of three treatments with [^{14}C]mevinphos at 0.95 kg ai/ha were stored at −20 °C for 3-10 months. After storage, lettuce samples were extracted three times with acetonitrile/water, cleaned up on a C-18 reverse-phase silica cartridge column and analysed by reverse-phase HPLC.

Strawberries were harvested 2 days after the last of 3 treatments with [^{14}C]mevinphos at 0.95 kg ai/ha and stored at −20°C for 4-10.5 months. After storage, fruit and plant top samples were analysed in the same way as lettuce.

Turnips were treated three times with [^{14}C]mevinphos at 0.48 kg ai/ha, harvested 3 days after the last treatment and stored at −20°C for 2.7-9.9 months. Plant top samples were analysed in the same way as lettuce. Because no mevinphos residues were found in the tubers they were not included in the study.

Table 10. Stability of mevinphos under frozen storage (−20°C).

Storage period, months[1]	Lettuce			Strawberry fruit			Strawberry tops		Turnip tops	
	3 (0.5)	3.5 (3)	10 (2)	4 (1)	6 (4)	10.5 (1.5)	4 (4)	10.5 (1.8)	2.7 (6.1)	9.9 (1.1)
E-mevinphos	100	85	91	100	103	104	100	92	100	116
Z-mevinphos	100	91	99	100	103	98	100	97	100	87

[1]Months in parentheses are storage periods of acetonitrile/water extracts

Definition of the residue

The plant metabolism studies showed that residues of mevinphos are degraded rapidly by cleavage of the P-O-C group, with the formation of methyl acetoacetate. Mevinphos is also converted to (*E*)-mevinphos acid by a minor route but the Meeting concluded that the level of (*E*)-mevinphos acid was low in relation to that of mevinphos and it could be excluded from the definition of the residue, which should be “sum of (*E*)- and (*Z*)-mevinphos" for both enforcement and the estimation of dietary intake.

USE PATTERN

Mevinphos is a systemic and contact organophosphate insecticide and acaricide. It is used to protect a wide range of crops such as pome and stone fruit, berries and small fruit, fruiting vegetables, bulb, stem and root vegetables, pulses, nuts and beet. It is also used on ornamentals and tobacco. The registered uses on food crops are shown in Table 11 and those on ornamentals and tobacco in Table 12.

Table 11. Registered uses of mevinphos on food and feed commodities. All EC applications.

Crop[1]	Country	Application			No.	PHI, days[2]
		Method	kg ai/ha	kg ai/hl		
Apples	Austria	Spray	0.096-0.19	0.0096-0.019		14
Apples	France	Spray	0.25-0.75	0.05	4	7
Apples	Netherlands	Spray	0.11-0.16	0.011	1	7
Apples	Netherlands	Spray	0.073-0.11	0.007	3	7
Apples	Portugal	Spray		0.012-0.036		4
Apples	Switzerland	Spray	0.54	0.036		21
Apricots	Austria	Spray	0.096-0.19	0.0096-0.019		14
Apricots	France	Spray	0.25-0.75	0.05	8	7
Cherries	Austria	Spray	0.096-0.19	0.0096-0.019		14
Cherries	Netherlands	Spray	0.073-0.11	0.007	3	7
Citrus	South Africa	Spray		0.015		3
Grapes	Austria	Spray	0.096-0.19	0.0096-0.019		14
Grapes	France	Spray	0.05-0.25	0.05	3	7
Grapes	South Africa	Spray		0.019-0.023		7
Grapes	Switzerland	Spray	0.54	0.036		21
Grapes (G)	Netherlands	Spray	0.036-0.11	0.007	3	7 or 14
Peaches	Austria	Spray	0.096-0.19	0.0096-0.019		14
Peaches	France	Spray	0.25-0.75	0.05	8	7
Peaches (G)	Netherlands	Spray	0.036-0.11	0.007	3	7 or 14
Pears	Austria	Spray	0.096-0.19	0.0096-0.019		14
Pears	Netherlands	Spray	0.073-0.11	0.007	3	7
Pears	Portugal	Spray		0.012-0.036		4
Pears	Switzerland	Spray	0.54	0.036		21
Plums	Austria	Spray	0.096-0.19	0.0096-0.019		14
Plums	France	Spray	0.25-0.75	0.05	8	7
Plums	Netherlands	Spray	0.073-0.11	0.007	3	7
Plums (G)	Netherlands	Spray	0.036-0.11	0.007	3	7 or 14
Berries and small fruit (F/G)	Netherlands	Spray	0.073-0.087	0.007	3	7 (F) 7 or 14 (G)
Strawberries	France	Spray	0.35	0.088-0.3	4	7
Brassicas	Netherlands	Spray	0.015-0.11	0.007-0.011	3	7
Brassicas	South Africa	Spray	0.11	0.011		4
Brassicas	Thailand	Spray	0.36-0.48	0.036-0.048		3
Brassicas	Zimbabwe	Spray	0.19	0.019		4

