

CHLORFENVINPHOS (014)

EXPLANATION

Chlorfenvinphos was evaluated for residues by the JMPR in 1971 and 1984 and maximum residue levels for a number of commodities were estimated.

Chlorfenvinphos was proposed for re-evaluation by the Working Group on Priorities at the 1989 CCPR (ALINORM 89/24A, para 298 and Appendix V). The review was scheduled for 1994 at the 1990 CCPR (ALINORM 91/24, Appendix V Part II) and confirmed by the 1991 CCPR on the understanding that new data would be available (ALINORM 91/24A, para 316 and Appendix VI, Annex I).

Information on current GAP and data on residues were requested from governments by CL 1991/15-PR.

The manufacturer informed FAO that data on residues would not be available in time for the 1994 JMPR and the review was therefore delayed until the 1996 Meeting.

The Meeting received data on residues and information on GAP from the manufacturer, and additional information was provided by Australia, Germany, The Netherlands, Poland and the UK.

IDENTITY

ISO common name: chlorfenvinphos

Chemical name

IUPAC: 2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate

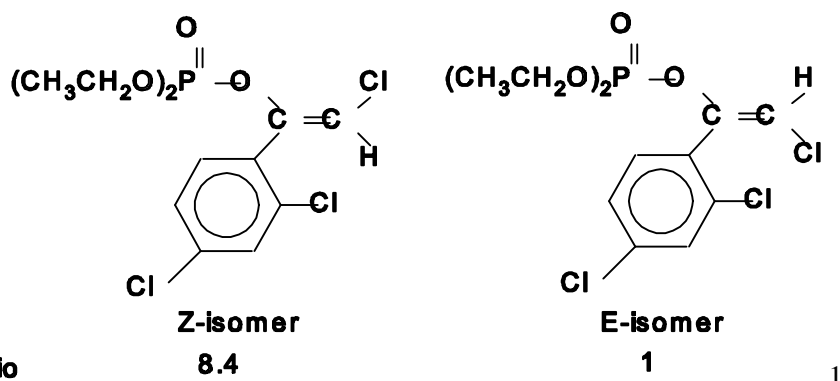
CA: 2-chloro-1-(2,4-dichlorophenyl)ethenyl diethyl phosphate

CAS registry no: 470-90-6 (formerly 2701-86-2) (*Z*)- + (*E*)- isomers;
18708-87-7 (*Z*)- isomer;
18708-86-6 (*E*)- isomer

CIPAC No: 88

Synonyms: "Birlane", "Supona", CL 58,085, SD 7859, GC 4072

Structural formula:



Molecular formula: $C_{12}H_{14}Cl_3O_4P$

Molecular weight: 359.6

Physical and chemical properties

Pure active ingredient

No information was submitted.

Technical material

Purity:

Typical specification based on the analysis of 12 manufacturing batches in 1994 was 90-91.4% (total *E*- + *Z*-).

The purity of the technical material with which the physical and chemical properties listed below were determined was 93.1% (83.3% *Z*- isomer, 9.8% *E*- isomer) or 94.5% (84.2% *Z*- isomer, 10.3% *E*- isomer).

Colour:	amber
Physical state:	liquid at 25°C
Odour:	weak inherent smell
Melting point:	below -30°C
Boiling Point:	above 280°C
Relative Density	1.351
Surface tension of aqueous solutions	
	90% sat 51.8 mN/m
	80% sat 53.0 mN/m
Vapour Pressure	
at 25°C:	(<i>Z</i>)- isomer 0.37×10^{-3} Pa
	(<i>E</i>)- isomer 5.4×10^{-5} Pa

Flash Point: No flash point was observed up to a temperature of 285°C.

Auto-flammability: $542.6^{\circ}\text{C} \pm 1.1^{\circ}\text{C}$ (mean of 5 assays)

Hydrolysis: Half-life in hours for the (*Z*)- isomer 6300 (pH 4), 6500 (pH 7) and 2100 (pH 9); (*E*)- isomer 6600 (pH 4), 4900 (pH 7) and 1700 (pH 9).

Photolysis: Half-life for phototransformation in water at 21°C and a nominal pH of 7 was 482 hours (Calmels, 1992; Robson 1992, 1993, 1994)

Data on the solubility of chlorfenvinphos in water, fat and organic solvents and the octanol-water partition coefficient were also supplied but were not supported by full study reports (Anon, 1996c)

Formulations

Chlorfenvinphos is formulated as GR, WP and EC products.

METABOLISM AND ENVIRONMENTAL FATE

Animal metabolism

Humans. In a volunteer study (Hutson, 1969) a male was given a single oral dose of 12.5 mg of [^{14}C]chlorfenvinphos in olive oil. The radiolabel was rapidly excreted in the urine with 72% of the applied dose excreted in the first 4.5 hours and 94.2% in 26.5 hours. Five metabolites were identified in the urine, two of which were quantified. These were 2-chloro-1-(2,4-dichlorophenyl)vinyl ethyl hydrogen phosphate and 2,4-dichloromandelic acid, which accounted for 23.8 and 23.9 % of the applied dose respectively. The other three metabolites were tentatively identified as [1-(2,4-dichlorophenyl)ethyl- α -D-glucopyranosidyl]uronic acid, 2,4-dichlorophenylethanediol glucuronide and 2,4-dichlorohippuric acid (*N*-2,4-dichlorobenzoylglycine).

Rats and dogs. In a study on rats and dogs (Hutson and Hathway, 1966) rats were given single oral doses of 2 mg/kg [^{14}C]chlorfenvinphos. Within 96 hours 87% of the applied dose was excreted in the urine, 1.4% in expired air and 11% in the faeces. Most of the radiolabel in the urine was excreted in the first 24 hours.

Dogs were given single oral doses of 0.3 mg/kg [^{14}C]chlorfenvinphos in gelatine capsules. In the first 24 hours 86% of the applied dose was excreted in the urine, and in 96 hours 89.4% was excreted in the urine and 4.5% in the faeces.

The urine was analysed for metabolites: five were identified from the rats and four from the dogs. Their relative proportions are shown in Table 1.

Table 1. Metabolites of chlorfenvinphos in rat and dog urine.

Metabolite	% of ^{14}C in urine	
	Rat	Dog
2,4-dichlorophenylethanediol glucuronide	3	3
[1-(2,4-dichlorophenyl)ethyl- α -D-glucopyranosidyl]uronic acid	47	4
2,4-dichlorohippuric acid	5	absent
2,4-dichloromandelic acid	8	5
2-chloro-1-(2,4-dichlorophenyl)vinyl ethyl hydrogen phosphate	37	78

Cattle. In a briefly reported study (Hutson and Hoadley, 1969; Hunter, 1969), one small (400 kg) Friesian cow was given a single intramuscular injection of 233 mg of [*vinyl*-1,2-¹⁴C]chlorfenvinphos (unspecified radiochemical purity; specific radioactivity 2.8 µCi/mg) in 'Infonutrol'. The cow had free access to water and hay, was fed 3.6 kg of concentrate per day over the five day duration of the study and was milked twice daily (at 10 am and 4 pm).

Milk samples were analysed for total radioactive residues by LSC, and were found to contain a maximum initial radioactive residue of 0.076 mg/kg chlorfenvinphos equivalents. Overall, only 0.2% of the administered dose was recovered in the milk (Table 2).

Table 2. Radioactive residues in milk after intramuscular administration of [*vinyl*-¹⁴C]chlorfenvinphos to a cow.

Day	Time	¹⁴ C	
		% of administered dose	mg/kg parent equivalents
1	4 pm	0.13	0.076
2	10 am	0.04	0.011
2	4 pm	0.01	0.006
3	10 am	0.01	0.004
3	4 pm	0.009	0.006
4	10 am	0.006	0.002
4	4 pm	0.0005	0.0003
5	10 am	0.001	0.0005

The nature of the residues was investigated in the first milk sample. The second sample was analysed for the parent compound only. The milk was separated into cream, residual whey, and precipitated protein by centrifugation. The cream was extracted with acetone and hexane. The radioactivity was distributed as follows: hexane-soluble fat 52%, acetone-soluble fat 28%, insoluble fat residue 3%, whey 13%, and insoluble protein 4%. A fat sample was prepared by mixing dried cream with sodium sulfate before dissolution in acetone/hexane and concentration by evaporation. The fat content of the milk was estimated as 5%. TLC of the fat solution with reference standards showed mainly chlorfenvinphos (0.049 mg/kg) with the metabolites (found in the range 0.0004 to 0.0023 mg/kg) shown in Table 3. The levels of unchanged chlorfenvinphos in the first and second milk samples represented 75% and 60% of the total radioactive residue (TRR) respectively. The major metabolite found in milk was 2,4-dichloroacetophenone (III), found only at a level of 0.0023 mg/kg (3.6% of the TRR). Of the radioactivity remaining in the whey, 29% was extracted with ether at neutral pH (postulated as parent) and 23% was extracted at pH 2 (considered to be indicative of metabolites VI and IX).

Table 3. Distribution and nature of the radioactive residue in milk fat.

Metabolites		Residue in milk fat expressed as mg/kg in whole milk
I	chlorfenvinphos	0.049
II	2,4-dichlorophenacyl chloride	0.0008
III	2,4-dichloroacetophenone	0.0023
IV	1-(2,4-dichlorophenyl)ethanol	0.0014
V	1-(2,4-dichlorophenyl)ethane-1,2-diol	not detected
VI	2,4-dichloromandelic acid	0.0011
VII	2,4-dichlorobenzoic acid	<0.0014
VIII	2-chloro-1-(2,4-dichlorophenyl)ethanol	0.0004
IX	desethyl-chlorfenvinphos	0.0007

Urine was sampled at an unspecified time and found to contain 29% of the administered dose, of which 90% was extracted with ether/ethanol. Paper chromatography in butanol/ammonia revealed the presence of metabolites IV, V, VI, and IX accounting for 34%, 23%, 12% and 57% of the extracted radioactive residue.

The proposed metabolic pathway for chlorfenvinphos in ruminants is given in Figure 1 below.

A number of investigations with [^{32}P]chlorfenvinphos were briefly reported in a paper published in 1966. In the first of these [^{32}P]chlorfenvinphos (unspecified radiochemical purity) was applied dermally to two calves in two litres of spray (one at 0.25% and the other at 0.05% concentration). Omental fat samples were taken at 3, 7 and 15 days after spraying and were found to contain radioactive residues of 0.675, 0.055 and "0" mg/kg from the 0.25% treatment and 0.06, 0.001 and "0" mg/kg from the 0.05% treatment.

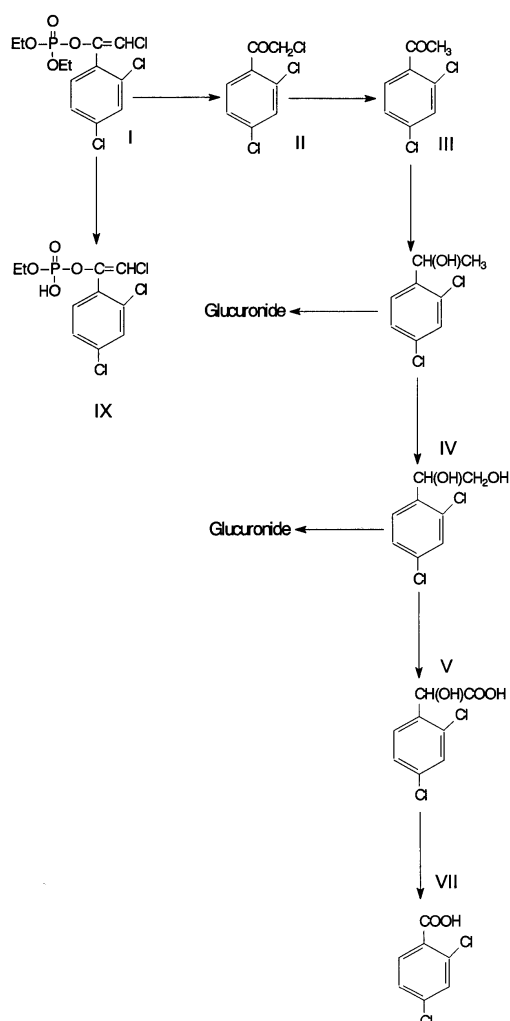
In a second investigation, two calves were similarly treated dermally with 2 litres of a spray emulsion, one at 0.25% and the other at 0.5% concentration. Both animals were killed 7 days after treatment and samples of renal and omental fat, heart, kidney, and muscle were taken for radiometric analysis. The results are shown in Table 4.

Table 4. Radioactive residues in fat and tissues of calves 7 days after treatment with a [^{32}P]chlorfenvinphos spray.

Sample	^{32}P as chlorfenvinphos, mg/kg	
	0.25% spray	0.5% spray
Renal fat	0.042	0.204
Omental fat	0.036 (0.36 ¹)	0.223
Heart	0.002	0.015
Kidney	0.001	0.008
Muscle	0.001	0.008

¹ Additional sample taken by omentectomy 24 hours after treatment

Figure 1. Proposed metabolic pathways of chlorfenvinphos in ruminants.



In a third investigation, three Hereford calves were treated “to saturation” with a 0.25% spray emulsion of chlorfenvinphos. The calves were killed 7 (calf A), 16 (calf B) and 28 (calf C) days after treatment. Samples of omental and renal fat, muscle, heart, kidney, liver, brain, and spleen were analysed for the parent compound by GLC (Table 5).

Table 5. Residues of chlorfenvinphos in fat and tissues of cattle sprayed ‘to saturation’ with a 0.25% spray of chlorfenvinphos.

Sample	Chlorfenvinphos, mg/kg, at intervals, days, after spraying		
	7	16	28
Omental fat	0.085	0.006	<0.005
Renal fat	0.021	<0.005	<0.005
Muscle	<0.004	<0.004	<0.004
Heart	<0.004	<0.004	<0.004
Kidney	<0.004	<0.004	<0.004

Sample	Chlorfenvinphos, mg/kg, at intervals, days, after spraying		
	7	16	28
Liver	<0.004	<0.004	<0.004
Brain	<0.004	<0.004	<0.004
Spleen	<0.004	<0.004	<0.004

In a fourth, more comprehensive, investigation (Ivey *et al.*, 1966) six Hereford cattle (group A) were sprayed 12 times at weekly intervals with a 1% emulsion of chlorfenvinphos. Another group (B) of six cattle was sprayed six times at two-week intervals with the same concentration of spray. Control animals were sprayed with "formulation blank". Fat samples were taken by omentectomy from three animals from group A, one week after the 1st, 2nd, 4th, 6th, 8th, 10th and 12th spray treatments, and from three animals from group B two weeks after each treatment. The samples were analysed for chlorfenvinphos and the metabolite 2,4-dichlorophenacyl chloride by GLC. 2,4-dichlorophenacyl chloride was not detected in any of the samples. The residues of chlorfenvinphos in the omental fat of the cattle in groups A and B are shown in Tables 6 and 7 respectively. All results were corrected for blanks and a recovery of 80%.

Table 6. Residues of chlorfenvinphos in omental fat from cattle sprayed weekly with a 0.1% emulsion.

Animal	Residues, mg/kg, in omental fat 7 days after indicated spray						
	1st	2nd	4th	6th	8th	10th	12th
A.1	0.012				0.161		0.010
A.2	0.009		0.065		0.121		0.010
A.3	0.056		0.142		0.245		0.020
A.4		0.047		0.051		0.020	
A.5		0.070		0.065		0.019	
A.6		0.020		0.035		0.009	

Table 7. Residues of chlorfenvinphos in omental fat from cattle sprayed biweekly with a 0.1% emulsion.

Animal	Residues, mg/kg, in omental fat 14 days after indicated spray					
	1st	2nd	3th	4th	5th	6th
B.1	<0.005		<0.005		0.247	
B.2	0.006		0.006		0.170	
B.3	<0.005		<0.005		0.080	
B.4		0.009		<0.005		0.180
B.5		0.008		0.007		0.110
B.6		<0.005		<0.005		

No residues of chlorfenvinphos were detected in omental or renal fat taken from animals of group A or B slaughtered 14 and 28 days after the last spray respectively.

In a very briefly reported study (Roberts *et al.*, 1961) two dairy cows were sprayed with ³²P-labelled chlorfenvinphos (unspecified radiochemical purity; specific activity 3.4 mCi/g). One cow (Holstein) was treated with 400 ml of a water-based spray formulated from a simple EC containing 5 g of the radiolabelled compound. This was done by spraying 200 ml on each side of the cow, avoiding the udder, and working into the hair with a comb. The second cow (Jersey) was similarly treated with 5 g of ³²P-labelled chlorfenvinphos (unspecified radiochemical purity; specific activity 1.7 mCi/g), using a

different EC formulation based on xylene and lanolin in a total spray volume of 60 ml; this was not worked into the hair, and resulted in a loss of about 5%. Duplicate milk samples (200 ml) were taken from the morning milk just before treatment and up to 12 days after treatment. The organosoluble radioactivity was extracted and determined with a Geiger tube. The maximum residues were found in the milk sampled 5 hours after treatment, 0.06 mg/kg in the Holstein and 0.03 mg/kg in the Jersey. One day after treatment the residues had decreased to 0.011 mg/kg and 0.005 mg/kg in the Holstein and Jersey milk, and residues were finally eliminated in 12 and 10 days after treatment respectively.

Chamberlain and Hopkins (1962) applied [³²P]chlorfenvinphos (radiochemical purity in the range 76 to 87%) at 55, 25 and 8 mg/kg body weight to the back and sides of three steers, A, B and C respectively, in a volume of 300 ml as an EC spray using a chromatography spray bottle held 1.2 cm from the surface of the skin, with subsequent combing into the skin. Blood samples and excreta were taken at regular intervals for 1 week after treatment and radioassayed with a gas-flow proportional counter. The results are shown in Table 8. It was stated that 18 to 42% of the chloroform-soluble radioactivity in the blood co-chromatographed with unchanged chlorfenvinphos. Twenty five to 35% of the applied radioactivity was excreted in the urine, but only 2% was recovered from the faeces.

It was reported, although full details were not given, that 9 or 10 radioactive compounds were excreted in the urine, one of which (representing 2 to 14% of the TRR) co-chromatographed with dimethyl hydrogen phosphate. Another metabolite (in the range 0.4 to 7%) was tentatively identified as diethyl 1-methyl-2-chlorovinyl hydrogen phosphate. The predominant component, which represented "49% of all the radioactive material in early hourly samples", remained unidentified. It was stated to decrease in concentration with time. A further unidentified component was reported in the range 6 to 44% of the TRR.

Table 8. Total radioactive residues in blood, urine and faeces of dermally treated steers.

Time	³² P as chlorfenvinphos, mg/kg								
	Steer A			Steer B			Steer C		
	Blood ¹	Urine	Faeces	Blood ¹	Urine	Faeces	Blood ¹	Urine	Faeces
1 h	7.1 (1.4)	741					0.7	2.8	
2 h	7.8 (1.2)	2504		3.9 (0.3)			0.9	16	
3 h	6.7 (0.8)	2966	7.2	3.9 (0.7)	1148	1.1	0.8 (0.04)	27	0.5
6 h	3.8 (0.8)	2589	13	2.2 (0.3)	1117	2.9	0.6	84	2.2
9 h	3.2 (0.4)	1556	113				0.4	74	
12 h	3.3	1445					0.3	57	
18 h	2.9	918	428	0.8 (0.2)	408	56	0.2	56	
1 day	2.1	684	441	0.7	193	52	0.2	38	7.6
2 days	1.5	196	108		121	32	0.2	26	4.9
4 days	1.1	46	26	0.6	57	42	0.2	17	5.0
7 days	0.9	18	21	0.4	18	7	0.3	6.6	3.8

¹ Chloroform-soluble residues are shown in parentheses

A further study on the toxicology and metabolism of chlorfenvinphos (Herbst and Herbst, 1995) was submitted but was not evaluated because it was written in German.

Plant metabolism

In a 1965 study, later described in two papers and summarized in a further review (Beynon and Wright 1965, 1967; Beynon *et al.* 1973; Anon, undated) [¹⁴C]vinyl-labelled (*E*)-chlorfenvinphos (radiochemical purity not specified) was applied to soil around cabbage plants at a rate of 4 mg per plant (growth stage not specified) to soil eight weeks after it had been sown with carrots at an application rate of 3.4 kg ai/ha, and to soil ten weeks after it had been sown with onions at a rate of 4.5 kg ai/ha. Cabbages were harvested 12-14 weeks, and carrots and onions 18 weeks, after treatment. All three crops were grown in the laboratory.

The samples were extracted with acetone and analysed by TLC (only brief details supplied). Quantification of the unextractable residues was by combustion analysis.

The results are summarized in Tables 9-11 below. In cabbages no radiolabel (<0.01 mg/kg as chlorfenvinphos) was detected in the heart but 0.11 mg/kg was found in the outer leaves, of which 0.05 mg/kg was extractable but not characterized. An acetone extract of the stump/root was found to contain a residue of 0.26 mg/kg, of which 95% was chlorfenvinphos and 5% 2,4-dichloroacetophenone. A total residue of 0.15 mg/kg was found in the roots of carrots, of which 0.12 mg/kg was chlorfenvinphos, and a total residue of 0.08 mg/kg in onion bulbs, of which 0.07 mg/kg was chlorfenvinphos.

Table 9. Residues of (*E*)-[vinyl-¹⁴C]chlorfenvinphos and its breakdown products in cabbages grown indoors following application to the soil around the roots at transplanting.

Sample	¹⁴ C as chlorfenvinphos ¹	
	Acetone-extractable	Acetone-unextractable
Heart	0.005	0.005
Outer leaf	0.05	0.06
Dead leaf (on soil)	0.15	0.04
Stump and root	0.26 ²	0.26

¹ Controls <0.005 mg/kg

² 95% chlorfenvinphos, 5% 2,4-dichloroacetophenone

Table 10. Residues of (*E*)-[vinyl-¹⁴C]chlorfenvinphos and its breakdown products in carrots grown indoors.

Sample	Acetone extractability	Component	¹⁴ C as chlorfenvinphos ¹
edible root	Extractable	Chlorfenvinphos	0.12
		2,4-dichloroacetophenone	0.01
	Unextractable	Unidentified	0.024
leaf	Extractable	Chlorfenvinphos	0.33
		Unextractable	Unidentified

¹ Recovery of [¹⁴C]chlorfenvinphos at approximately 1 mg/kg was 82%

Table 11. Residues of (*E*)-[vinyl-¹⁴C]chlorfenvinphos and its breakdown products in onions grown indoors.

Sample	Acetone extractability	Component	¹⁴ C as chlorfenvinphos ¹
Bulb	Extractable	Chlorfenvinphos	0.07
	Unextractable	Unidentified	0.01
Leaf	Extractable	Unidentified	0.05
	Unextractable	Unidentified	0.01

¹ Recovery of [¹⁴C]chlorfenvinphos at approximately 0.7 mg/kg was 90-95%. Control plants showed ¹⁴C corresponding to <0.01 mg/kg

In reviews of the metabolism and degradation of vinyl phosphate insecticides (Beynon *et al.*, 1973; Beynon and Wright, 1968) it was reported that [¹⁴C]vinyl-labelled (*E*)-chlorfenvinphos of unspecified radiochemical purity was foliar-applied (precise method and rate not specified) to potatoes, cabbage and maize growing in a greenhouse. Analyses of crop samples taken 28-112 days after treatment gave the results shown in Table 12. The methods used to extract and analyse the samples were not described.

In potatoes, 39% of the applied ¹⁴C was found in the foliage after 28 days and less than 0.5% in the tubers after 80 days. Evidence for identification was not given, but the authors indicated that 21% of the applied radiolabel represented chlorfenvinphos, 11% a conjugate of 1-(2,4-dichlorophenyl)ethanol and 7.2% could not be extracted with acetone. They suggested that plant metabolism studies with tetrachlorvinphos indicated that the unextracted residues were mainly further quantities of conjugates of 1-(2,4-dichlorophenyl)ethanol.

Twenty per cent of the radiolabel applied to cabbages was found in the foliage 24 days after treatment: 6.7% of the dose as chlorfenvinphos and 6.7% as the 1-(2,4-dichlorophenyl)ethanol conjugate; 6.7% could not be extracted with acetone and again appeared to consist mainly of conjugates of 1-(2,4-dichlorophenyl)ethanol.

In maize, 54% of the applied radiolabel was found in the foliage after 24 days and less than 0.5% in the grain after 112 days. In the foliage 26% of the dose was chlorfenvinphos, 12% the 1-(2,4-dichlorophenyl)ethanol conjugate and 16%, unextractable with acetone, apparently also conjugates of 1-(2,4-dichlorophenyl)ethanol.

Table 12. Metabolites found after foliar treatment of glasshouse crops with [¹⁴C]chlorfenvinphos.

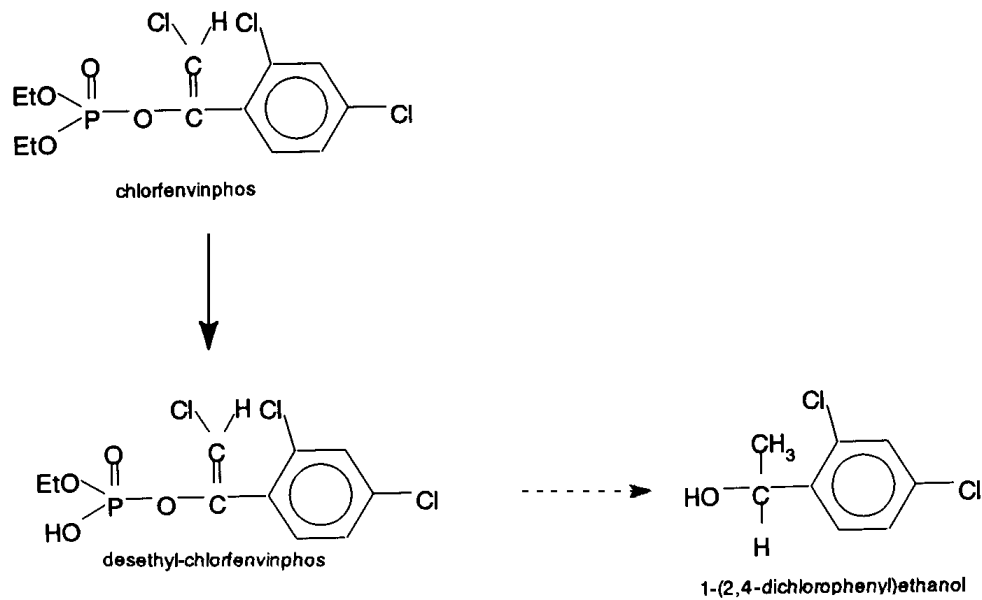
Crop	Sample	Days from treatment to sampling	% of applied ¹⁴ C			
			Chlorfenvinphos	Conjugate of 1-(2,4-dichlorophenyl)ethanol ¹	Unextracted by acetone ²	Total
Potato	Whole plant above ground	28	21	11	7.2	39
	Tubers	80	-	-	-	<0.5
Cabbage	Whole plant above ground	24	6.7	6.7	6.7	20
Maize	Whole plant above ground	24	26	12	16	54
	Grain	112	-	-	-	<0.5

¹ Approximately 1% of the activity ascribed to the conjugate could be from desethyl-chlorfenvinphos

² Probably also mainly conjugates of 1-(2,4-dichlorophenyl)ethanol

The metabolic pathway proposed on the basis of foliar application is shown in Figure 2.

Figure 2. Metabolism of chlorfenvinphos in plants following foliar treatment.



Environmental fate in soil and water/sediment systems

In the study of plant metabolism following soil application described above (Beynon and Wright,

1965), further work was carried out to identify degradation products in the soil. In addition, a second phase of the study involved the treatment of different soil types with higher rates of [*vinyl*-¹⁴C]chlorfenvinphos (15 mg/kg) in closed containers. Acetone extracts of soil samples taken from below the onion crop were reported to contain chlorfenvinphos at 2.4 mg/kg, desethyl-chlorfenvinphos (near 0.02 mg/kg) and 2,4-dichlorophenacyl chloride. Further treatment of the soil with acid extracted 0.35 mg/kg chlorfenvinphos equivalents, which consisted of chlorfenvinphos (0.28 mg/kg), desethyl-chlorfenvinphos (0.07 mg/kg) and a trace of 2,4-dichlorophenacyl chloride. The authors stated that the desethyl-chlorfenvinphos in the acid extract may have been present as such in the soil but was more likely to have been in the form of a salt or conjugate which was hydrolysed to desethyl-chlorfenvinphos by the acid. Few further details were given, and no results of the second phase were presented.

In a summarized study of the degradation of chlorfenvinphos in soil under laboratory conditions (Anon., undated; Beynon *et al.*, 1973) [*vinyl*-¹⁴C]chlorfenvinphos was applied to 4 different soils at an initial concentration of 15 mg/kg. The pH and water contents of the soils are given in Table 13. The soils were incubated in the dark at 22°C and samples were taken for analysis at intervals for 4 months.

Table 13. Characteristics of experimental soils.

Soil type	pH	Water content (% w/w)
Clay	8.0	21.1
Loam	8.0	15.1
Sand	7.9	13.9
Peat	6.4	88.6

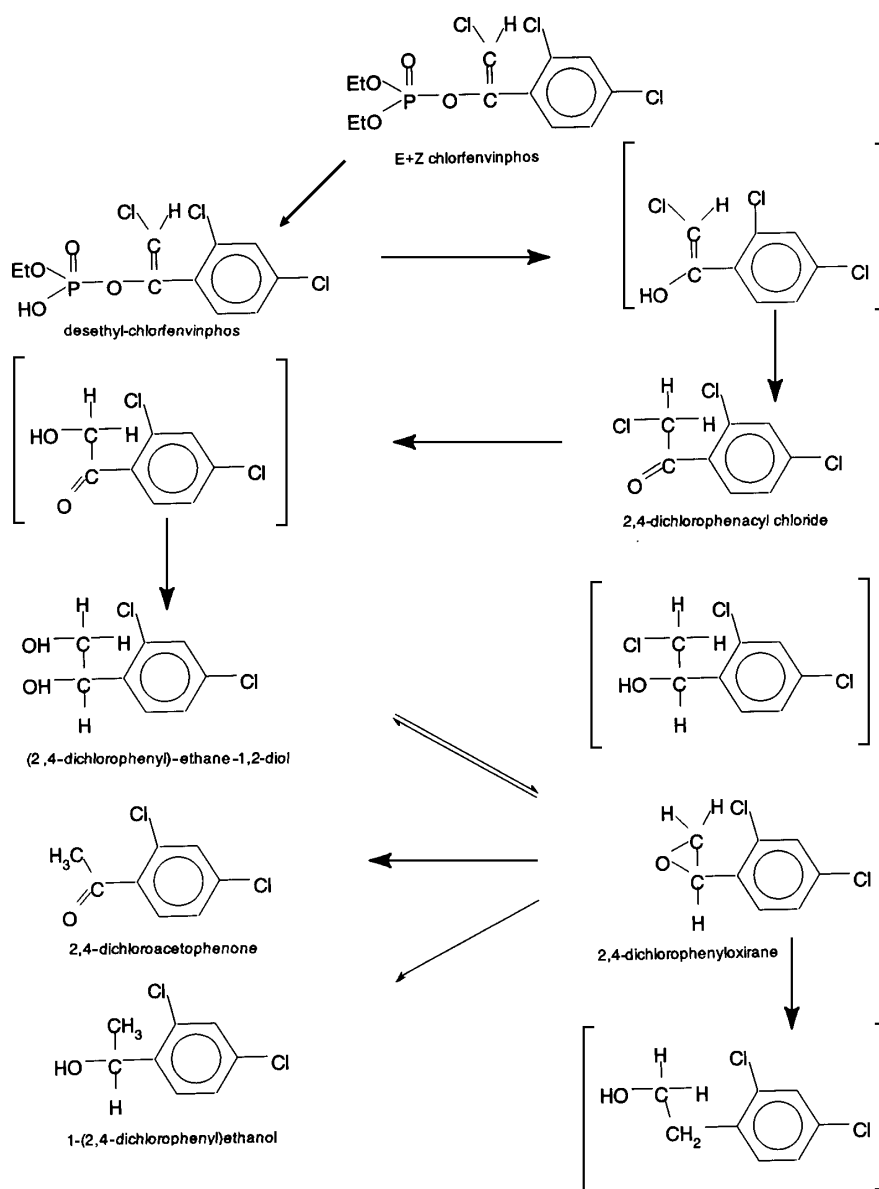
Extracts of the soils were examined for products of degradation by TLC with radio-analysis, with the results shown in Table 14. Radioactivity designated as unextractable was obtained by oxidation of the treated soil by "Van Slyke oxidation".