Crop[1]	Country	Application			No.	PHI, days[2]
		Method	kg ai/ha	kg ai/hl		
Broccoli	Australia	Spray	0.29-1.1	0.072		2
Broccoli	Finland	Spray	0.24-0.48			4
Broccoli	Sweden	Spray	0.24-0.48			4
Brussels sprouts	Australia	Spray	0.29-1.1	0.072		2
Cabbages	Australia	Spray	0.29-1.1	0.072		2
Cabbages	Austria	Spray	0.096	0.0096		14
Cabbages	Finland	Spray	0.24-0.48			4
Cabbages	France	Spray	0.35	0.035	3	7
Cabbages	Sweden	Spray	0.24-0.48			4
Carrots	Australia	Spray	0.29-0.87	0.072		2
Carrots	Zimbabwe	Spray	0.19	0.019		4
Cauliflower	Australia	Spray	0.29-1.1	0.072		2
Celery	Australia	Spray	0.29-0.87	0.072		2
Corn salad	France	Spray	0.35		1	7
Courgettes	France	Spray	0.35	0.035	2	7
Courgettes	Netherlands	Spray	0.015-0.15	0.007-0.015	6	7
Cucumbers (G)	Belgium	pulverization or nebulization	0.12-0.36	0.012-0.018	3	3
Cucumbers (G)	Finland	Spray		0.024		4
Cucumbers	France	Spray	0.35	0.035	5	7
Cucumbers (G)	Luxembourg	pulverization or nebulization	0.12-0.36	0.012-0.018	3	3
Cucumbers	Norway	Spray		0.024		7
Cucumbers	Portugal	Spray		0.036		4
Cucumbers (G)	Sweden	Spray		0.024		3
Cucurbits	Australia	Spray	0.29-0.87	0.072		2
Cucurbits	South Africa	Spray	0.11	0.011		4
Egg plants	France	Spray	0.35	0.035		7
Egg plants	Australia	Spray	0.29-0.87	0.072		2
Fruiting vegetables (G)	Netherlands	Spray	0.073-0.22	0.007-0.015	4	3
Garden cress	France	Spray	0.35	0.088-0.3		7
Garlic	Portugal	Spray		0.036		4
Gherkins (G)	Belgium	pulverization or nebulization	0.12-0.36	0.012-0.018	3	3
Gherkins	France	Spray		0.035	2	7
Gherkins (G)	Luxembourg	pulverization or nebulization	0.12-0.36	0.012-0.018	3	3
Gherkins	Netherlands	Spray	0.015-0.15	0.007-0.015	6	3
Globe artichokes	Australia	Spray	0.29-0.87	0.072		2
Herbs (F/G)	Netherlands	Spray	0.015-0.058	0.007	3	7 (F) 7 or 14 (G)
Legume vegetables	Netherlands	Spray	0.015-0.15	0.007-0.015	3	7
Legume vegetables (G)	Netherlands	Spray	0.036-0.15	0.007-0.015	2	7 or 14
Lettuce	Australia	Spray	0.29-0.87	0.072		2
Lettuce (G)	Finland	Spray	0.24-0.48		2	~~7~~
Lettuce	France	Spray	0.35	0.035	4	7
Lettuce	South Africa	Spray	0.11	0.011		4
Lettuce	Sweden	Spray	0.24-0.48			7
Lettuce	Netherlands	Spray	0.015-0.22	0.007-0.011	3	7
Lettuce (G)	Netherlands	Spray	0.036-0.15	0.007-0.015	2	7 or 14
Lettuce	Norway	Spray		0.024		7
Lucerne	Australia	Spray	0.39			2
Melons	France	Spray	0.35	0.035	2	7
Melons	Portugal	Spray	0.36-0.72	0.036	2	4

Crop[1]	Country	Application			No.	PHI, days[2]
		Method	kg ai/ha	kg ai/hl		
Onions	Australia	Spray	0.29-0.58	0.072		2
Onions	Netherlands	Spray	0.029-0.15	0.015	6	7
Onions	Thailand	Spray	0.075-0.15	0.012-0.024		3
Parsnips	Australia	Spray	0.29-0.87	0.072		2
Peppers (G)	Belgium	pulverization or nebulization	0.12-0.36	0.012-0.018	3	7 or 14
Peppers	France	Spray	0.35	0.035		7
Peppers (G)	Luxembourg	pulverization or nebulization	0.12-0.36	0.012-0.018	3	7 or 14
Peppers	South Africa	Spray	0.094	0.019		2
Peppers (Capsicums)	Australia	Spray	0.29-0.87	0.072		2
Potatoes	Australia	Spray	0.29-0.87	0.072		2
Potatoes	Zimbabwe	Spray	0.19	0.019		4
Rhubarb	Australia	Spray	0.29-0.87	0.072		2
Root and tuber vegetables	Netherlands	Spray	0.015-0.15	0.007-0.015	6	7
Root and tuber vegetables (G)	Netherlands	Spray	0.036-0.15	0.007-0.015	2	7 or 14
Shallots	Netherlands	Spray	0.029-0.15	0.015	6	7
Spinach	Australia	Spray	0.29-0.87	0.072		2
Spinach	France	Spray	0.35	0.035	2	7
Spinach	Netherlands	Spray	0.015-0.22	0.007-0.011	3	7
Spinach	South Africa	Spray	0.11	0.011		3
Spinach (G)	Netherlands	Spray	0.034-0.11	0.007-0.011	2	7 or 14
Stem vegetables	Netherlands	Spray	0.015-0.15	0.007-0.015	3	7
Stem vegetables (G)	Netherlands	Spray	0.036-0.073	0.007	2	7 or 14
Sweet corn	Australia	Spray	0.29-1.1	0.072		2
Sweet corn	Thailand	Spray	0.06-0.12	0.012-0.024		3
Tomatoes	Australia	Spray	0.29-1.1	0.072		2
Tomatoes (G)	Belgium	Pulverization/nebulization	0.12-0.36	0.012-0.018	3	7 or14
Tomatoes (G)	Finland	Spray		0.024		3
Tomatoes	France	Spray	0.35	0.035		7
Tomatoes (G)	Luxembourg	Pulverization/nebulization	0.12-0.36	0.012-0.018	3	7 or 14
Tomatoes	Norway	Spray		0.024		7
Tomatoes	Portugal	Spray	0.36-0.96	0.036-0.048	2	4
Tomatoes	South Africa	Spray		0.019		2
Tomatoes (G)	Sweden	Spray		0.024		3
Tomatoes	Thailand	Spray	0.075-0.15	0.012-0.024		3
Tomatoes	Zimbabwe	Spray	0.14	0.029		2
Witloof	France	Spray	0.35	0.088-0.3	1	7
Beetroot	Australia	Spray	0.29-0.58	0.072		2
Beetroot	Zimbabwe	Spray	0.19	0.019		4
Beets	France	Spray	0.35	0.035	2	7
Silver beet	Australia	Spray	0.29-0.87	0.072		2
Sugar beet	Austria	Spray	0.12	0.02-0.03		14
Sugar beet	France	Spray	0.35	0.035	2	7
Fodder beet	France	Spray	0.35	0.035	2	7
Beans	Australia	Spray	0.29-0.87	0.072		2
Beans	France	Spray	0.35	0.035	2	7
Beans	South Africa	Spray	0.11	0.011		4
Beans	Zimbabwe	Spray	0.19	0.019		4
Broad beans	Australia	Spray	0.29-0.87	0.072		2