Table 14. Residues of [¹⁴C]chlorfenvinphos and its degradation products in soils four months after treatment.

Compound or fraction	Residue, mg/kg moist soil			
	Clay	Loam	Sand	Peat
desethyl-chlorfenvinphos	0.2	0.1	0.2	0.1
(2,4-dichlorophenyl)ethan-1,2-diol	≤0.02	≤0.02	≤0.03	≤0.02
unknown	0.07	0.06	0.04	0.1
1-(2,4-dichlorophenyl)ethanol	1.0	0.1	0.06	0.2
chlorfenvinphos	2.0	4.2	1.0	4.7
2,4-dichloroacetophenone	0.5	0.2	0.1	0.2
2,4-dichlorophenacyl chloride	≤0.005	≤0.005	≤0.005	≤0.005
2,4-dichlorophenyloxirane	≤0.005	≤0.005	≤0.005	≤0.005
salts or conjugates of desethyl-chlorfenvinphos	0.1	0.5	0.6	<0.05
unextractable radioactivity	2.0	1.8	-	-

The pathways for the degradation of chlorfenvinphos proposed by the authors are shown in Figure 3. Structures enclosed in brackets were described as “transient intermediates”, although no derivative of the phenethyl alcohol "intermediate" is suggested.

Figure 3. Proposed degradation pathways of chlorfenvinphos in soil.



The high application rate was employed to identify products which might not be identified at lower rates. Radioactivity which was not recovered from the soils represented 60-80% of the applied dose; it included ^{14}C and residues which could not be extracted with common organic solvents. The predominant products were 1-(2,4-dichlorophenyl)ethanol, 2,4-dichloroacetophenone and the sodium salt of desethyl-chlorfenvinphos.

In additional summarized experiments (Beynon *et al.*, 1973) onions and carrots grown in boxes containing John Innes No 2 compost under glasshouse conditions were treated with [^{14}C]chlorfenvinphos at the commercial rate of 3.4-4.5 kg/ha. Eight weeks after application of the insecticide the ^{14}C in the compost, expressed as mg chlorfenvinphos equivalents/kg moist soil, was accounted for by 2.7 mg/kg of chlorfenvinphos, 0.09 mg/kg of desethyl-chlorfenvinphos and 0.03 mg/kg of 2,4-dichloroacetophenone or 2,4-dichlorophenacyl chloride.

A summarized study (Anon., undated), presented as a poor copy which was illegible in places, described three further experiments on degradation in field soils. In all of these it was unclear whether the application rate referred to product/ha or active ingredient/ha. In the first experiment, chlorfenvinphos was applied at 4.5 or 9 kg/ha to crops in the field at 4 sites in the UK in spring or summer. Soil samples were taken for analysis at intervals up to 6 months. The soils were a brick-earth, a sandy loam, a loam and a peat. Half-lives of chlorfenvinphos were in the range of about 14-84 days in the mineral soils and more than 150 days in the peat soil. 2,4-dichlorophenacyl chloride was found in peat samples taken 4 weeks or more after treatment at concentrations up to 0.1 mg/kg of soil (105 day sample) after application of chlorfenvinphos at 9 kg/ha. The properties of the soils were not given.

In the second experiment, chlorfenvinphos was applied to field soils at rates of 4.5, 6.7, 9 or 22 kg/ha. Samples of soil were taken for analysis at intervals up to 6 months after application in spring or summer and examined for the degradation products 1-(2,4-dichlorophenyl)ethanol, 2,4-dichloroacetophenone and 2,4-dichlorophenacyl chloride. There was no evidence of isomerisation of the (Z)- isomer in soil. 2,4-Dichlorophenacyl chloride was not detected in the soils within 6 months of application at 4.5 or 6.7 kg/ha but was found at a concentration of 0.1 mg/kg 105 days after application at 9 kg/ha. The highest residue of 2,4-dichloroacetophenone was 0.2 mg/kg, found 30 days after application at 9 kg/ha. 1-(2,4-dichlorophenyl)ethanol was not detected within 6 months of treatment at 4.5-9 kg/ha with a limit of detection of 0.2 mg/kg, but was found at 0.6 mg/kg 28 days after application of the unrealistically high rate of 22 kg/ha.

In the third experiment, carried out in 1966-7, labelled chlorfenvinphos was applied as a GR to a brick loam soil and as an EC to clay loam soil in the UK at 4 kg ai/ha. The residues remaining in soil samples taken at intervals are given in Table 15.

Table 15. Decay of chlorfenvinphos residues in soils.

Interval	Chlorfenvinphos equivalents, mg/kg	
	Faversham brick loam	Woodstock clay loam
0 days	-	3.2
2 days	4.6	-
1 week	4.4	-
2 weeks	2.6	-
4 weeks	4.4	3.3
10 weeks	1.1	1.9
20 weeks	-	1.1
52 weeks	0.11	0.4
82/86 weeks	0.05	0.3
99 weeks	Illegible	-
107 weeks		0.04

A further paper was submitted which provided an overview of the occurrence and fate of residues in soil, mainly of the work described above (Anon., 1985). Laboratory data on the degradation of chlorfenvinphos in water/sediment systems (Wable, 1993) and in fresh water aquatic systems (Edwards and Gibb, 1981) were also submitted but not reviewed.

METHODS OF RESIDUE ANALYSIS

Analytical methods

Fruit and vegetables. The Netherlands submitted a qualitative multi-residue TLC method which allows the determination of the (*E*)- and (*Z*)- isomers of chlorfenvinphos (Anon., 1988a). Samples are extracted with ethyl acetate in the presence of sodium sulfate. An aliquot of the extract is run on a TLC plate using an organic solvent mixture (chloroform/diethyl ether, benzene/acetone, benzene/acetone/hexane, or hexane/acetone). The plate is then sprayed with a homogenate of bee heads, incubated at 370°C and subsequently sprayed with a solution of 2-naphthyl acetate and Fast Blue B. The cholinesterase from the bee heads hydrolyses 2-naphthyl acetate to 2-naphthol, which reacts with the Fast Blue B to form a dye. Where inactivators of cholinesterase are present no dye is formed, so such places appear as white spots on a pink-violet background.

It was reported that 0.2 mg/kg of the (*E*)- isomer and 2 to <20 mg/kg of the (*Z*)- isomer could be detected. The method is not suitable for quantitative determination.

Fruit and vegetables, animal products, and grains. A quantitative multi-residue method, also submitted by The Netherlands, allowed determination of the (*E*)- and (*Z*)- isomers of chlorfenvinphos (Anon., 1988b,c). Samples are extracted with ethyl acetate in the presence of sodium sulfate, cleaned up where necessary by gel permeation chromatography using cyclohexane/ethyl acetate as eluant, and determined in the filtered extract by GLC with a phosphorus-specific detector. The LOD was stated to be in the range 0.01-0.05 mg/kg with a recovery of >80%, although no further information on validation of the method was given.

Carrots and onions. The Netherlands provided brief details of the methods of analysis used in the trials which they reported (Olthof, 1996). Extraction with petroleum ether or ethyl acetate is followed by analysis by GLC with FP detection. The limits of determination ranged from 0.005 to 0.02 mg/kg.

Crops and soil. In a method developed by Shell (Anon., 1966) samples were extracted by maceration with acetone in petroleum spirit in the presence of anhydrous sodium sulfate. After filtering, determination was by GLC with EC detection. Interfering co-extractives were removed with a Florisil column clean-up. An LOD of 0.01 mg/kg was reported although no chromatograms or details of the commodities with which this had been achieved were submitted. No recovery or other validation data were provided.

In a second reported method (Anon., 1990) soil was mixed with anhydrous sodium sulfate before extraction of soil and crop samples with acetone/hexane, and extracts of oily crops were partitioned between hexane and aqueous acetonitrile. The extracts were cleaned up on Florisil before analysis by GLC with an NPD. The method was validated with three soils (clay loam, sandy loam and silty clay), apples, soya beans, wheat grain and cabbage by fortifying with 0.05-0.5 mg/kg of each isomer. Recoveries were consistently between 75 and 115%. At each level the standard deviation was ≤12% of the mean. Sample chromatograms showed resolution of the isomers. The limit of determination was 0.01 mg/kg of each isomer in all samples.

A further method (Anon., 1969) was submitted for the determination of 2,4-dichloroacetophenone, 1-(2,4-dichlorophenyl)ethanol, and 2,4-dichlorophenacyl chloride. Crop and soil samples were extracted with a mixture of acetone and petroleum spirit. The extracts were washed with water, dried, and analysed by GLC with an ECD. Where required, an alumina column clean-up (elution with diethyl ether in petroleum spirit) was included. The method was stated to be suitable for determining metabolites down to a level of 0.01 mg/kg except 2,4-dichloroacetophenone, 2,4-dichlorophenacyl chloride and 1-(2,4-dichlorophenyl)ethanol. The LOD for the dichlorophenylethanol was 0.1 mg/kg.

Analysis of crops in supervised trials. Several other methods (Mathews, 1972; Bosio, 1981i) included in the reports of residue trials were modifications of the methods for crops reviewed above. Extraction was into either acetone/hexane or acetone/petroleum spirit and determination was by GLC with either FP or EC detection. LODs in the range 0.01-0.05 mg/kg were reported although generally no sample chromatograms were submitted. Some samples were analysed for 1-(2,4-dichlorophenyl)ethanol, 2,4-dichlorophenacyl chloride and 2,4-dichloroacetophenone, but with limited data on validation of the methods and few sample chromatograms. Confirmation of residues, when carried out, was by GC-MS.

Grass. Samples were extracted by tumbling with anhydrous sodium sulfate, acetone and petroleum spirit. The extracts were filtered and analysed without clean-up by GLC with an ECD (Elgar, 1966e).

Milk. In a briefly summarized method (Elgar, 1966e), samples of milk were diluted with ethanol and extracted with an ether/hexane mixture. After drying over anhydrous sodium sulfate the solvent was evaporated and the fatty residue washed with hexane and extracted into acetonitrile. The acetonitrile extract was cleaned up on Florisil columns, eluting with ether in petroleum spirit. Analysis was by GLC with EC detection.

Stability of pesticide residues in stored analytical samples

No data were submitted.

Residue definition

The studies of animal and plant metabolism indicate that chlorfenvinphos is the main residue in products of animal and plant origin. A definition of the residue as "chlorfenvinphos, sum of (*E*)- and (*Z*)- isomers" is therefore considered appropriate.

USE PATTERN

Chlorfenvinphos is registered in a number of countries for use on a wide range of vegetable crops, but no uses were reported on fruit crops. Topical veterinary uses on cattle and other animals were reported for Australia.

The information on GAP supplied by the manufacturer (Anon., 1996c) was incomplete. No copies of product labels were submitted, only summary sheets. In some cases the reported PHI appeared to be inappropriate for the type of treatment (e.g. a 21-day PHI for pre-planting or pre-emergence application).

Details of registered use patterns are given in Tables 16-18.

Table 16. Registered uses of chlorfenvinphos on vegetables.

Commodity	Country	Form.	F or G	Application			PHI, days	Ref.	Remarks	
				Method	Rate kg ai/ha	Spray conc. kg ai/hl				No.
Asparagus	Netherlands	WP, EC	F	Spraying without incorporation into soil	3.84-4.0 ¹	0.5-0.768	1	within two days after casing	Olthof 1996	Soil treatment
Broccoli	Germany	GR	F	Spreading and mixing	100 g/m ²	-----	1	pre-planting	Anon 1996d	Soil treatment
	Germany	GR	F	Spreading	0.1 g/plant	-----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
	Germany	GR	F	Spreading with rain	2 g/100 plants	-----	1		Anon 1996d	Nursery bed seedbed
	Germany	GR	F	Spreading	2 kg/ha	-----	1	5-6 days after planting	Anon 1996d	Row treatment
	Netherlands	WP, EC, GR	F	Spraying/granular application onto plant beds	3.84-4.0 ¹	0.0768-0.08	1	60 before sowing	Olthof 1996	Soil application
	Netherlands	WP, EC, GR	F	Spraying/granular application onto "production fields"	1-3.75 ²	0.05 g (WP & EC) and 0.75 g (Gr) ai/plant	1	60	Olthof 1996	At planting or after cabbage fly eggs have set
	UK	EC	F	Seed bed spray	1.34 ¹	0.268-0.446	1	pre-emergence	Anon 1996e	Applied immediately after drilling
	UK	EC	F	Overall soil incorporated spray	2.35 ¹	0.47-0.78	1	21 pre-planting	Anon 1996e	
	UK	EC	F	Soil drench to base of plant	-----	0.0044	1	21 post-emergence	Anon 1996e	Applied April or within 4 days of transplanting if this is later
	UK	GR	F	Sub-surface band	4.5	-----	1	21 Pre- and post-emergence	Anon 1996e	Plants or seed placed into line of granules at drilling or transplanting
	UK	GR	F	Incorporated into peat blocks	-----	50 g ai/640 litre peat	1	21 pre-planting	Anon 1996e	To protect seedlings before planting out
Brussels sprouts	Netherlands	WP /EC/ GR	F	Spraying/granular application onto plant beds	3.84-4.0 ¹	0.0768-0.08	1	60 before sowing	Olthof 1996	Soil application
	Netherlands	WP /EC/ GR	F	Spraying/granular application onto "production fields"	1-3.75	0.05 g (WP & EC) and 0.75 g (Gr) ai/plant	1	60	Olthof 1996	At planting or after cabbage fly eggs have set
	UK	EC	F	Seed bed spray	1.34 ¹	0.268-0.446	1	pre-emergence	Anon 1996e	Applied immediately after drilling
	UK	EC	F	Overall soil incorporated spray	2.35 ¹	0.47-0.78	1	21 pre-planting	Anon 1996e	
	UK	EC	F	Soil drench to base of plant	-----	0.0044	1	21 post-emergence	Anon 1996e	Applied April or within 4 days of transplanting if this is later
	UK	GR	F	Sub-surface band	4.5	-----	1	21 Pre- and post-emergence	Anon 1996e	Plants or seed placed into line of granules at

Commodity	Country	Form.	F or G	Application			PHI, days	Ref.	Remarks	
				Method	Rate kg ai/ha	Spray conc, No. kg ai/hl				
									drilling or transplanting	
	UK	GR	F	Incorporated into peat blocks	-----	50 g ai/640 litre peat	1	21 pre-planting	Anon 1996e	To protect seedlings before planting out
Cabbage	Belgium	EC	-	-----	0.01 g/plant	-----	-	56	Anon 1996c	Post-emergence
	Belgium	GR	-	-----	3-5	-----	-	56	Anon 1996c	Post-emergence
	Denmark	EC	-	-----	0.96	-----	-	56	Anon 1996c	Post-emergence
	Denmark	EC	-	-----	3.8	-----	-	56	Anon 1996c	Pre-planting
	Denmark	EC	-	-----	4	-----	-	70	Anon 1996c	Pre-planting
	France	GR	-	soil treatment	6	-----	-	15	Anon 1996c	
	France	EC	-	soil treatment	0.6-6	-----	-	15	Anon 1996c	
	France	---	-	soil treatment	6	-----	-	15	Anon 1996c	
	Germany	EC	-	furrow treatment	1.4	-----	-	28	Anon 1996c	
	Germany	GR	-	seed bed treatment	0.02 g ai/plant	-----	-		Anon 1996c	
	Germany	GR	-	single plant treatment	0.1 g ai/plant	-----	-		Anon 1996c	
	Germany	GR	-	row treatment	2	-----	-		Anon 1996c	
	Germany	GR	-	incorporation before sowing	0.1 kg ² soil	-----	-		Anon 1996c	
, Chinese	Germany	GR	F	Spreading	0.1 kg ² soil	-----	1	pre-planting	Anon 1996d	Soil treatment spreading and mixing
, Chinese	Germany	GR	F	Spreading	0.1 g ai/plant	-----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
, Chinese	Germany	GR	F	Spreading	2 g ai/100 plants	-----	1		Anon 1996d	Nursery bed seedbed spreading with rain
, Chinese	Germany	GR	F	Spreading	2 kg/ha	-----	1	5-6 days after planting	Anon 1996d	Row treatment
, red	Germany	GR	F	Spreading	100 g/m ²	-----	1	pre-planting	Anon 1996d	Soil treatment spreading and mixing
, red	Germany	GR	F	Spreading	0.1 g/plant	-----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
, red	Germany	GR	F	Spreading	24 g/100 plants	-----	1		Anon 1996d	Nursery bed seedbed spreading with rain
, red	Germany	GR	F	Spreading	2 kg/ha	-----	1	5-6 days after planting	Anon 1996d	Row treatment
, Savoy	Germany	GR	F	Spreading	100 g ²	-----	1	pre-planting	Anon 1996d	Soil treatment spreading and mixing
, Savoy	Germany	GR	F	Spreading	0.1 g/plant	-----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
, Savoy	Germany	GR	F	Spreading	2 g/100 plants	-----	1		Anon 1996d	Nursery bed seedbed

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Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc. kg ai/hl	No.			
										spreading with rain
, Savoy	Germany	GR	F	Spreading	2 kg/ha	-----	1	5-6 days after planting	Anon 1996d	Row treatment
, white	Germany	GR	F	Spreading	100 g/m ²	-----	1	pre-planting	Anon 1996d	Soil treatment spreading and mixing
, white	Germany	GR	F	Spreading	0.1 g/plant	-----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
, white	Germany	GR	F	Spreading	2 g/100 plants	-----	1	-----	Anon 1996d	Nursery bed seedbed spreading with rain
, white	Germany	GR	F	Spreading	2 kg/ha	-----	1	5-6 days after planting	Anon 1996d	Row treatment
	Ireland	GR	-	-----	2.25	-----	---	21	Anon 1996c	at planting
	Ireland	EC	-	-----	2.4	-----	---	21	Anon 1996c	
	Italy	GR	-	-----	2-3	-----	---	30	Anon 1996c	at transplanting
	Italy	EC	-	foliar applied	-----	0.0438-0.0614	---	30	Anon 1996c	
	Italy	WP	-	foliar applied	-----	0.0625-0.075	---	30	Anon 1996c	
	Italy	GR	-	broadcast	0.018-0.023	-----	---	30	Anon 1996c	
	Italy	EC	-	foliar applied	-----	0.05-0.0583	---	30	Anon 1996c	
	Japan	DP	-	foliar applied	0.6-0.9	-----	4	14	Anon 1996c	
	Japan	EC	-	foliar applied	-----	0.024-0.048	---		Anon 1996c	
	Netherlands	GR	-	-----	0.075 g/plant	-----	---	60	Anon 1996c	at planting
, Chinese , Oxhead , Red , Savoy , White	Netherlands	WP/EC/GR	F	Spraying/granular application onto plant beds	3.84-4.0 ¹	0.0768-0.08	1	60 before sowing	Olthof 1996	Soil application
, Chinese , Oxhead , Red , Savoy , White	Netherlands	WP/EC/GR	F	Spraying/granular application onto "production fields"	1-3.75	0.05 g (WP & EC) and 0.75 g (Gr) ai/plant	1	60	Olthof 1996	At planting or after cabbage fly eggs have set
	Sweden	GR	-	---	0.8-1.0 and 2	-----	---	at planting	Anon 1996c	
	Sweden	GR	-	-----	1-1.5	-----	---	at drilling	Anon 1996c	
	Sweden	GR	-	---	1.5-2	-----	---	before drilling	Anon 1996c	
	Sweden	GR	-	---	1.5-2	-----	---	at planting	Anon 1996c	
	Switzerland	EC	-	---	15 g/plant ³	-----	---	21	Anon 1996c	Treatment during vegetation period
	Switzerland	WG	-	---	0.025 g/plant	-----	---	21	Anon 1996c	After planting
	UK	GR	-	-----	2.25	-----	1	21	Anon 1996c	At planting

Commodity	Country	Form.	F or G	Application			PHI, days	Ref.	Remarks	
				Method	Rate kg ai/ha	Spray conc, No. kg ai/hl				
	UK	EC	-	---	4.7	-----	2	21	Anon 1996c	Pre-emergence
	UK	EC	-	---	2.4	-----	2	21	Anon 1996c	Post-emergence
	UK	EC	F	Seed bed spray	1.34 ¹	0.268-0.446	1	pre-emergence	Anon 1996e	Applied immediately after drilling
	UK	EC	F	Overall soil incorporated spray	2.35 ¹	0.47-0.78	1	21 pre-planting	Anon 1996e	
	UK	EC	F	Soil drench to base of plant	-----	0.0044	1	21 Post-emergence	Anon 1996e	Applied April or within 4 days of transplanting if this is later
	UK	GR	F	Sub-surface band	4.5	-----	1	21 Pre- and post-emergence	Anon 1996e	Plants or seed placed into line of granules at drilling or transplanting
	UK	GR	F	Incorporated into peat blocks	-----	50 g ai/640 litre peat	1	21 pre-planting	Anon 1996e	To protect seedlings before planting out
Carrots	Belgium	GR	-	---	3-5	-----	---	pre-planting	Anon 1996c	
	Belgium	EC	-	---	3-5	-----	---	pre-planting	Anon 1996c	
	Denmark	GR	-	---	4	-----	---	84	Anon 1996c	Pre-planting
	Denmark	EC	-	---	4	-----	---		Anon 1996c	Pre-planting
	France	---	-	soil treatment	5	-----	---	15	Anon 1996c	
	France	GR	-	soil treatment	5	-----	---	15	Anon 1996c	
	France	EC	-	soil treatment	0.6-5	-----	---	15	Anon 1996c	
	Germany	GR	-	incorporated by sowing	5	-----	---		Anon 1996c	
	Germany	GR	-	---	5	-----	---		Anon 1996c	Post-emergence
	Germany	EC	-	In furrow	1.44	-----	---		Anon 1996c	
	Germany	GR	-	Incorporation before sowing	5	-----	---		Anon 1996c	
	Germany	GR	F	Spreading	---	---	1		Anon 1996d	Post-emergence, at planting, after planting and Before sowing
	Ireland	GR	-	---	2.25 or 4.5	-----	---	21	Anon 1996c	Before drilling
	Ireland	EC	-	---	5	-----	---	21	Anon 1996c	Pre-emergence
	Ireland	EC	-	---	2.4	-----	---	21	Anon 1996c	Post-emergence
	Italy	GR	-	broadcast	0.0018-0.0023	-----	---	30	Anon 1996c	
	Italy	EC	-	foliar	---	0.05-0.0583	---	30	Anon 1996c	

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Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc. kg ai/hl	No.			
	Italy	WP	-	foliar	---	0.04-0.05	---	30	Anon 1996c	
	Italy	EC	-	foliar	---	0.0351-0.0438	---	30	Anon 1996c	
	Italy	GR	-		2-3	----	---	30	Anon 1996c	Pre-sowing, pre-transplanting
	Luxembourg	EC	-		4	----	---		Anon 1996c	Pre-planting
	Netherlands	GR	-	In furrow	2	----	---	60	Anon 1996c	
	Netherlands	WP	-	seed treatment	25 g ai/kg seed	----	---	60	Anon 1996c	
	Netherlands	EC	-	-----	3-4	----	---	60	Anon 1996c	Pre-planting
	Netherlands	WP	-	-----	3-4	----	---	60	Anon 1996c	Post-emergence
	Netherlands	WP	-	---	3-4	----	---	60	Anon 1996c	Pre-planting
	Netherlands	EC	-	-----	3-4	----	---	60	Anon 1996c	Post-emergence
	Netherlands	GR	-	-----	3-4	----	---	60	Anon 1996c	Broadcast
	Netherlands	WP/EC/GR	F	Broadcast spraying or granular application followed by incorporation into 5-7 cm of soil	3.84-4.0 ¹	0.5-1.92	1	60 (before sowing)	Olthof 1996	Lower dosages (2.88-4 kg ai/ha) for soils with low organic matter (<3%)
	Netherlands	WP/EC	F	soil treatment by spraying	3.84-4.0	0.5-1.92	1	60 (post-emergence at 2-leaf stage)	Olthof 1996	Lower dosages (2.8-4 kg ai/ha) for soils with low organic matter (<3%)
	Netherlands	WP	F	seed treatment	25 g ai per kg seed	---	1	---	Olthof 1996	
, winter	Netherlands	GR	F	Granular application in furrow	2.0	----	---	60	Olthof 1996	
	Switzerland	WG	-	-----	max 0.4	----	1	56	Anon 1996c	Treatment at vegetation period every two years
	Switzerland	WG	-	-----	max 0.6	----	1	56	Anon 1996c	Treatment at vegetation period every two years
	UK	EC	-	---	5	----	3	21	Anon 1996c	Pre-emergence
	UK	EC	-	---	2.4	----	3	21	Anon 1996c	Post-emergence
	UK	GR	-	---	2.25 or 4.5	----	1	21	Anon 1996c	Before drilling
	UK	EC	F	Overall and soil incorporated spray	2.35 (mineral soils) 4.7 (organic soils)	0.235-0.94 or 0.47-1.88	1	---	Anon 1996e	Pre-planting
	UK	EC	F	Overall spray	2.35	0.235-0.39	1-2	21	Anon	Post-

Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc, kg ai/hl	No.			
								1996e	emergence ²	
	UK	GR	F	Broadcast incorporated	2.25 (mineral soils), 4.5 (organic soils)	---	1	21	Anon 1996e	Pre-planting
Cauliflower	Germany	GR	F	Soil treatment spreading and mixing	100 g/m ²	---	1		Anon 1996d	Pre-planting
	Germany	GR	F	Spreading	0.1 g/plant	----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
	Germany	GR	F	Spreading	2 g/100 plants	----	1	---	Anon 1996d	Nursery bed seedbed spreading with rain
	Germany	GR	F	Spreading	2 kg/ha	----	1	5-6 days after planting	Anon 1996d	Row treatment
	Ireland	GR	-	-----	2.25	----	---	21	Anon 1996c	
	Ireland	EC	-	-----	2.4	---	---	21	Anon 1996c	
	Netherlands	GR	-	---	0.075 g ai/plant	----	---	60	Anon 1996c	At planting
	Netherlands	WP/EC/GR	F	Spraying/granular application onto plant beds	3.84-4.0 ¹	0.0768-0.08	1	60 before sowing	Olthof 1996	Soil application
	Netherlands	WP/EC/GR	F	Spraying/granular application onto "production fields"	1-3.75	0.05 g (WP & EC) and 0.75 g (Gr) ai/plant	1	60	Olthof 1996	At planting or after cabbage fly eggs have set
	UK	EC	-	-----	5	----	2	21	Anon 1996c	Pre-emergence
	UK	GR	-	-----	2.25	----	1	21	Anon 1996c	At planting
	UK	EC	-	---	2.4	----	2	21	Anon 1996c	Post-emergence
	UK	EC	F	Seed bed spray	1.34	0.268-0.446	1	pre-emergence	Anon 1996e	Applied immediately after drilling
	UK	EC	F	Overall soil incorporated spray	2.35	0.47-0.78	1	21	Anon 1996e	Pre-planting
	UK	EC	F	Soil drench to base of plant	---	0.0044	1	21	Anon 1996e	Applied post-emergence in April or within 4 days of transplanting if this is later
	UK	GR	F	Sub-surface band	4.5	---	1	21	Anon 1996e	Plants or seed placed into line of granules at drilling or transplanting
	UK	GR	F	Incorporated into peat blocks	-----	50 g ai/640 litre peat	1	21	Anon 1996e	To protect seedlings before planting out
Celeriac	Netherlands	WP/EC/GR	F	Spraying or granular application	3.84-4.0	0.5-1.92	1	---	Olthof 1996	Broadcast; incorporation before sowing
	UK	EC	F	Overall spray	2.35	0.39-0.78	1	21	Anon	Pre-planting

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Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc. kg ai/hl	No.			
								1996e		
	UK	GR	F	Broadcast incorporated	2.25 (mineral soils) 4.5 (organic soils)	---	1	---	Anon 1996e	Pre-planting
Celery, leaf and blanched	Netherlands	WP/EC	F	Spraying directly to soil followed by incorporation before sowing	3.84-4.0	0.5-1.92	1	---	Olthof 1996	
Cucumber	Germany	GR	F	Spreading	---	3 kg ai/ha	1	---	Anon 1996d	At planting, after planting, before sowing
Fennel Bulb	Netherlands	WP/EC	F	Spraying soil treatment	3.84-4.0	0.5-1.92	1	---	Olthof 1996	Incorp. at sowing
Horseradish	UK	EC	F	Overall and soil incorporated spray	2.35 (mineral soils) 4.7 (organic soils)	0.235-0.94 or 0.47-1.88	1	---	Anon 1996e	Pre-planting
	UK	EC	F	Overall spray	2.35	0.235-0.39	1-2	21	Anon 1996e	Post-emergence ²
	UK	GR	F	Broadcast incorporated	2.25 (mineral soils), 4.5 (organic soils)	---	1	21	Anon 1996e	Pre-planting
Kale	Germany	GR	F	Soil treatment spreading and mixing	100 g/m ²	---	1	---	Anon 1996d	Pre-planting
	Germany	GR	F	Spreading	0.1 g/ plant	----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
	Germany	GR	F	Spreading	2 g/100 plants	----	1	---	Anon 1996d	Nursery bed seedbed spreading with rain
	Germany	GR	F	Spreading	2 kg/ha	----	1	5-6 days after planting	Anon 1996d	Row treatment
	Netherlands	WP/EC/GR	F	Spraying or granular application to soil. Incorporation before sowing	3.84-4.0	0.0768-0.08	1	60	Olthof 1996	Application on plant beds
	Netherlands	WP/EC/GR	F	Spraying/granular application onto "production fields"	1-3.75	0.05 g (WP & EC) and 0.75 g (Gr) ai/plant	1	60	Olthof 1996	At planting or after cabbage fly eggs have set
	Portugal	24% EC	-	-----	100 ml/30-50l water	----	---	42	Anon 1996c	Pre-emergence
	Spain	EC	-	-----	2	----	---	30	Anon 1996c	Pre-planting
	Spain	EC	-	Spray	2	----	---	30	Anon 1996c	
	Spain	GR	-	Broadcast	2-3	----	---	30	Anon 1996c	
Kohlrabi	Germany	GR	F	Soil treatment spreading and mixing	100 g/m ²	----	1	---	Anon 1996d	Pre-planting
	Germany	GR	F	Spreading	0.1 g/plant	----	1	5-6 days after planting	Anon 1996d	Treatment of single plants
	Germany	GR	F	Spreading	2 g/100	----	1	---	Anon	Nursery bed

Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc, kg ai/hl	No.			
					plants				1996d	seedbed spreading with rain
	Germany	GR	F	Spreading	2 kg/ha	----	1	5-6 days after planting	Anon 1996d	Row treatment
	Netherlands	WP/EC/GR	F	Spraying/granular application onto plant beds	3.84-4.0 ¹	0.0768-0.08	1	60 before sowing	Olthof 1996	Soil application
	Netherlands	WP/EC/GR	F	Spraying/granular application onto "production fields"	1-3.75	0.05 g (WP & EC) and 0.75 g (Gr) ai/plant	1	60	Olthof 1996	At planting or after cabbage fly eggs have set
	UK	EC	F	Overall spray at pre-planting or root dip at transplanting	2.35	0.39-0.78	1	21	Anon 1996e	
Leek	Germany	EC	F	Spraying	0.144	0.024	1	28	Anon 1996d	At infestation
	Netherlands	WP/EC/GR	F	Spraying or granular soil treatment.	5.76-6.0	0.75-2.88	1	60	Olthof 1996	Incorp. before sowing
Mooli	UK	GR	F	Broadcast incorporated	2.0	---	1	---	Anon 1996e	pre-planting
Mushroom	UK	EC		Compost incorporated spray before spawning (inside)	-----	72 g ai per tonne compost	1	---	Anon 1996e	Maximum of one treatment per spawning
	UK	EC		Casing incorporated spray before adding to bed (inside)	---	54 g ai per tonne casing	1	---	Anon 1996e	Maximum of one treatment per spawning
	UK	GR		Compost incorporated (inside)	-----	110 g ai per tonne compost	1	21	Anon 1996e	At spawning
	UK	GR		Casing incorporated before adding to bed (inside)	---	50 g ai per tonne casing	1	21	Anon 1996e	At spawning
, edible fungi other than mushrooms	UK	EC	F	Compost incorporated spray before spawning	-----	72 g ai per tonne compost	1	---	Anon 1996e	Maximum of one treatment per spawning
	UK	EC		Casing incorporated spray before adding to bed (inside)	---	54 g ai per tonne casing	1	---	Anon 1996e	Maximum of one treatment per spawning
	UK	GR		Compost incorporated (inside)	-----	110 g ai per tonne compost	1	21	Anon 1996e	At spawning
	UK	GR		Casing incorporated before adding to bed (inside)	---	50 g ai per tonne casing	1	21	Anon 1996e	At spawning
Onion	Belgium	EC	-	-----	3-5	----	---	---	Anon 1996c	Pre-planting
	Belgium	GR	-	-----	3-5	----	---	---	Anon 1996c	Pre-planting
	Denmark	GR	-	-----	4	----	---	35	Anon 1996c	Pre-planting
	Denmark	EC	-	-----	1	----	---	56	Anon 1996c	Post-emergence