Crop[1]	Country	Application			No.	PHI, days[2]
		Method	kg ai/ha	kg ai/hl		
Peas	France	Spray	0.35	0.035	2	7
Peas	South Africa	Spray	0.11	0.011		4
Peas	Switzerland	Spray	0.096	0.024		21
Peas	Zimbabwe	Spray	0.19	0.019		4
Peas (fresh)	Netherlands	Spray	0.058-0.29	0.029	3	7
Maize	Thailand	Spray	0.06-0.12	0.012-0.024		3
Wheat	South Africa	Spray	0.06-0.12			7
Wheat	Zimbabwe	Aerial spray	0.096-0.19			7

[1]F = Field; G = Glasshouse
[2]"7 or 14" means a PHI of 7 days for the period from March to October and 14 days from November to February

Table 12. Registered uses of mevinphos on ornamentals and tobacco. All spray applications of EC formulations.

Crop	Country	Application			PHI, days
		kg ai/ha	kg ai/hl	No.	
Tobacco	South Africa	0.15			7
Cut flowers	Netherlands	0.073-0.11	0.0073-0.011		
Flowers	Austria	0.096-0.19	0.0096-0.019		14
Gladioli	Australia	0.78			2
Ornamentals	Austria	0.096-0.19	0.0096-0.019		14
Ornamentals	Finland	0.024-0.12	0.0024-0.03	5	4
Ornamentals	South Africa		0.015		
Ornamentals	Switzerland	0.48	0.024		
Pot plants	Netherlands	0.073-0.11	0.0073-0.011		
Roses	France		0.035	4	
Tree nurseries	Netherlands	0.073-0.11	0.0073-0.011		

RESIDUES RESULTING FROM SUPERVISED TRIALS

The results of supervised trial on agricultural crops are shown in Tables 13-24. All trials were reported on detailed summary sheets, but necessary information was well documented except where indicated.

The trials were with several types of formulation (e.g. 10-50% EC, 50% WP, 24% SL and technical grade active ingredient), but in view of the high solubility of mevinphos in water it is unlikely that the type of formulation will significantly affect the residue level.

The information on recoveries and limits of determination was generally sufficient for evaluation.

In the trials before 1970 residues were determined by enzymatic methods. Because the (*E*)-isomer is a stronger inhibitor of acetylcholinesterase than the (*Z*)- and the (*Z*)- isomer is more persistent than the (*E*)- the results of enzymatic analyses are likely to be lower than those obtained by GLC. The Meeting therefore agreed not to use the data from trials in which the analyses were by enzymatic methods. It was also agreed not to use data from trials in which the conditions or duration of the storage of analytical samples were not reported, because such information is essential to assess the validity of the data. The trials which were excluded on these grounds are shown shaded in the Tables.

Residues resulting from trials according to GAP are underlined.

Table 13. Residues of mevinphos in oranges. South Africa, 1972.

Form.	Application			PHI, days	Residues, mg/kg[1]			Ref.
	No.	kg ai/ha	kg ai/hl		(*E*)- isomer	(*Z*)- isomer	Total	
24%	1		0.04	0	f<0.01, p0.55	f<0.01, p0.15	f<0.02, p0.70	WKGR
EC							w0.20	0187.72
				2	f<0.01, p0.04	f<0.01, p0.04	f<0.02, p0.08	
							w0.04	
				7	f<0.01, p0.02	f<0.01, p0.02	f<0.02, p0.04	
							w0.02	

[1]f = pulp; p = peel; w = whole fruit

Table 14. Residues of mevinphos in pome fruit. All single applications.