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Commodity	Country	Form.	F or G	Application			PHI, days	Ref.	Remarks	
				Method	Rate kg ai/ha	Spray conc, No. kg ai/hl				
	France	GR	-	Soil treatment	5	----	---	15	Anon 1996c	
	France	EC	-	Soil treatment	0.6-5	----	---	15	Anon 1996c	
	France	---	-	Soil treatment	5	----	---	15	Anon 1996c	
	Germany	GR	-	Incorporated by sowing	5	----	---	---	Anon 1996c	
	Germany	EC	-	In furrow	1.4	----	---	---	Anon 1996c	
	Germany	GR	-	Incorporation before sowing	5	----	---	---	Anon 1996c	
	Germany	GR	--	---	5	----	---	---	Anon 1996c	Post-emergence
	Germany	GR	F	Spreading	5 kg ai/ha	---	1	---	Anon 1996d	At planting, after planting, before sowing, post emergence
	Japan	DP	-	Broadcast	0.6-13.5	----	---	---	Anon 1996c	
	Japan	EC	-	Foliar	---	0.024-0.032	---	7	Anon 1996c	
	Luxembourg	EC	-		4.8	----	---	---	Anon 1996c	Pre-planting
	Netherlands	GR	-	In furrow	1.2	----	---	60	Anon 1996c	
	Netherlands	WP	-	-----	6	----	---	60	Anon 1996c	Pre-planting
	Netherlands	EC	-	---	6	----	---	60	Anon 1996c	Pre-planting
	Netherlands	GR	-	Broadcast	6	----	---	60	Anon 1996c	
, Bulb, Silverskin	Netherlands	WP/EC/GR	F	Spraying or granular broadcast soil application	5.76-6.0	0.75-2.88	1	---	Olthof 1996	Incorp. before sowing
, Bulb, Silverskin	Netherlands	GR	F	Granular application	1.2	---	1	---	Olthof 1996	Incorp. at sowing
	Sweden	GR	-	-----	0.8-1	----	---	---	Anon 1996c	Post-emergence
	Sweden	GR	-	---	1	----	---	---	Anon 1996c	At planting
	Switzerland	WG	-	---	1-2 g ai/m soil	----	---	21	Anon 1996c	Post-emergence. One treatment every two years
	Switzerland	EC	-	-----	37.5 ml ai/m	----	---	21	Anon 1996c	Treatment at vegetation period
Parsley	Netherlands	WP	F	Spraying	3.84-4.0	0.4-1.92	1	---	Olthof 1996	Soil incorporation directly after treatment
	Netherlands	EC	F	Spraying	3.84-4.0	0.4-1.92	1	---	Olthof 1996	Soil incorporation directly after treatment
	Netherlands	WP	F	Spraying	3.84-4.0	0.5-1.92	1	---	Olthof 1996	Soil incorporation at sowing

Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc, kg ai/hl	No.			
	Netherlands	EC	F	Spraying	3.84-4.0	0.5-1.92	1	---	Olthof 1996	Soil incorporation at sowing
	UK	EC	F	Overall and soil incorporated spray	2.35 (mineral soils) 4.7 (organic soils)	0.235-0.94 or 0.47-1.88	1	---	Anon 1996e	Pre-planting
	UK	EC	F	Overall spray	2.35	0.235-0.39	1-2	21	Anon 1996e	Post-emergence ²
Parsnip	Netherlands	WP	F	Spraying	3.84-4.0	0.4-1.92	1	---	Olthof 1996	Soil incorporation directly after treatment
	Netherlands	EC	F	Spraying	3.84-4.0	0.4-1.92	1	---	Olthof 1996	Soil incorporation directly after treatment
	UK	EC	F	Overall and soil incorporated spray	2.35 (mineral soils)4.7 (organic soils)	0.235-0.94 or 0.47-1.88	1	---	Anon 1996e	Pre-planting
	UK	EC	F	Overall spray	2.35	0.235-0.39	1-2	21	Anon 1996e	Post-emergence ²
	UK	GR	F	Broadcast incorporated	2.25 (mineral soils), 4.5 (organic soils)	----	1	21	Anon 1996e	Pre-planting
Potato, seed, starch, ware	Netherlands	WP/EC	F	Spraying of aerial parts	0.120-0.125	0.0208-0.06	1	14	Olthof 1996	At larvae infestation
	Poland	44% EC	F	High volume spray	220-330 ml/ha	---	1-2	14	Anon 1996a	
Radish, long	Germany	GR	F / G	Spreading	3 kg/ha (field) 4 kg/ha (glass)	----	1	---	Anon 1996d	Before sowing and below/after planting
, small	Germany	GR	F / G	Spreading	3 kg/ha (field) 4 kg/ha (glass)	----	1	---	Anon 1996d	
	Netherlands	WP/EC/GR	F	Soil incorporation before sowing	2.88-3.0	0.375-1.44	1	---	Olthof 1996	
, black	Netherlands	WP/EC/GR	F	Soil incorporation before sowing	2.88-3.0	0.375-1.44	1	---	Olthof 1996	
	UK	EC	F	Overall and incorporated spray	2.35	0.47-0.94	1	21	Anon 1996e	Pre-planting
Salsify	UK	EC	F	Overall and soil incorporated spray	2.35 (mineral soils) 4.7 (organic soils)	0.235-0.94 or 0.47-1.88	1	---	Anon 1996e	Pre-planting
	UK	EC	F	Overall spray	2.35	0.235-0.39	1-2	21	Anon 1996e	Post-emergence ²
	UK	GR	F	Broadcast incorporated	2.25 (mineral soils), 4.5 (organic	----	1	21	Anon 1996e	Pre-planting

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Commodity	Country	Form.	F or G	Application			PHI, days	Ref.	Remarks	
				Method	Rate kg ai/ha	Spray conc, No. kg ai/hl				
					soils)					
Shallots	Netherlands	WP/EC/GR	F	Spraying or granular broadcast application of soil	5.76-6.0	0.75-2.88	1	---	Olthof 1996	Before sowing
	Netherlands	GR	F	Granular application of soil in furrow	1.2	----	1	---	Olthof 1996	Incorp. before sowing
Swede	Netherlands	WP/EC/GR	F	Soil treatment followed by incorporation	2.88-3.0	0.375-1.44	1	---	Olthof 1996	Before sowing
	UK	EC	F	Overall soil incorporated spray	2.35	0.47-0.78	1	---	Anon 1996e	Applied immediately before drilling
	UK	EC	F	Band spray in furrow	2.35	----	---		Anon 1996e	Pre-emergence
	UK	EC	F	Overall post-emergence spray	0.72	0.12	2	21	Anon 1996e	1st application July/August, 2nd application 14 days later
	UK	GR	F	Band application incorporated	4.5	----	1	21	Anon 1996e	Post and pre-emergence
Turnip	Netherlands	WP/EC/GR	F	Soil treatment followed by incorporation	2.88-3.0	0.375-1.44	1	---	Olthof 1996	
	UK	EC	F	Overall soil incorporated spray	2.35	0.47-0.78	1		Anon 1996e	Applied immediately before drilling
	UK	EC	F	Band spray in furrow	2.35	----	---		Anon 1996e	Pre-emergence
	UK	EC	F	Overall spray in furrow	0.72	0.12	2	21 (pre-emergence)	Anon 1996e	1st application July/August, 2nd application 14 days later
	UK	GR	F	Band application in furrow incorporated	4.5	----	1	21 (pre-emergence)	Anon 1996e	

F = Field G = Glasshouse

¹ Application rate calculated from estimated l/ha

² Calculated from 0.05 g/plant

³ For lifting October/November apply 1st week August, for lifting December or later apply 1st week August and repeat 4-6 weeks later (according to advice or pest level)

⁴ Application rate appears high but is as stated by the manufacturer

Table 17. Registered uses of chlorfenvinphos on oilseeds and cereals.

Commodity	Country	Form	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate, kg ai/ha	Spray conc, kg ai/hl	No.			
Maize	Netherlands	WP or EC	F	Spraying of aerial parts at infestation	0.48-0.50	0.08-0.24	1	42 For cutting maize.	Olthof 1996	Application if and when the attack is expected in the 2-3 leaf stage of the crop.
, regrowth of potatoes in maize crop	Netherlands	WP or EC	F	Spraying of aerial parts at infestation	0.120-0.125	0.02-0.06	1	42 For cutting maize	Olthof 1996	Application if larvae of the Colorado beetle have the size of a wheat grain
Rape seed	Austria	EC	-	-----	0.15	-----	---	21	Anon 1996c	Treatment when pests occur
	Germany	EC	-	-----	0.14	-----	---	56	Anon 1996c	Treatment at infestation
	Germany	EC	F	Spraying	0.144	0.024	1	56	Anon 1996d	Treatment at infestation
	Netherlands	GR	-	Broadcast	3	-----	---	60	Anon 1996c	
, winter	Poland	44% EC	F	High volume spray	440 ml/ha	-----	1	35	Anon 1996a	Pest, ceutor-rhynchid beetle
	Poland	44% EC	F	High volume spray	330-400 ml/ha	-----	1	35	Anon 1996a	Pest, Pollen beetle
Rye and triticale	UK	EC	F	Overall soil incorporated spray	1.34	0.39-0.59	1	21 ¹	Anon 1996e	Pre-planting
	UK	EC	F	Overall spray	1.01	0.29-0.44	1	21 ¹	Anon 1996e	Autumn application after planting
	UK	EC	F	Overall spray	0.67 or 1.34 on organic soils	0.19-0.27 or 0.39-0.59	1	21 ¹	Anon 1996e	Application at egg hatch of pest normally Jan/Feb
	UK	EC	F	Conventional seed treatment machine	-----	966 g ai/tonne seed	1	-----	Anon 1996e	Pre-planting
Wheat, winter	UK	EC	F	Overall soil incorporated spray	1.34	0.39-0.59	1	21 ¹	Anon 1996e	Pre-planting
....., winter	UK	EC	F	Overall spray	1.01	0.29-0.44	1	21 ¹	Anon 1996e	Autumn application after planting
....., winter	UK	EC	F	Overall spray	0.67 or 1.34 on organic soils	0.19-0.27 or 0.39-0.59	1	21 ¹	Anon 1996e	Application at egg hatch of pest normally Jan/Feb
....., winter	UK	LS	F	Conventional seed treatment machine	966 g ai/tonne seed	-----	1	-----	Anon 1996e	
, durum	UK	EC	F	Overall soil incorporated spray	1.34	0.39-0.59	1	21 ¹	Anon 1996e	Pre-planting
, durum	UK	EC	F	Overall spray	1.01	0.29-0.44	1	21 ¹	Anon 1996e	Autumn application after

Commodity	Country	Form	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate, kg ai/ha	Spray conc, kg ai/hl	No.			
									planting	
, durum	UK	EC	F	Overall spray	0.67 or 1.34 on organic soils	0.19-0.27 or 0.39-0.59	1	21 ¹	Anon 1996e	Application at egg hatch of pest normally Jan/Feb
, durum	UK	EC	F	Conventional seed treatment machine	-----	966 g ai /tonne seed	1	-----	Anon 1996e	

¹ This 21-day interval which is currently stated on the UK notices of approval for use on winter wheat is shorter than that required in practice. The latest time of application in wheat would be March and the earliest time of harvest July

Table 18. Registered topical uses of chlorfenvinphos on livestock in Australia.

Animal	Application				Ref.	Remarks
	Form.	Method	Spray or dip conc, kg ai/hl	No.		
Cattle (cattle ticks, buffalo fly and lice), Horses, deer, goats, sheep and dogs may also be treated	138 g/l liquid	Plunge dip or spray	0.0552	Used at 19-21 day intervals	Anon 1996b	Treat in early Autumn when infestations first occur

The use of chlorfenvinphos on roses in The Netherlands was also reported (Olthof, 1996).

RESIDUES RESULTING FROM SUPERVISED TRIALS

The results of the residue trials are given in Tables 19-39. They were carried out under field conditions and reported in sufficient detail with acceptable analytical information unless otherwise indicated. Where analytical recoveries were outside the range 70-120% and/or where samples were stored for longer than 6 months or for an unspecified time this is indicated in a footnote. Analytical results have generally been rounded to one significant figure for residues below 0.1 mg/kg. Data in the JMPR format were submitted by the manufacturer only for carrots (some results), onions, kale, cabbage, cauliflower and rape seed.

Many of the trials were very old with reports which lacked details such as the method of analysis, duration of sample storage, recovery data and plot size.

The trials which were considered unsatisfactory have been identified by shading in the Tables. The acceptability of the results of some other trials in which the duration of sample storage was not reported will depend on the future availability of satisfactory data on the stability of residues in representative stored samples.

In most of the trials the samples were analysed for 1-(2,4-dichlorophenyl)ethanol, identified in the Tables as "met". Several of the trials also included analyses for 2,4-dichlorophenacyl chloride and 2,4-dichloroacetophenone, but the residues were below the LODs of 0.02 mg/kg and 0.05 mg/kg respectively in all the analysed samples. Residues discussed in the text are parent chlorfenvinphos unless otherwise indicated.