Crop, Country, Year	Application			PHI, days	Residues, mg/kg[1]			Ref.
	Form	kg ai/ha	kg ai/hl		(E)- isomer	(Z)- isomer	Total	
Apple	10%	0.5	0.05	0	0.17 (0.13)	0.25 (0.22)	0.42 0.35)	BEGR
France	EC			3	0.16 (0.07)	0.26 (0.16)	0.42 (0.23)	0041/70
1969				7	0.07 (0.06)	0.22 (0.17)	0.29 (0.23)	
				14	0.01 (<0.01)	0.11 (0.07)	0.12 (0.08)	
		1.0	0.10	0	0.43 (0.11)	0.39 (0.19)	0.82 (0.30)	
				3	0.36 (0.11)	0.45 (0.17)	0.81 (0.28)	
				7	0.23 (0.09)	0.26 (0.16)	0.49 (0.25)	
				14	0.04 (0.01)	0.13 (0.09)	0.17 (0.10)	
		0.5	0.05	0	0.15 (0.05)	0.11 (0.16)	0.26 (0.21)	
				3	0.12 (0.07)	0.17 (0.15)	0.29 (0.22)	
				7	0.10 (0.07)	0.18 (0.15)	0.28 (0.22)	
				14	<0.01 (<0.01)	0.14 (0.07)	0.15 (0.08)	
		1.0	0.10	0	0.37 (0.21)	0.35 (0.28)	0.72 (0.49)	
				3	0.35 (0.16)	0.34 (0.30)	0.69 (0.46)	
				7	0.25 (0.15)	0.37 (0.23)	0.62 (0.38)	
				14	0.03 (0.03)	0.20 (0.15)	0.23 (0.18)	
Apple	TG[2]	0.5		1	0.45, 0.30	0.20, 0.15	0.65, 0.45	WKGR
UK				3	0.30, 0.10	0.15, 0.10	0.45, 0.20	0052.72
1971				7	0.15, 0.08	0.10, 0.07	0.25, 0.15	
				10	0.08, 0.06	0.10, 0.09	0.18, 0.15	
				14	0.10, 0.05	0.09, 0.10	0.19, 0.15	
		1.0		1	0.90, 0.70	0.35, 0.30	1.25, 1.00	
				3	0.40, 0.80	0.20, 0.35	0.60, 1.15	
				7	0.40, 0.40	0.15, 0.25	0.55, 0.65	
				10	0.30, 0.35	0.20, 0.25	0.50, 0.60	
				14	0.15, 0.15	0.15, 0.20	0.30, 0.35	
Apple	24%	0.25		0	0.15, 0.15	0.05, 0.06	0.20, 0.21	WKGR
UK	SL			2	0.06, 0.04	0.04, 0.03	0.10, 0.07	0005.73
1972				5	<0.01, <0.01	<0.01, 0.01	<0.02, 0.02	
				8	<0.01, <0.01	0.02, 0.02	0.03, 0.02	
				13	<0.01, 0.02	0.02, <0.01	0.03, 0.03	
		0.5		0	0.50, 0.30	0.15, 0.10	0.65, 0.40	
				2	0.15, 0.15	0.07, 0.08	0.22, 0.23	
				5	0.06, 0.05	0.05, 0.05	0.11, 0.10	
				8	0.04, 0.03	0.05, 0.04	0.09, 0.07	

Crop, Country, Year	Application			PHI, days	Residues, mg/kg[1]			Ref.
	Form	kg ai/ha	kg ai/hl		(E)- isomer	(Z)- isomer	Total	
				13	0.01, 0.02	0.04, 0.03	0.05, 0.05	
	24%	0.25		0	0.10, 0.10	0.04, 0.04	0.14, 0.14	
	EC			2	0.03, 0.03	0.03, 0.03	0.06, 0.06	
				5	<0.01, <0.01	0.02, 0.02	0.03, 0.03	
				8	<0.01, <0.01	0.02, 0.02	0.03, 0.03	
				13	<0.01, <0.01	0.02, 0.01	0.03, 0.02	
Pear	10%	0.5	0.05	0	0.10 (0.04)	0.05 (0.01)	0.15 (0.05)	BEGR
France	EC			1	0.03 (<0.01)	0.01 (<0.01)	0.04 (<0.02)	0020/70[3]
1969				3	0.02 (<0.01)	<0.01 (<0.01)	0.03 (<0.02)	
				7	<0.01 (<0.01)	<0.01 (<0.01)	<0.02 (<0.02)	
				14	<0.01 (<0.01)	<0.01 (<0.01)	<0.02 (<0.02)	
				21	<0.01 (<0.01)	<0.01 (<0.01)	<0.02 (<0.02)	
		1.0	0.10	0	0.22 (0.10)	0.09 (0.05)	0.31 (0.15)	
				1	0.12 (0.05)	0.06 (0.01)	0.18 (0.06)	
				3	0.06 (0.03)	0.03 (0.01)	0.09 (0.04)	
				7	0.03 (0.01)	0.01 (<0.01)	0.04 (0.02)	
				14	<0.01 (<0.01)	<0.01 (<0.01)	<0.02 (<0,02)	
				21	<0.01 (<0.01)	<0.01 (<0.01)	<0.02 (<0.02)	

[1]Figures in parentheses are for peeled fruits
[2]Technical grade active ingredient was used
[3]Sample storage conditions not clear

Table 15. Residues of mevinphos in stone fruit.

Crop, country, year	Application				PHI, days	Residues, mg/kg[1]			Reference
	Form.	No.	kg ai/ha	kg ai/hl		(*E*)- isomer	(*Z*)- isomer	Total	
Apricot		1	0.28		0			0.15	RES
USA					1			0.13	58-65[2,3]
1958					3			0.10	
					7			0.04	
Cherry	10%	1	0.5	0.05	1	0.55	0.25	0.80	BEGR
France	EC				3	0.20	0.10	0.30	0056/70
1970					5	0.10	0.08	0.18	
					7	0.04	0.05	0.09	
		1	1.0	0.10	1	0.70	0.35	1.05	
					3	0.30	0.15	0.45	
					5	0.10	0.06	0.16	
					7	0.05	0.05	0.10	
		1	0.5	0.05	1	1.10	0.55	1.65	
					3	0.60	0.30	0.90	
					5	0.45	0.35	0.80	
					7	0.20	0.25	0.45	
		1	1.0	0.10	1	1.80	0.85	2.65	
					3	1.60	0.70	2.30	
					5	0.95	0.65	1.60	
					7	0.35	0.60	0.95	
Cherry	10%	1	0.5	0.05	0	0.30	0.15	0.45	BEGR
France	EC				8	0.20	0.15	0.35	0018.72
1971					14	0.05	0.08	0.13	
		1	1.0	0.10	0	1.20	0.55	1.75	
					8	0.50	0.30	0.80	

Crop, country, year	Application Form.	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg[1] (*E*)- isomer	(*Z*)- isomer	Total	Reference
					14	0.25	0.25	0.50	
		1	0.5	0.05	1	0.45	0.25	0.70	
					7	0.35	0.20	0.55	
					14	0.15	0.20	0.35	
		1	1.0	0.10	1	2.10	0.90	3.00	
					7	0.65	0.35	1.00	
					14	0.25	0.25	0.50	
Cherry	50%	3		0.025	0	0.90	0.31	1.21	WKGR
Germany	EC				7	0.09	0.07	0.16	0172.74
1974					10	0.04	0.05	0.09	
					14	0.01	0.02	0.03	
					21	<0.01	<0.01	<0.02	
		3		0.025	0	0.29	0.16	0.45	
					7	0.01	0.02	0.03	
					10	<0.01	0.02	0.03	
					14	<0.01	0.01	0.02	
					21	<0.01	<0.01	<0.02	
					28	<0.01	<0.01	<0.02	
		3		0.025	7	0.08	0.06	0.14	
					10	0.09	0.08	0.17	
					14	0.01	0.03	0.04	
					21	<0.01	<0.01	<0.02	
Cherry	48%	3	0.24	0.024	0	0.21	0.11	0.32	BEGR
Germany	EC				4	0.12	0.09	0.21	83.016
1982					7	0.07	0.07	0.14	
					10	0.04	0.05	0.09	
Cherry	48%	3	0.24	0.024	0	0.55	0.23	0.78	BETR
Germany	EC				7	0.16	0.13	0.29	84.011
1983					14	0.02	0.07	0.09	
					21	<0.01	0.05	0.06	
Cherry		1	0.28		0			0.64	RES
USA					1			0.56.	58-65
1958					3			0.45	2), 3)
					7			0.31	
					14			0.11	
					21			0.10	
Peach	10%	1	0.5	0.05	0	0.51 (0.51)	0.27 (0.27)	0.78 (0.78)	BEGR
France	EC				1	0.23 (0.23)	0.14 (0.13)	0.37 (0.36)	0019/70[4]
1969					3	0.15 (0.10)	0.10 (0.04)	0.25 (0.14)	
					7	0.08 (0.06)	0.06 (0.04)	0.14 (0.10)	
					14	<0.01 (<0.01)	0.10 (0.01)	0.11 (0.02)	
					21	<0.01 (<0.01)	0.03 (0.02)	0.04 (0.03)	
		1	1.0	0.10	0	1.50 (0.71)	0.80 (0.39)	2.30 (1.10)	
					1	1.10 (0.73)	0.60 (0.37)	1.70 (1.10)	
					3	0.57 (0.28)	0.36 (0.11)	0.93 (0.39)	
					7	0.25 (0.20)	0.17 (0.15)	0.42 (0.35)	
					14	0.25 (0.19)	0.17 (0.16)	0.42 (0.35)	
					21	0.04 (<0.01)	0.05 (0.03)	0.09 (0.04)	
Peach	50%	3		0.025	0	0.60	0.21	0.81	WKGR
Germany	EC				7	0.04	0.03	0.07	0023.75
1974					10	0.01	0.02	0.03	
					14	0.01	0.01	0.02	

Crop, country, year	Application Form.	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg[1] (*E*)- isomer	(*Z*)- isomer	Total	Reference
					21	<0.01	<0.01	<0.02	
		3		0.025	0	0.31	0.11	0.42	
					7	0.03	0.01	0.04	
					10	0.02	0.01	0.03	
					14	0.02	0.01	0.03	
					21	<0.01	<0.01	<0.02	
		3		0.025	0	0.76	0.26	1.02	
					7	0.03	0.05	0.08	
					10	0.02	0.03	0.05	
					14	<0.01	<0.01	<0.02	
					21	<0.01	<0.01	<0.02	
Peach	15%	5	0.56	0.15	0			0.32	RES
USA	EC				1			0.09	57-45[2,3]
1957					2			0.05	
					4			0.04	
					7			0.04	

[1]Figures in parentheses are for peeled fruits
[2]Sample storage period not clear.
[3]Analyses by enzymatic method
[4]Sample storage conditions not clear

Table 16. Residues of mevinphos in small fruits and berries.

Crop, country, year	Application Form.	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg[1] (E)-isomer	(Z)-isomer	Total	Ref.
Currant	50%	3		0.025	0	1.40	0.45	1.85	BEGR
Germany	EC				7	0.07	0.03	0.10	0113.74
1974					10	0.01	<0.01	0.02	
					14	<0.01	<0.01	<0.02	
					21	<0.01	<0.01	<0.02	
		3		0.025	0	1.30	0.45	1.75	
					7	0.03	0.01	0.04	
					10	0.02	0.01	0.03	
					14	<0.01	<0.01	<0.02	
					21	<0.01	<0.01	<0.02	
Currant	50%	3		0.025	0	0.40	0.18	0.58	BEGR
Germany	EC				7	0.03	0.04	0.07	0114.74
1974					10	0.02	0.03	0.05	
					14	<0.01	<0.01	<0.02	
					21	<0.01	<0.01	<0.02	
					28	<0.01	<0.01	<0.02	
		3		0.025	0	0.45	0.09	0.54	
					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
					14	<0.01	<0.01	<0.02	
					21	<0.01	<0.01	<0.02	
		3		0.025	0	0.80	0.37	1.17	
					7	0.04	0.10	0.14	
					10	0.02	0.10	0.12	
					14	<0.01	0.05	0.06	
					21	<0.01	<0.01	<0.02	