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Location, Country, year	Application				PHI, days	Residues, mg/kg		Reference
	Form	No.	kg ai/ha	kg ai/hl		Parent	Met	
Althen les Paluds S. France 1969 ¹	GR	1	5	-	182	<0.02	----	CH-722 -003
	GR	1	5	-	182	<0.02	----	
	GR	1	6	-	182	<0.02	----	
Le Thor S. France 1969 ¹	GR	1	5	-	168	<0.02	----	CH-722 -003
	GR	1	5	-	168	<0.02	----	
	GR	1	6	-	168	<0.02	----	
	GR	1	5	-	154	<0.02	----	
	GR	1	5	-	154	<0.02	----	
	GR	1	5	-	154	<0.02	----	
	GR	1	6	-	154	<0.02	----	
Le Thor S. France 1971 ¹	GR	1	4	-	133	<0.02	<0.02	CH-790 -029
	GR	1	8	-	133	<0.02	<0.02	
Le Thor S. France 1972 ¹	GR	2	4	-	175	<0.02	<0.02	CH-790 -031
	GR	2	8	-	175	<0.02	<0.02	
Baden Germany 1973 ¹	EC	1	4.8	-	60	0.04	<0.02	CH-722 -007
München Germany 1973 ¹	EC	1	4.8	-	56	<0.02	----	CH-722 -007
					74	<0.02	<0.02	
Frankfurt Germany 1973 ¹	EC	1	4.8	-	49	0.39	----	CH-722 -007
					70	0.08	----	
					175	<u><0.02</u>	<u><0.02a</u>	
Baden Germany 1973 ¹	WP	1	seed treatment 25 g ai/kg seed	-	42	<0.02	----	CH-722 -008
					56	<0.02	<0.02	
Freising Germany 1973 ¹	WP	1	seed treatment 25 g ai/kg seed	-	49	<0.02	----	CH-722 -008
					77	<0.02	----	
					126	<0.02	<0.02	
Fischenich Germany 1973 ¹	WP	1	seed treatment 25 g ai/kg seed	-	91	<0.02	----	CH-722 -008
					112	<0.02	----	
					133	<0.02	----	
					161	<0.02	<0.02	
Baden Germany 1973 ¹	GR	1	5	-	42	0.70	----	CH-722 -009
					60	<0.02b	<0.02	
Frankfurt Germany 1973 ¹	GR	1	5	-	49	1.37	----	CH-722 -009
					70	0.21	----	
					175	<u><0.02</u>	<u><0.02b</u>	
Freising Germany 1973 ¹	GR	1	5	-	49	0.72	----	CH-722 -009
					77	<0.02	----	
					147	<u><0.02</u>	<u><0.02b</u>	
Frankfurt Germany ¹	GR	1	5.0	-	86	<0.02	----	CH-722 -013
					100	<0.02	----	

Location, Country, year	Application				PHI, days	Residues, mg/kg		Reference
	Form	No.	kg ai/ha	kg ai/hl		Parent	Met	
					114	<u>≤0.02b</u> -----		
Bonn Bad Godesberg Germany ¹	GR	1	5.0	-	35 69 83	<0.02	-----	CH-722 -013
Bad Segeberg Germany ¹	GR	1	5.0	-	55 69 83	<0.02	-----	CH-722 -013
Germany 1965 ¹	GR	1	3	-	120	<0.02	-----	CH-722-001
Chuo Japan 1972 ¹	EC	5	0.32	0.032	8 8 14 14	<u>≤0.02</u>	<u><0.02c</u>	CH-722 -005
	EC	9	0.32	0.032	8 8 14 14	<u>≤0.02</u>	<u><0.02c</u>	
Kimitami Japan 1972 ¹	EC	6	0.32	0.032	7 7 14 14	<u>≤0.02</u>	<u><0.02c</u>	CH-722 -005
	EC	9	0.32	0.032	7 7 14 14	<u>≤0.02</u>	<u><0.02c</u>	
Seville Spain 1971 ¹	GR	1	2	-	133	<0.02	0.01	CH-722 -004
	GR	1	3	-	133	<0.02	0.02	
	GR	1	4	-	133	<0.02	0.03	
Seville Spain 1972 ¹	GR	1	4	-	140	<0.02	<0.02	CH-722 -006
	GR	1	8	-	140	<0.02	<0.02	
Seville Spain 1973 ¹	GR	1	4	-	140	<0.02	<0.02	CH-722 -010
	GR	2	8	-	140	<0.02	<0.02	
Seville Spain 1974 ¹	GR	1	4	-	175	<0.02	-----	CH-722 -011
	GR	1	8	-	175	<0.02	-----	
	GR	1	4	-	175	<<0.02	-----	
	GR	1	8	-	175	<0.02	-----	
UK undated ²	pure ai	1	4.48	-	61	0.07	----	CH-601-001
USA undated ²	GR	1	2.8	-	72	<0.05	----	CH-601-001
Switzerland undated ²	EC	1	1	-	31	<0.02	----	CH-601-001

Spring onions								
Alkmaar	GR	1	6	-	90	0.01	----	J. W.
Netherlands						0.01	----	Dornseiffen
1982 ³						0.04	----	1985
						0.03	----	
						0.04	----	

Results underlined once or twice are considered comparable with

a - Belgian and Netherlands GAP for spray treatments

b - GAP in Belgium, Denmark, Germany and The Netherlands for pre-planting granular treatments

c - Japanese GAP for foliar treatments

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ Duration of sample storage unspecified

² No detailed study report; only very brief details of the trial and analysis were available

³ Information is taken from residue trial summary sheets submitted by The Netherlands. Full study reports were submitted but were in Dutch

Met = 1-(2,4-dichlorophenyl)ethanol

Head cabbage. GAP was reported for Belgium, Denmark, France, Germany, Ireland, Italy, Japan, The Netherlands, Sweden, Switzerland, and the UK. The maximum application rates were 0.96-6 kg ai/ha with PHIs of 14-70 days or as governed by pre-planting or post-emergence treatment .

Residue trials were available from the UK, Germany, the USA and India. In 7 German trials complying with German GAP at 100 g/m² all residues were <0.02 mg/kg. In 6 more German trials reflecting German GAP for granular seedbed treatment (2 g/100 plants) residues were again all <0.02 mg/kg. Residues of 0.07 mg/kg and 0.02 mg/kg were found in two Indian trials in samples taken 17 and 11 days after treatment, but no Indian GAP was reported. One UK trial was considered comparable with the UK pre-emergence spray GAP, but it was poorly reported with few details. No trials were considered to comply with GAP for foliar treatments, which have shorter PHIs.

Table 21. Supervised field trials on head cabbages. Heads analysed.

Location, Country, year	Application				PHI, days	Residues, mg/kg		Ref.
	Form.	No.	kg ai/ha	kg ai/hl		Parent	Met	
Wellesbourne UK 1965 ¹	EC	1	0.84	-	0	4.2	----	CH-640-002
					4	2.89	----	
					10	0.29	----	
					20	<0.02	----	
Unknown UK undated ¹	GR	1	4.48	-	112	<0.05	----	CH-601-001
					112	<0.05	----	
Unknown USA undated ¹	GR	1	0.52kg/1000 m row	-	77	<0.05	----	CH-601-001
Geisenheim Germany 1980 ²	GR	1	0.1kg/m ²	-	63	0.2	----	CH-721 -014
					74	0.05	----	
					94	<0.02a	----	
Bamberg Germany 1980 ²	GR	1	0.1kg/m ²	-	70	0.3	----	CH-721 -014
					84	0.10	----	
					98	<0.02a	----	
Frankfurt Germany 1980 ²	GR	1	0.1kg/m ²	-	70	0.4	----	CH-721 -014
					84	0.2	----	
					98	<0.02a	----	
Frankfurt Germany 1989 ²	GR	1	100g/m ²	-	144	<0.02	----	CH-721 -018
					180	<0.02	----	
					190	<0.02a	----	
					144	<0.02	----	
	GR	1	2g/100 plants	-	144	<0.02	----	

chlorfenvinphos

Location, Country, year	Application				PHI, days	Residues, mg/kg		Ref.
	Form.	No.	kg ai/ha	kg ai/hl		Parent	Met	
	EC	1	0.14	-	180 190 0 16 21 28 35	<0.02 <u><0.02b</u> 0.1 <0.02 <0.02 <0.02 <0.02	----- ----- ----- ----- ----- ----- -----	
Bonn Germany 1989 ²	GR	1	100g/m ²	-	82 103 113	<0.02 <0.02 <u><0.02a</u>	----- ----- -----	CH-721 -018
	GR	1	2g/100 plants	-	70 86 96	<0.02 <0.02 <u><0.02b</u>	----- ----- -----	
	GR	1	2g/100 plants	-	105 129 139	<0.02 <0.02 <u><0.02b</u>	----- ----- -----	
	EC	1	0.14	-	0 14 21 28 35	1.0 0.01 <0.02 <0.02 <0.02	----- ----- ----- ----- -----	
München Germany 1989 ²	GR	1	100g/m ²	-	108 126 136	<0.02 <0.02 <u><0.02a</u>	----- ----- -----	CH-721 -018
	EC	1	0.14	-	0 14 21 28 35	0.3 <0.02 <0.02 <0.02 <0.02	----- ----- ----- ----- -----	
Hannover Germany 1989 ²	GR	1	100g/m ²	-	107 121 132	<0.02 <0.02 <u><0.02a</u>	----- ----- -----	CH-721 -018
Poona India 1974 ²	EC	1	0.25	-	17	<0.02	-----	CH-721 -002
	EC	1	0.5	-	17	0.07	-----	
Holibazar India 1974 ²	EC	3	0.25	-	11	<0.02	-----	CH-721 -002
	EC	3	0.50	-	11	0.02	-----	
Geisenheim Germany 1978 ²	GR	2	0.1kg/m ² and 0.1g/plant	-	30 50 60	10.1 1.6 <u>0.9c</u>	0.05 <0.02 <0.02	CH-721 -008 & CH- 721-010
München Germany 1990 ³	EC	2	0.144	0.024	0 14 21 28 35	1.2 <0.02 <0.02 <0.02 <0.02	----- ----- ----- ----- -----	CH-721 -032
Bonn Germany 1990 ³	EC	2	0.144	0.024	0 14 21	0.07 <0.02 <0.02	----- ----- -----	CH-721 -033

Location, Country, year	Application				PHI, days	Residues, mg/kg		Ref.
	Form.	No.	kg ai/ha	kg ai/hl		Parent	Met	
					28	<0.02	----	
					35	<0.02	----	
Buttelborn Germany 1990 ³	EC	2	0.144	0.024	0	0.6	----	CH-721
					14	<0.02	----	-033
					21	<0.02	----	
					28	<0.02	----	
					35	<0.02	----	
Frankfurt Germany 1990 ³	GR	1	2g/100 plants	-	65	<0.02	----	CH-721
					98	0.04	----	-034
					108	<u><0.02b</u>	----	
	GR	1	2g/100 plants		60	<0.02	----	
					84	<0.02	----	
					98	<u><0.02b</u>	----	
Bonn Germany 1990 ³	GR	1	2g/100 plants	-	55	<0.02	----	CH-721
					99	<0.02	----	-034
					109	<u><0.02b</u>	----	
Munich Germany 1990 ³	GR	1	2g/100 plants	-	42	<0.02	----	CH-721
					56	<0.02	----	-034
					66	<u><0.02b</u>	----	
Hannover Germany 1990 ³	GR	1	2g/100 plants	-	64	<0.02	----	CH-721
					80	<0.02	----	-034
					90	<u><0.02b</u>	----	
Bonn Germany 1990 ³	GR	1	0.1	-	80	<0.02	----	CH-721
					114	<0.02	----	-035
					124	<0.02	----	
Frankfurt Germany 1990 ³	GR	1	0.1	-	100	<0.02	----	CH-721
					144	<0.02	----	-035
					154	<0.02	----	
Hannover Germany 1990 ³	GR	1	0.1	-	97	<0.02	----	CH-721
					113	<0.02	----	-035
					123	<0.02	----	
München Germany 1990 ³	GR	1	0.1	-	89	<0.02	----	CH-721
					103	<0.02	----	-035
					113	<0.02	----	

Results underlined once or twice are considered comparable with

a - German GAP for pre-planting soil treatments at 100 g/m²

b - German GAP for granular treatments at 2 g/100 plants

c - German GAP for granular nursery bed treatment at 0.1 g/plant in combination with pre-planting soil treatment at 100 g/m²

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ No detailed study report; only very brief details of the trial and analysis were available.

² Duration of sample storage unspecified

³ Report not in English

Met = 1-(2,4-dichlorophenyl)ethanol

Savoy cabbage. GAP was reported for Germany and The Netherlands. A variety of treatment regimes are used although all applications are either before or soon after planting.

Only Germans trials were submitted. The German soil treatment at 0.1kg ai/m² was reflected by three trials, with all residues <0.02 mg/kg. The 0.1 g/plant granular treatment was used in 3 acceptable trials with residues of 0.02, 0.03 and 0.15 mg/kg. In one additional trial a combination of these two treatments gave a residue of 0.3 mg/kg. In three trials with the German 2 kg ai/ha GAP application all residues were <0.02 mg/kg.

Table 22. Supervised field trials on Savoy cabbage in Germany. Heads analysed.

Location, year	Application				PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl		Parent	Met	
München 1973 ¹	EC	1	4.8	-	35	<0.02	-----	CH-721 -003
					49	<0.02	-----	
					56	<0.02	<0.02	
Baden 1973 ¹	EC	1	4.8	-	49	<0.02	-----	CH-721 -003
					59	<0.02	<0.02	
Kiel 1973 ¹	EC	1	4.8	-	0	33.3	-----	CH-721 -003
					10	1.0	-----	
					28	0.3	0.04	
Geisenheim 1977 ¹	EC	1	4.8	-	40	0.2	<0.02	CH-721 -004 & CH- 721-005
					60	0.03	<0.02	
					80	<0.02	<0.02	
Frankfurt 1977 ¹	EC		4.8	-	30	0.04	<0.02	CH-721 -004 & CH- 721-005
					50	<0.02	<0.02	
					63	<0.02	<0.02	
Bamberg 1977 ¹	EC	1	4.8	-	40	0.02	<0.02	CH-721 -004 & CH- 721-005
					60	<0.02	<0.02	
					80	<0.02	<0.02	
Geisenheim 1980 ¹	EC	1+ 2	4.88 + 1.4	-	0	2.9	-----	CH-721 -012
					7	0.2	-----	
					14	0.04	-----	
					21	<0.02	-----	
					28	<0.02	-----	
Bamberg 1980 ¹	EC	1+ 2	4.88 + 1.4	-	0	4.5	-----	CH-721 -012
					7	0.7	-----	
					14	0.3	-----	
					21	0.08	-----	
					28	<0.02	-----	
Geisenheim 1980 ¹	GR	1	2	-	49	0.03	-----	CH-721 -015
					56	<0.02	-----	
					77	<0.02d	-----	
	GR	1	0.1kg/m ²	-	49	0.08	-----	
					56	0.03	-----	
					77	<0.02a	-----	
	GR	1	4 g/200 plants	-	49	0.2	-----	
					56	0.03	-----	
					77	<0.02	-----	
Bamberg 1980 ¹	GR	1	2	-	49	0.09	-----	CH-721 -015
					63	<0.02	-----	
					77	<0.02d	-----	
	GR	1	0.1 kg/m ²	-	49	0.2	-----	
					63	0.05	-----	
					77	<0.02a	-----	

Location, year	Application				PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl		Parent	Met	
	GR	1	4 g/200 plants	-	49 63 77	0.3 0.05 <0.02	----- ----- -----	
Frankfurt 1980 ¹	GR	1	2	-	49 63 77	0.3 0.04 <0.02d	----- ----- -----	CH-721 -015
	GR	1	0.1 kg/m ²	-	49 63 77	0.3 0.05 <0.02a	----- ----- -----	
	GR	1	4 g/200 plants	-	49 56 77	0.4 0.03 <0.02	----- ----- -----	
Bad Segeberg 1981 ¹	EC	1+ 2	4.9 + 0.17	-	0	0.9	-----	CH-721 -017
					7	0.4	-----	
					14	0.2	-----	
					21	0.1	-----	
Vorwohle 1981 ¹	EC	1+ 2	4.9 + 0.17	-	0	0.5	-----	CH-721 -017
					7	0.07	-----	
					14	<0.02	-----	
					21	<0.02	-----	
Hannover 1986 ²	GR	1	0.1 g/plant	-	40	0.2	----	Anon 1995
					60	0.1	----	
					81	0.08	----	
Saarlouis 1986 ²	GR	1	0.1 g/plant	-	40	0.4	----	Anon 1995
					60	0.03	----	
					80	0.05	----	
Frankfurt 1986 ²	GR	1	0.1 g/plant	-	40	0.07	----	Anon 1995
					60	<0.02	----	
					81	<0.02	----	
Berlin 1986 ²	GR	1	0.1 g/plant	-	105	0.06	----	Anon 1995
					124	0.05	----	
					145	<0.02	----	
Bonn 1986 ²	GR	1	0.1 g/plant	-	40	0.1	----	Anon 1995
					60	0.06	----	
					80	<0.02	----	
Lübeck 1986 ²	GR	1	0.1 g/plant	-	38	0.3	----	Anon 1995
					63	0.2	----	
					83	0.07	----	
München 1986 ²	GR	1	0.1 g/plant	-	40	0.74	----	Anon 1995
					60	0.06	----	
					80	0.01	----	
Münster 1986 ²	GR	1	0.1 g/plant	-	42	0.2	----	Anon 1995
					63	0.02	----	
					84	0.01	----	
Braunschweig 1986 ²	GR	1	0.1 g/plant	-	39	0.2	----	Anon 1995
					60	0.04	----	
					80	0.08	----	
Stuttgart 1986 ²	GR	1	0.1 g/plant	-	40	0.34	----	Anon 1995
					60	0.03	----	
					80	<0.02	----	
Geisenheim 1977 ¹	GR	1	0.1 g/plant	-	40	2.03	<0.02	CH-721 -006 & CH- 721-007
					60	0.14	<0.02	
					80	0.03b	<0.02	

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Location, year	Application				PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl		Parent	Met	
Frankfurt 1977 ¹	GR	2	0.1 kg/m ² and 0.1 g/plant	-	30	3.4	<0.02	CH-721 -006 & CH- 721-007
					50	0.25	<0.02	
					63	<u>0.15c</u>	<0.02	
	GR	1	0.1 g/plant	-	30	0.9	<0.02	
					50	0.20	<0.02	
					63	<u>0.15b</u>	<0.02	
Bamberg 1977 ¹	GR	2	0.1 kg/m ² and 0.1 g/plant	-	40	0.4	<0.02	CH-721 -006 & CH- 721 -007
					60	0.1	<0.02	
					80	<u>0.02c</u>	<0.02	
	GR	1	0.1 g/plant	-	40	0.4	<0.02	
					60	0.1	<0.02	
					80	<u>0.02b</u>	<0.02	
Geisenheim 1978 ¹	GR	2	0.1 kg/m ² and 0.1 g/plant	-	30	3.1	0.02	CH-721 -009 & CH- 721-011
					50	0.4	<0.02	
					60	<u>0.3c</u>	<0.02	

Results underlined once or twice are considered comparable with

a - the German 0.1 kg ai/m² soil treatment

b - the German 0.1 g/plant granular nursery bed treatment

c - a combination of the German 0.1 kg ai/m² soil treatment and 0.1 g/plant granular treatment

d - the German 2 kg ai/ha treatment 5-6 days after planting

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ Duration of sample storage unspecified

² Only the JMPR residue trial summary sheets were supplied, no study report with further trial and analytical information

Met = 1-(2,4-dichlorophenyl)ethanol

Cauliflower. GAP was reported for Germany, Ireland, The Netherlands and the UK. Application is usually pre-emergence or at planting although post-emergence application is allowed in the UK and Ireland.