Crop, country, year	Application				PHI, days	Residues, mg/kg[1]			Ref.
	Form.	No.	kg ai/ha	kg ai/hl		(E)-isomer	(Z)-isomer	Total	
Currant	50%	3		0.025	0	2.30	1.00	3.30	BEGR
Germany	EC				7	0.10	0.04	0.14	0095.75
1975					10	0.05	0.02	0.07	
					14	<0.01	<0.01	<0.02	
					21	<0.01	<0.01	<0.02	
					25	<0.01	<0.01	<0.02	
Currant	24%	1	0.28		1	0.32	0.12	0.44	WKGR
UK	EC				3	0.19	0.10	0.29	0028.72
1971					6	0.07	0.05	0.12	
		1	0.56		1	0.32	0.12	0.44	
					3	0.43	0.18	0.61	
					6	0.08	0.05	0.13	
		1	0.28		1	0.26	0.13	0.39	
					3	0.34	0.18	0.52	
					6	0.09	0.06	0.15	
		1	0.56		1	0.60	0.22	0.82	
					3	0.34	0.21	0.55	
					6	0.12	0.08	0.20	
Grape	10%	1	0.5	0.05	0	0.45	0.33	0.78	BEGR
France	EC				1	0.12	0.08	0.20	0018.70[1]
1969					3	0.12	0.09	0.21	
					7	0.02	0.03	0.05	
					14	<0.02	<0.02	<0.04	
					21	<0.02	<0.02	<0.04	
		1	1.0	0.10	0	1.40	0.53	1.93	
					1	0.43	0.23	0.66	
					3	0.16	0.11	0.27	
					7	0.12	0.15	0.27	
					14	0.02	0.04	0.06	
					21	<0.02	0.02	0.04	
		1	0.5	0.05	0	0.25	0.12	0.37	
					1	0.05	0.03	0.08	
					3	0.05	0.03	0.08	
					7	<0.02	<0.02	<0.04	
					14	<0.02	<0.02	<0.04	
					21	<0.02	<0.02	<0.04	
		1	1.0	0.10	0	0.60	0.20	0.80	
					1	0.17	0.07	0.24	
					3	0.16	0.07	0.23	
					7	0.09	0.03	0.12	
					14	<0.02	<0.02	<0.04	
					21	<0.02	<0.02	<0.04	
Grape	24%	1	0.15		5	<0.01	<0.01	<u>≤0.02</u>	WKGR
France	EC								077.72
1971	2% D	2	0.48		5	<0.01	<0.01	<0.02	
Grape	24%	1		0.045	0	0.58	0.17	0.75	WKGR
South Africa	EC				3	0.14	0.07	0.21	0182.70
1970					7	0.06	0.05	0.11	
Grape	24%	1		0.045	0	0.90	0.28	1.18	BEGR
South Africa	EC				2	0.73	0.24	0.97	0092.74
1974					4	0.27	0.19	0.46	
Grape		1	0.56		0			0.20	RES
USA					1			0.06	57-36[2]
1957					2			<0.05	
					3			<0.05	

Crop, country, year	Application				PHI, days	Residues, mg/kg[1]			Ref.
	Form.	No.	kg ai/ha	kg ai/hl		(E)-isomer	(Z)-isomer	Total	
Strawberry	24%	1		0.024	1	0.13	0.05	0.18	WKGR
Portugal	EC				4	0.05	0.02	0.07	0168.71
1971					7	0.03	0.01	0.04	
		1		0.048	1	0.26	0.08	0.34	
					4	0.08	0.04	0.12	
					7	0.06	0.03	0.09	
		1		0.024	1	0.08	0.03	0.11	
					4	0.03	0.01	0.04	
					7	0.04	0.01	0.05	
		1		0.048	1	0.09	0.04	0.13	
					4	0.03	0.02	0.05	
					7	0.04	0.02	0.06	
Strawberry	10%	1	0.22		2			0.06	RES
USA	EC				4			0.06	57-25[2,3]
1957					10			<0.05	
Strawberry	EC	1	1.1		0			0.26	RES
USA					1			0.14	62-23[2]
1962					2			0.24	
(aerial application)					3			0.14	
		1	1.4		0			0.62	
					1			0.45	
					2			0.28	
					3			<0.05	

[1]Sample storage conditions not clear
[2]Analyses by enzymatic method
[3]Sample storage period not clear.

Table 17. Residues of mevinphos in brassica vegetables.

Country, crop, year	Application				PHI, days	Residues, mg/kg[1]			Reference
	Form.	No.	kg ai/ha	kg ai/hl		(E)- isomer	(Z)- isomer	Total	
Broccoli		1	1.1		1			1.6	RES
USA	EC				2			0.12	62-27[2]
1965					3			0.08	
					4			<0.01	
		1	1.7		1			2.3	
					2			1.8	
					3			0.14	
					4			<0.01	
Cauliflower	10%	1	0.25	0.025	0	0.52, 0.38	0.55, 0.40	1.07, 0.78	BEGR
France	EC				1	0.46, 0.50	0.55, 0.52	1.01, 1.02	0016/70[3]
1969					2	0.32, 0.18	0.35, 0.20	0.67, 0.38	
					4	0.04, <0.02	0.15, 0.07	0.19, 0.09	
					7	0.02, <0.02	0.05, 0.05	0.07, 0.07	
		1	0.50	0.050	0	0.80, 0.80	0.75, 0.70	1.55, 1.50	
					1	0.58, 0.60	0.55, 0.65	1.13, 1.25	
					2	0.45, 0.40	0.50, 0.42	0.95, 0.82	
					4	0.04, 0.06	0.10, 0.20	0.14, 0.26	
					7	0.02, <0.02	0.05, 0.02	0.07, 0.04	
Cauliflower	50%	3		0.025	0	0.15	0.08	0.23	BEGR

Country, crop, year	Application				PHI, days	Residues, mg/kg[1]			Reference
	Form.	No.	kg ai/ha	kg ai/hl		(E)- isomer	(Z)- isomer	Total	
Germany	EC				4	0.04	0.03	0.07	0116.74
1974					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
		3		0.025	0	0.06	0.10	0.16	
					4	0.02	0.08	0.10	
					7	<0.01	0.05	0.06	
					10	<0.01	<0.01	<0.02	
		3		0.025	0	0.10	0.07	0.17	
					4	0.05	0.05	0.10	
					7	0.01	0.03	0.04	
					10	<0.01	<0.01	<0.02	
Cauliflower	48%	1	1.1		0	0.04	0.02	0.06	WKGR
USA 1972	EC				2	<0.01	<0.01	<0.02	0073.72
(aerial application)									
Brussels	15%	9		0.011	0	<0.02	<0.02	<0.04	SBGR
sprout	EC				1	<0.02	<0.02	<0.04	81.224
South Africa					2	<0.02	<0.02	<0.04	
1980					4	<0.02	<0.02	<0.04	
					8	<0.02	<0.02	<0.04	
					16	<0.02	<0.02	<0.04	
Cabbage		2		0.025	0	0.82	0.44	1.26	WKGR
Germany					4	0.01	0.02	0.03	0014.75
1975					7	0.01	0.01	0.02	
					10	<0.01	<0.01	<0.02	
					14	<0.01	<0.01	<0.02	
					21	0.01	0.01	0.02	
		2		0.025	0	0.08	0.08	0.16	
					4	<0.01	0.01	0.02	
					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
					14	<0.01	<0.01	<0.02	
					21	0.01	0.02	0.03	
		2		0.025	0	0.33	0.16	0.49	
					4	0.01	0.03	0.04	
					7	<0.01	0.02	0.03	
					10	<0.01	0.02	0.03	
					21	<0.01	<0.01	<0.02	
Cabbage	48%	2	0.43	0.072	0	1.70	0.75	2.45	BEGR
Germany	EC				4	0.02	0.02	0.04	82.128
1982					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
Cabbage	48%	2	0.43	0.072	0	3.00	1.30	4.30	BETR
Germany	EC				4	0.02	0.02	0.04	84.002
1983					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
		2	0.43	0.072	0	1.90	0.56	2.46	
					4	0.03	0.02	0.05	
					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
Cabbage	TG	1	0.28	0.05	0			0.40	WK
UK					1			0.20	138/60[2,3,5]
1960					2			0.15	
					4			0.04	
					7			0.02	

Country, crop, year	Application				PHI, days	Residues, mg/kg[1]			Reference
	Form.	No.	kg ai/ha	kg ai/hl		(E)- isomer	(Z)- isomer	Total	
		1	0.56	0.10	0			0.85	
					1			0.55	
					2			0.13	
					4			0.02	
					7			0.02	
	10%	1	0.28	0.05	0			0.51	
	EC				1			0.25	
					2			0.23	
					4			<0.01	
					7			<0.02	
		1	0.56	0.10	0			0.95	
					1			0.64	
					2			0.20	
					4			0.05	
					7			<0.02	
	24%	1	0.28	0.05	0			0.55	
	EC				1			0.15	
					2			0.07	
					4			0.05	
					7			<0.02	
		1	0.56	0.10	0			0.83	
					1			0.52	
					2			0.11	
					4			<0.01	
					7			<0.02	
Cabbage	50%	1	0.25		1	<0.01	<0.01	H<0.02	WKGR
UK	WP				2	<0.01	<0.01	H<0.02	0180.71
1970					4	<0.01	<0.01	H<0.02	
					7	<0.01	<0.01	H<0.02	
		1	0.50		1	0.01,0.45	<0.01,0.19	H0.02,L0.64	
					2	0.02,0.14	<0.01,0.08	H0.03,L0.22	
					4	<0.01	<0.01	H<0.02	
					7	<0.01	<0.01	H<0.02	
Cabbage	24%	1	0.25		0	0.25	0.15	0.40	WKGR
UK	SL				1	0.01	0.03	0.04	0006.73
1972					3	<0.01	<0.01	<0.02	
					5	<0.01	<0.01	<0.02	
		1	0.5		0	0.60	0.30	0.90	
					1	0.03	0.05	0.08	
					3	0.02	0.02	0.04	
					5	0.01	0.01	0.02	
	24%	1	0.25		0	0.25	0.15	0.40	
	EC				1	<0.01	0.03	0.04	
					3	<0.01	<0.01	<0.02	
					5	<0.01	<0.01	<0.02	
	24%	5	0.25		0	0.55	0.25	0.80	
	SL				1	0.10	0.09	0.19	
					3	0.02	0.02	0.04	
					5	0.01	0.01	0.02	
		5	0.5		0	1.45	0.60	2.05	
					1	0.10	0.10	0.20	
					3	0.08	0.06	0.14	
					5	0.03	0.03	0.06	
					8	<0.01	<0.01	<0.02	
	24%	5	0.25		0	0.30	0.20	0.50	