Residue trials were reported from Germany, India, the USA and the UK. There were three German trials according to each of three different German GAP treatments: 2 g/100 plants nursery granular, the 0.1 g/plant single bed treatment and the 2 kg ai/ha granular “spreading” application. The UK and Dutch spray treatment (ca. 4-5 kg ai/ha) at the time of drilling or transplanting was reflected by four German trials. All the residues in these trials were <0.02 mg/kg.

Table 23. Supervised field trials on cauliflower. Heads analysed.

Location, Country, year	Application				PHI, days	Chlorfenvinphos, mg/kg	Ref.
	Form	No.	kg ai/ha	kg ai/hl			
Frankfurt Germany 1980 ¹	EC	1+2	4.8+	-	0	<0.02	CH-721 -022
			0.14	-	7	<0.02	
					14	<0.02	
					28	<0.02	
Geisenheim Germany 1980 ¹	GR	1	4 g/200 plants	-	49	0.10	CH-721 -023
					77	<0.02	
					84	<0.02	
					91	<u><0.02a</u>	
	GR	1	0.1 g/ plant	-	49	0.5	
					77	<0.02	
					84	<0.02	
					91	<u><0.02b</u>	
	GR	1	2	-	49	0.1	
					77	<0.02	
					84	<0.02	
					91	<u><0.02c</u>	
Bamberg Germany 1980 ¹	GR	1	4 g/200 plants	-	70	<0.02	CH-721 -023
					77	<0.02	
					84	<u><0.02 a</u>	
	GR	1	0.1 g/ plant	-	70	<0.02	
					77	<0.02	
					84	<u><0.02b</u>	
	GR	1	2	-	70	<0.02	

chlorfenvinphos

Location, Country, year	Application				PHI, days	Chlorfenvinphos, mg/kg	Ref.
	Form	No.	kg ai/ha	kg ai/hl			
					77 84	<0.02 <u>≤0.02c</u>	
Frankfurt Germany 1980 ¹	GR	1	4 g/200 plants	-	49	0.3	CH-721 -023
					77	<0.02	
					84	<0.02	
					91	<u>≤0.02a</u>	
	GR	1	0.1 g/ plant	-	49	1.9	
					77	0.02	
					84	<0.02	
					91	<u>≤0.02b</u>	
	GR	1	2	-	49	0.4	
77					<0.02		
84					<0.02		
91					<u>≤0.02c</u>		
Bad Segeberg Germany 1981 ¹	EC	1+ 2	4.9 + 0.17	-	0	1.0	CH-721 -024
					7	0.1	
					14	0.05	
					21	0.07	
Vorwohl Germany 1981 ¹	EC	1+2	4.9 + 0.17	-	0	0.80	CH-721 -024
					7	0.10	
					14	0.06	
					21	<0.02	
Frankfurt Germany 1989 ¹	EC	2	0.144	0.019	0	<0.02	CH-721 -025
					14	<0.02	
					21	<0.02	
					28	<0.02	
	EC	1	4.8	1.2	119	<0.02	
					126	<0.02	
140	<u>≤0.02d</u>						
Bonn Germany 1989 ¹	EC	1	4.8	1.2	91	<0.02	CH-721 -025
					98	<0.02	
					112	<u>≤0.02d</u>	
USA undated ²	GR	1.1 2	1.12	-	20	<0.05	CH-601- 001
					48	<0.05	
USA undated ²	GR + EC	1+ 3	1.12+ 1.12	- -	20	1.3	CH-601- 001
					48	<0.05	
Nasik India 1972 ¹	EC	3	0.25	-	7	0.1	CH-721 -019
	EC	3	0.50	-	7	0.2	
Wellesbourne UK 1964 ^{1,3}	WP	1	root dip	0.05	88	<0.05	CH-724 -065
	WP	1	root dip	0.05	88	<0.05	
	EC	1	root dip	0.1	88	<0.05	
	EC	1	root dip	0.1	88	<0.05	
Bonn Germany 1990 ⁴	EC	2	0.144	0.024	0	0.55	CH-721 -030
					14	0.16	
					21	0.06	
					28	<0.02	

Location, Country, year	Application				PHI, days	Chlorfenvinphos, mg/kg	Ref.
	Form	No.	kg ai/ha	kg ai/hl			
					35	<0.02	
Buttelborn Germany 1990 ⁴	EC	1	4.8	0.48	83 90 104	<0.02 <0.02 <u><0.02d</u>	CH-721 -031
Bonn Germany 1990 ⁴	EC	1	4.8	0.48	129 136 150	<0.02 <0.02 <u><0.02d</u>	CH-721 -031

Results underlined once or twice are considered comparable with

- a - the German 2 g/100 plants nursery granular treatment
- b - the German 0.1 g/plant single bed treatment
- c - the Germans 2 kg ai/ha granular treatment
- d - the UK and Dutch spray treatments (ca. 4-5 kg ai/ha) at time of drilling or transplanting.

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ Duration of sample storage unspecified

² No detailed study report; only very brief details of the trial and analysis were available.

³ High analytical recovery (>120%)

⁴ Report not in English

Mushrooms. GAP was reported only for the UK as either compost or casing incorporation. Only one trial was available which was poorly described with no detailed study report.

Table 24. Supervised residue trials on protected mushrooms, UK, undated. Fruit analysed.¹

Application				PHI, days	Chlorfenvinphos, mg/kg	Ref.
Form.	No.	kg ai/ha	kg ai/hl			
GR	1	5 kg/tonne compost	-	30	<0.02	CH-601 -001
GR	1	17 kg/tonne compost	-	30	<0.02	

¹ No detailed study report; only very brief details of the trial and analysis were available

Kale. There are registered uses in Germany, The Netherlands, Portugal and Spain, but residue trials were available only from Germany. Five trials were according to the Dutch GAP for spray treatments at planting or before sowing. Residues were all <0.02 mg/kg. In one of these trials the residue of dichlorophenylethanol was 0.07 mg/kg. Three further trials complied with the German granular single plant treatment, and in two others this treatment was combined with soil treatment according to German GAP. Residues in these trials were <0.02 (2), 0.02, 0.07 and 0.09 mg/kg.

Table 25. Supervised field trials on kale in Germany.¹

Location, year	Application			PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha		Parent	Met	
Lübeck 1973	EC	1	4.8	56 63 140	<0.02 <0.02 <u><0.02a</u>	----- ----- <u><0.02</u>	CH-726 -001
Kiel	EC	1	4.8	0	1.58	-----	CH-726

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Location, year	Application			PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha		Parent	Met	
1973				7	0.52	----	-001
				28	0.13	0.06	
Koldenbuttel 1973	EC	1	4.8	35	<0.02	----	CH-726
				56	<0.02	----	-001
				84	<0.02a	0.07	
Geisenheim 1977	EC	1	4.8	40	0.22	<0.02	CH-726
				60	<0.02	<0.02	-002 & CH-726-
				80	<0.02a	<0.02	003
Frankfurt 1977	EC	1	4.8	30	0.08	<0.02	CH-726
				50	<0.02	<0.02	-002 & CH-726-
				63	<0.02a	<0.02	003
Bamberg 1977	EC	1	4.8	40	0.47	<0.02	CH-726
				60	0.15	<0.02	-002 & CH-726-
				80	<0.02a	<0.02	003
Geisenheim 1977	GR	1	0.1 g/plant	40	1.44	<0.02	CH-726
				60	0.37	<0.02	-004 & CH-726-
				80	<0.02b	<0.02	005
Frankfurt 1977	GR	2	0.1 kg/m ² and 0.1 g/plant	30	3.05	<0.02	CH-726
				50	0.10	<0.02	-004 & CH-726-
				63	0.07c	<0.02	005
	GR	1	0.1 g/plant	30	0.82	<0.02	
				50	0.15	<0.02	
				63	0.09b	<0.02	
Bamberg 1977	GR	2	0.1 kg/m ² and 0.1 g/plant	40	0.40	<0.02	CH-726
				60	0.20	<0.02	-004 & CH-726
				80	0.02c	<0.02	-005
	GR	1	0.1 g/plant	40	0.71	<0.02	
				60	0.10	<0.02	
				80	<0.02b	<0.02	

Results underlined once or twice are considered comparable with

a - Dutch GAP where treatment is by spraying at or before planting

b - the German granular single plant treatment

c - the German granular single plant combined with soil treatment according to German GAP

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ Duration of sample storage was unspecified in all trials

Met = 1-(2,4-dichlorophenyl)ethanol

Carrots. GAP was reported for Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, The Netherlands, Switzerland and the UK.

Residue trials were available from Canada, France, Germany, The Netherlands, South Africa, Spain, Sweden, Switzerland, Trinidad and the UK (Table 26). In addition the UK government provided data on residues in overwintered commercial carrots whose treatment history had been recorded (Table 27). The highest residues resulted from post-planting EC or WP sprays at *c.*4 kg ai/ha according to GAP in The Netherlands and France. Similar treatments at *c.*2.5 kg ai/ha are GAP in Ireland and the UK. The PHIs reported for these countries ranged between 21 and 60 days which reflects second-generation carrot fly control. French GAP was also reported to include an EC spray at 5 kg ai/ha with a PHI of 15 days, but the Meeting was informed that the use in practice was at the time of sowing. Several trials in France, Germany and The Netherlands complied with the higher rate GAP, with residues of <0.02, 0.05, 0.08, 0.12, 0.14, 0.2(3), 0.22, 0.3, 0.37, 0.45, 0.9, 1.2, 1.8, 2.0, and 3.8 mg/kg. In the overwintered commercial carrots treated in accordance with UK GAP the residues were <0.02-1.6 mg/kg. The Meeting estimated an STMR of 0.22 mg/kg and a maximum residue level of 5 mg/kg.

Table 26. Supervised field trials on carrots.

Location Country, year	Application				PHI, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
Canada 1970 ¹	GR	1	2.2	-	14	Root	<0.02	-----	CH-724 -014
					147	Pulp	0.7	0.04	
					126	Pulp	0.5	0.07	
Canada 1971 ¹	GR	1	1.1	-	112	Root	0.1	<0.02	CH-724 -015
						Pulp	<0.02	<0.02	
						Boiled	0.05	<0.02	
	EC	4	3.5	49	Root	0.09	<0.02		
					Pulp	<0.02	<0.02		
					Boiled	0.04	<0.02		
EC	5	4.6	49	Root	0.2	<0.02			
				Pulp	<0.02	<0.02			
				Boiled	0.08	<0.02			
Surtainville France 1969 ¹	GR	1	5.0	-	210	Root	0.01	<0.05	CH-724 -011
Avignon France 1969 ¹	GR	1	5.0	-	175	Root	<0.02	<0.05	CH-724 -011
							<0.02	<0.05	
Entraigues	GR	1	5.0	-	294	Root	0.02	<0.05	CH-724

Location Country, year	Application				PHI, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
France 1970 ¹							0.01	<0.05	-012
Surtainville France 1970 ¹	GR	1	5.0	-	98	Root	0.3	<0.05	CH-724
	GR	1	6.0	-	98	Root	0.2	<0.05	-012
Le Thor France 1971 ¹	GR	1	4.0	-	133	Root	0.1	0.2	CH-790
	GR	1	8.0	-	133	Canned Tops and peel	<0.02	0.03	-029
	GR		4.0	-	133	Root	0.2	0.25	
	GR		8.0	-	133	Canned Tops and peel	<0.02	0.03	
	GR		4.0	-	133	Root	0.1	0.1	
	GR		8.0	-	133	Canned Tops and peel	0.1	0.2	
	GR		8.0	-	133	Root	<0.02	0.02	
	GR		8.0	-	133	Canned Tops and peel	0.1	0.2	
	GR		8.0	-	133	Root	0.2	0.3	
	GR		8.0	-	133	Canned Tops and peel	<0.02	0.01	
	GR		8.0	-	133	Root	0.20	0.3	
Le Thor France 1972 ¹	GR	1	4.0	-	504	Root	<0.02	<0.02	CH-790
	GR	1	8.0	-	504	Root	<0.02	<0.02	-031
	GR	2	4.0	-	175	Root	0.03	0.03	
	GR	2	4.0	-	175	Juice Pulp	<0.02	<0.02	
	GR	2	8.0	-	175	Root	0.07	0.10	
	GR	2	8.0	-	175	Juice Pulp	<0.02	<0.02	
	GR	1	4.0	-	504	Root	<0.02	<0.02	
	GR	1	8.0	-	504	Root	<0.02	<0.02	
	GR	2	4.0	-	175	Root	0.06	0.1	
	GR	2	4.0	-	175	Juice Pulp	<0.02	<0.02	
	GR	2	8.0	-	175	Root	0.1	0.2	
	GR	2	8.0	-	175	Juice Pulp	<0.02	<0.02	
Le Thor France 1973 ¹	GR	3	4.0	-	175	Root	0.02	<0.02	CH-790
	GR	3	8.0	-	175	Root	0.03	0.04	-033
	GR	3	8.0	-	175	Root	0.02	0.07	

Location Country, year	Application				PHL, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
Frankfurt Germany 1973 ^{1,2}	EC	1	5.0	-	49	Root	3.1	----	CH-724 -017
					77	Root	1.5	----	
					168	Root	0.1	<0.02	
	EC	1	5.0	-	42	Root	1.2	----	
					63	Root	0.3	----	
					112	Root	<0.02	<0.02	
Frankfurt Germany 1973 ¹	GR	1	5.0	-	42	Root	0.4	----	CH-724 -018
					56	Root	0.1	----	
					112	Root	<0.02	<0.02	
	GR	1	5.0	-	49	Root	8.8	----	
					77	Root	1.4	----	
					168	Root	<0.02	<0.02	
Lübeck Germany 1973 ¹	GR	1	55.0	-	42	Root	2.4	----	CH-724 -018
					63	Root	0.7	----	
					112	Root	<0.02	<0.02	
Geisenheim Germany 1980	EC	1	4.8	--	53	Root	<u>1.8</u>	----	CH-724 -022
					67	Root	<u>0.5</u>	----	
					81	Root	<u>0.2</u>	----	
Bamberg Germany 1980	EC	1	4.8	-	42	Root	<u>0.9</u>	----	CH-724 -022
					56	Root	<u>0.3</u>	----	
					70	Root	<u>0.1</u>	----	
Frankfurt Germany 1980	EC	1	4.8	-	60	Root	<u>1.2</u>	----	CH-724 -022
					74	Root	<u>0.6</u>	----	
					88	Root	<u>0.3</u>	----	
Geisenheim Germany 1980	GR	1	5.0	-	49	Root	1.9	----	CH-724 -023
					63	Root	0.4	----	
					77	Root	0.2	----	
Bamberg Germany 1980	GR	1	5.0	-	42	Root	0.7	----	CH-724 -023
					56	Root	0.3	----	
					70	Root	0.1	----	
Frankfurt Germany 1980	GR	1	5.0	-	56	Root	<0.02	----	CH-724 -023
					70	Root	<0.02	----	
					84	Root	<0.02	----	
Frankfurt Germany 1989	EC	1	4.8	1.2	70	Root	<u>0.05</u>	----	CH-724 -024
					77	Root	<u>0.03</u>	----	
					84	Root	<u><0.02</u>	----	
Bonn Germany 1989	EC	1	4.8	1.2	42	Root	<u>0.2</u>	----	CH-724 -024
					49	Root	<u>0.2</u>	----	
					63	Root	<u>0.2</u>	----	
München Germany 1989	EC	1	4.8	1.2	84	Root	<u><0.02</u>	----	CH-724 -024
					91	Root	<u><0.02</u>	----	
					105	Root	<u><0.02</u>	----	
Hannover Germany 1989	EC	1	4.8	1.2	63	Root	<u>0.3</u>	----	CH-724 -024
					70	Root	<u>0.1</u>	----	
					84	Root	<u>0.04</u>	----	
Buttelborn Germany 1990 ³	EC	1	4.8	0.48	11	whole plant	21	----	Anon 1995
					44	root	0.1	----	
					60	root	0.06	----	
					89	root	<0.04	----	
					110	root	<0.04	----	
	EC	1	4.8	0.48	9	whole plant	5.5	----	