Country, crop, year	Application				PHI, days	Residues, mg/kg[1]			Reference
	Form.	No.	kg ai/ha	kg ai/hl		(E)- isomer	(Z)- isomer	Total	
	EC				1	0.06	0.06	0.12	
					3	0.02	0.03	0.05	
					5	0.01	0.01	0.02	
Kale	50%	3		0.025	0	1.00	0.60	1.60	BEGR
Germany	EC				4	0.04	0.08	0.12	0115.74
1974					7	0.04	0.05	0.09	
					10	0.03	0.04	0.07	
					14	<0.01	<0.01	<0.02	
		3		0.025	0	2.40	0.80	3.20	
					4	0.08	0.12	0.20	
					7	0.01	0.03	0.04	
					10	<0.01	0.03	0.04	
					14	<0.01	<0.01	<0.02	
		3		0.025	0	2.20	1.00	3.20	
					4	0.02	0.06	0.08	
					7	<0.01	0.02	0.03	
					10	<0.01	0.01	0.02	
					14	<0.01	<0.01	<0.02	
Kale		3	0.71	0.079	0	1.80	0.90	2.70	BEGR
Germany					4	0.02	0.10	0.12	0027.75
1974					7	<0.01	0.04	0.05	
					10	<0.01	0.02	0.03	
					14	<0.01	<0.01	<0.02	
		3	0.47	0.078	0	1.60	0.70	2.30	
					4	0.17	0.18	0.35	
					7	0.02	0.08	0.10	
					10	<0.01	<0.01	<0.02	
					14	<0.01	<0.01	<0.02	
		3	0.71	0.079	0	1.90	0.80	2.70	
					4	<0.01	0.05	0.06	
					7	<0.01	0.03	0.04	
					10	<0.01	0.02	0.03	
					14	<0.01	<0.01	<0.02	
Kale	48%	2	0.43	0.072	0	1.10	0.65	1.75	BEGR
Germany	EC				4	<0.01	0.07	0.08	83.017
1982					7	<0.01	0.02	0.03	
					10	<0.01	<0.01	<0.02	
Kale	48%	2	0.43	0.072	0	9.60	2.80	12.40	BETR
Germany	EC				4	0.33	0.15	0.48	84.015
1983					7	<0.01	0.03	0.04	
					10	<0.01	<0.01	<0.02	
		2	0.43	0.072	0	6.00	1.40	7.40	
					4	0.30	0.30	0.60	
					7	0.06	0.10	0.16	
					10	<0.01	<0.01	<0.02	
Chinese Kale	24%	1	0.45		0			6.40	Submitted
Thailand	EC				1			1.80	by
1987					3			0.22	Thailand
					5			0.08	
					7			0.12	
					10			0.19	
		1	0.89		0			19.45	
					1			3.18	
					3			0.19	
					7			0.12	

Country, crop, year	Application				PHI, days	Residues, mg/kg[1]			Reference
	Form.	No.	kg ai/ha	kg ai/hl		(E)- isomer	(Z)- isomer	Total	
					10			0.08	

[1]H= head; L = leaf
[2]Acnalyses by enzymatic method
[3]Sample storage conditions not clear
[4]Technical grade active ingredient was used
[5]Sample storage period not clear

Table 18. Residues of mevinphos in fruiting vegetables

Crop, country, year	Application				PHI, days	Residues, mg/kg[1]			Ref.
	Form.	No.	kg ai/ha	kg ai/hl		(*E*)-	(*Z*)-	Total	
Cucumber	50%	3		0.025	0	0.05	0.03	0.08	BEGR
Germany	EC				4	<0.01	<0.01	<0.02	0018.75
1974					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
		3		0.025	0	0.08	0.04	0.12	
					4	<0.01	<0.01	<0.02	
					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
		3		0.025	0	0.10	0.05	0.15	
					4	<0.01	<0.01	<0.02	
					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
Cucumber	24%	1		0.05	0	0.12	0.05	0.17	BEGR
Netherlands	EC				1	0.09	0.04	0.13	0015.7[2]
1970					2	0.09	0.04	0.13	
					4	0.06	0.05	0.11	
					7	0.02	0.03	0.05	
					10	<0.01	<0.01	<0.02	
		1		0.1	0	0.19	0.06	0.25	
					1	0.19	0.07	0.26	
					2	0.14	0.06	0.20	
					4	0.08	0.05	0.13	
					7	0.03	0.04	0.07	
					10	<0.01	0.02	0.03	
Cucumber	22%	1		0.011	0	<0.01	<0.01	<0.02	BEGR
Netherlands	EC				1	<0.01	<0.01	<0.02	0004.71[2]
1970					2	<0.01	<0.01	<0.02	
					4	<0.01	<0.01	<0.02	
					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
		1		0.023	0	0.15	0.08	0.23	
					1	0.09	0.04	0.13	
					2	0.04	0.03	0.07	
					4	0.03	0.04	0.07	
					7	<0.01	<0.01	<0.02	
					10	<0.01	<0.01	<0.02	
Cucumber	50%	3		0.025	4	0.32	0.08	0.40	BEGR
(glasshouse)	EC				7	0.15	0.05	0.20	0003.75
Germany					11	0.15	0.05	0.20	
1974					14	0.07	0.04	0.11	
(Sep.-Oct.)		3		0.025	0	0.50	0.15	0.65	
					4	0.45	0.15	0.60	