Location Country, year	Application				PHL, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
					42	root	0.8	----	
					59	root	0.9	----	
					92	root	0.7	----	
					101	root	0.5	----	
Wulfsdorf Germany 1990 ³	EC	1	4.8	0.48	42	root	1.1	----	Anon 1995
					60	root	0.2	----	
					91	root	0.05	----	
					117	root	0.04	----	
Braunschweig Germany 1990 ³	EC	1	4.8	0.48	20	whole plant	15	----	Anon 1995
					42	root	0.3	----	
					61	root	0.2	----	
					89	root	0.09	----	
					170	root	0.07	----	
Saarlouis Germany 1990 ³	EC	1	4.8	0.48	28	whole plant	3	----	Anon 1995
					42	root	0.6	----	
					61	root	0.09	----	
					90	root	<0.04	----	
München Germany 1990 ³	EC	1	4.8	0.48	25	whole plant	3.5	----	Anon 1995
					42	root	0.7	----	
					60	root	0.3	----	
					90	root	<0.2	----	
Rastede Germany 1990 ³	EC	1	4.8	0.48	26	whole plant	2	----	Anon 1995
					41	root	0.4	----	
					60	root	0.1	----	
					90	root	0.09	----	
					102	root	0.08	----	
Moos Germany 1990 ³	EC	1	4.8	0.48	28	whole plant	0.6	----	Anon 1995
					42	root	0.2	----	
					61	root	0.05	----	
					90	root	0.04	----	
					110	root	0.05	----	
Lubeck Germany 1990 ³	EC	1	4.8	0.48	25	whole plant	3.3	----	Anon 1995
					41	root	0.8	----	
					60	root	0.1	----	
					90	root	0.05	----	
					94	root	0.08	----	
Bonn Germany 1990 ³	EC	1	4.8	0.48	42	root	0.04	----	Anon 1995
					60	root	0.05	----	
					90	root	0.04	----	
Germany 1964 ⁴	GR	1	2	-	119	Root	0.02	----	CH-601-001
			4	-	119	Root	0.02	----	
			8	-	119	Root	0.12	----	
	EC	1	2	-	119	Root	<0.02	----	
			4	-	119	Root	0.03	----	
			8	-	119	Root	<0.02	----	
Netherlands 1964 ¹	WP	1	3	-	91	Root	<0.05	-----	CH-724-001
	WP	1	4	-	91	Root	0.1	-----	
	WP	1	5	-	91	Root	0.07	-----	
Noordwijk Netherlands 1966 ¹	GR	1	3	-	343	Root	0.2	-----	CH-724-002
	GR	2	3	-	252	Root	0.9	-----	

Location Country, year	Application				PHL, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
	GR	1	4	-	343	Root	0.3	----	
	GR	2	4	-	252	Root	1.0	----	
	WP	1	3	-	343	Root	0.2	----	
	WP	2	3	-	252	Root	3.8	----	
	WP	1	4	-	343	Root	<u>0.2</u>	----	
	WP	2	4	-	252	Root	1.6	----	
	GR	1	3	-	343	Root	0.2	<0.05	
	GR	2	3	-	252	Root	1.1	<0.05	
	GR	1	4	-	343	Root	0.3	<0.05	
	GR	2	4	-	252	Root	1.1	<0.05	
	WP	1	3	-	343	Root	<u>0.2</u>	<u><0.05</u>	
	WP	2	3	-	252	Root	<u>3.8</u>	<u><0.05</u>	
	WP	1	4	-	343	Root	0.1	<0.05	
	WP	2	4	-	252	Root	<u>2.0</u>	<u><0.05</u>	
Alkmaar Netherlands 1974 ⁵	WP	1	4	0.2	103	Root	<u>0.08</u> <u>0.07</u> <u>0.04</u> <u>0.06</u>	----	Anon 1996c
Alkmaar Netherlands 1974 ⁵	WP	1	4	0.2	60	Root	<u>0.13</u> <u>0.14</u> <u>0.13</u> <u>0.13</u>	----	Anon 1996c
Wageningen Netherlands 1977 ⁵	EC	1	5.3	1.06	93	Root	<u>0.03</u> <u>0.12</u> <u>0.09</u> <u>0.05</u>	----	Dorlijn, 1977
Twello Netherlands 1977 ⁵	EC	1	5.3	1.06	89	Root	<u>0.28</u> <u>0.25</u> <u>0.33</u> <u>0.37</u>	----	Dorlijn, 1977
Wieringerwerf Netherlands 1978 ⁵	GR	1	1.6	-	184	Root	<0.02	----	Ten Broeke, 1979
Wieringerwerf Netherlands 1978 ⁵	GR	1+	0.32+	-	184	Root	<0.02	----	Ten Broeke, 1979
Wieringerwerf Netherlands 1978 ⁵	GR	1	0.5	-					
Wieringerwerf Netherlands 1978 ⁵	GR	1+	1.26+	-	184	Root	<0.02	----	Ten Broeke, 1979
Wieringerwerf Netherlands 1978 ⁵	GR	1	1.0	-			<0.02	----	
Wieringerwerf Netherlands 1978 ⁵	GR	1	0.03	-			0.03	----	
Wieringerwerf Netherlands 1978 ⁵	GR	1+	2.0+	-	184	Root	0.05	----	Ten Broeke, 1979
Wieringerwerf Netherlands 1978 ⁵	GR	1	2.0	-			<0.02	----	

Location Country, year	Application				PHI, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
							0.03 ----- 0.04 -----		
Zwaagdijk Netherlands 1986 ⁵	EC	2	4	0.4	103	Root	<u>0.17</u> ----- <u>0.25</u> ----- <u>0.17</u> ----- <u>0.45</u> ----- <u>0.18</u> ----- <u>0.33</u> ----- <u>0.25</u> ----- <u>0.17</u> -----	Greve, 1987	
Zwaagdijk Netherlands 1986 ⁵	EC	2	4	0.4	72	Root	<u>0.15</u> ----- <u>0.2</u> ----- <u>0.15</u> ----- <u>0.22</u> -----	Greve, 1987	
Zwaagdijk Netherlands 1986 ⁵	EC	1+ 1	4+ 2	0.4+ 0.2	103	Root	0.15 ----- 0.19 ----- 0.07 ----- 0.08 ----- 0.07 ----- 0.1 ----- 0.1 ----- 0.14 -----	Greve, 1987	
Zwaagdijk Netherlands 1986 ⁵	EC	1+ 1	4+ 2	0.4+ 0.2	72	Root	0.16 ----- 0.11 ----- 0.04 ----- 0.06 -----	Greve, 1987	
Philippolis South Africa 1972 ^{1,6}	EC	2	1.0	-	42	Root Pulp	0.1 ----- 0.07 -----	CH-724 -008	
	EC	7	1.0	-	0	Root Pulp	1.0 ----- 0.5 -----		
	EC	2	2.0	-	42	Root Pulp	0.3 ----- 0.1 -----		
	EC	7	2.0	-	0	Root Pulp	2.3 ----- 1.0 -----		
Seville Spain 1970 ¹	GR	1	2	-	119	Root Pulp	<0.02 0.09 <0.02 <0.02	CH-724 -013	
	GR	1	3	-	119	Root Pulp	<0.02 0.1 <0.02 0.07		
	GR	1	4	-	119	Root Pulp	<0.02 0.40 <0.02 0.2		
Seville Spain 1972 ¹	GR	1	4	-	140	Root	0.4 0.2	CH-724 -016	
	GR	1	8	-	140	Root	2.9 0.6		
Seville Spain 1973 ¹	GR	1	4	-	511	Root	<0.02 <0.02	CH-724 -019	
	GR	2	4	-	140	Root	0.1 0.05		
	GR	1	8	-	511	Root	<0.02 <0.02		

Location Country, year	Application				PHI, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
	GR	2	8	-	140	Root	0.2	0.2	
Seville Spain 1974 ¹	GR	1	4	-	882	Root	<0.02	-----	CH-724 -021
	GR	3	4	-	182	Root Pulp	0.3	-----	
	GR	1	8	-	882	Root	<0.02	-----	
	GR	3	8	-	182	Root Pulp	0.5	-----	
Sweden 1966 ¹	GR	1	1.5 kg per 20,000 m	-	98	Peel	1.5	-----	CH-724 -004
						Peel	0.9	-----	
						Peel	0.9	-----	
						Pulp	0.06	-----	
						Root	0.3	-----	
	GR	1	1.5 kg per 20,000 m	-	98	Peel	0.9	-----	
						Peel	1.2	-----	
						Pulp Root	0.04	-----	
	GR	1	1.5 kg per 20,000 m	-	175	Root	0.2	-----	
						Root Root Root	0.2	-----	
	GR	1+	1.5+ 2 both kg per 20,000 m	-	84	Root	0.9	-----	
						Root	1.0	-----	
Root						1.4	-----		
Root						1.3	-----		
Root						1.5	-----		
Root						1.5	-----		
Root						1.7	-----		
Eggensil Switzerland 1974 ¹	GR	1	2	-	84	Root	0.01	-----	CH-724 -020
	GR	1	4	-	84	Root	0.02	-----	
Reichenberg Switzerland 1974 ¹	GR	2	1.5	-	140	Root	0.01	-----	CH-724 -020
	GR	2	2	-	140	Root	0.01	-----	
	GR	2	3	-	105	Root	0.04	-----	
	GR	2	4	-	105	Root	0.1	-----	
Switzerland undated ⁴	EC	1	1.5	-	49	Root	<0.02	----	CH-601-001
Shell Station Trinidad 1971 ¹	EC	1	4	-	140	Root	<0.02	<0.05	CH-790 -027
	EC	1	8	-	140	Root	<0.02	<0.05	
Shell Station Trinidad 1972 ¹	EC	1	4	-	448	Root	<0.02	<0.02	CH-790 -030
	EC	2	4	-	112	Root	<0.02	<0.02	
	EC	1	8	-	448	Root	<0.02	<0.02	
	EC	2	8	-	112	Root	<0.02	<0.02	

Location Country, year	Application				PHI, days	Sample	Residues, mg/kg		Ref.				
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met					
Shell Station Trinidad 1973 ¹	EC	3	4	-	112	Root	<0.02	<0.02	CH-790 -032				
	EC	3	8	-	112	Root	<0.02	<0.02					
Kent UK 1963 ⁴	EC	1	4.48	-	203	Root	0.02	----	CH-601-001				
UK undated ⁴	GR	1	4	-	98	Root	0.1	----	CH-601-001				
Suffolk UK undated ⁴	GR	1	4.48	-	183	Root	0.04	----	CH-601-001				
			8.96	-	183	Root	0.09	----					
	EC	1	4.48	-	183	Root	<0.02	----					
			8.96	-	183	Root	0.04	----					
Peterborough UK undated ⁴	GR	1	4.48	-	161	Root	0.03	----	CH-601-001				
			8.96	-	161	Root	0.06	----					
	EC	1	4.48	-	161	Root	0.01	----					
			8.96	-	161	Root	0.04	----					
UK 1967 ^{1,7}	EC	1	4.4	-	273	Root	<0.02	-----	CH-724-003				
Faversham UK 1969 ¹	GR	1	4	-	1274	Root	<0.02	-----	CH-790 -026				
	GR	4	4	-	182	Root	<0.02	-----					
East Anglia UK 1971 ¹	EC	5	1.1	-	98	Root	1.5	<0.05	CH-724 -007				
						Pulp	0.8	-----					
	EC	5	1.1	-	98	Pre-boiled	0.8	-----					
						Boiled	0.1	-----					
						Root	1.00	<0.05					
						Pulp	0.5	-----					
	EC	10	1.1	-	98	Pre-boiled	0.5	-----					
						Boiled	0.06	-----					
						Root	2.6	<0.05					
						Pulp	1.0	-----					
Feltwell UK 1992/3 ⁶	EC	1	4.7	-	90	Root	<0.02	<0.1	CH-724 -077				
						EC	2	4.7		19	Root	0.03	0.1
						EC	2	4.7 + 2.4		41	Root	0.05	0.1
						EC	3	4.7+2x2.4		20	Root	0.05	<0.1
						EC	3	4.7+2x2.4		42	Root	0.05	<0.1
						EC	7	4.7+6x0.78		20	Root	<0.02	<0.1
						EC	7	4.7+6x0.78		41	Root	<0.02	<0.1
						GR	1	4.5		90	Root	<0.02	<0.1
						Gr/Ec	2	4.5+1.2		19	Root	0.02	<0.1
						Gr/Ec	3	4.5+2x1.2		23	Root	<0.02	<0.1
						Gr/Ec	4	4.5+3x1.2		20	Root	0.01	<0.1
						Gr/Ec	4	4.5+3x1.2		42	Root	0.01	<0.1
Friday Bridge UK 1992/3 ⁸	EC	1	2.4	-	92	Root	<0.02	<0.1	CH-724 -077				
						EC	2	2.4		22	Root	0.3	<0.1
						EC	2	2.4		42	Root	0.05	<0.1
						EC	3	2.4		20	Root	0.2	<0.1
						EC	3	2.4		42	Root	0.08	<0.1
						GR	1	2.3		92	Root	<0.02	<0.1
						Gr/Ec	2	2.3+1.2		22	Root	0.09	<0.1

Location Country, year	Application				PHI, days	Sample	Residues, mg/kg		Ref.
	Form	No.	kg ai/ha	kg ai/hl			Parent	Met	
	Gr/Ec	3	2.3+2x1.2	-	23	Root	0.07	<0.1	
	Gr/Ec	4	2.3+3x1.2	-	20	Root	0.02	<0.1	
	Gr/Ec	4	2.3+3x1.2	-	42	Root	0.09	<0.1	
	EC	1	2.4	-	89	Root	0.06	<0.1	
	EC	2	2.4	-	22	Root	0.5	<0.1	
	EC	2	2.4	-	42	Root	0.2	<0.1	
	EC	3	2.4	-	20	Root	0.2	<0.1	
	EC	3	2.4	-	42	Root	0.1	<0.1	
	EC	7	2.4+6x0.78	-	20	Root	0.04	<0.1	
	EC	7	2.4+6x0.78	-	41	Root	0.05	<0.1	
	GR	1	2.3	-	89	Root	0.02	<0.1	
	Gr/ec	2	2.3+1.2	-	22	Root	0.2	<0.1	
	Gr/ec	3	2.3+2x1.2	-	23	Root	0.07	<0.1	
	Gr/ec	4	2.3+3x1.2	-	20	Root	0.2	<0.1	
	Gr/ec	4	2.3+3x1.2	-	42	Root	0.05	<0.1	
Kirton End UK 1992/3	EC	1	2.4	-	21	Root	0.2	<0.1	CH-724 -077
	EC	1	2.4	-	42	Root	0.2	<0.1	
	EC	2	2.4	-	19	Root	0.3	<0.1	
	EC	2	2.4	-	40	Root	0.3	<0.1	
Cawood UK 1992/3	EC	1	2.4	-	22	Root	0.2	<0.1	CH-724 -077
	EC	1	2.4	-	42	Root	0.2	<0.1	
	EC	2	2.4	-	22	Root	0.2	<0.1	
	EC	2	2.4	-	42	Root	0.4	<0.1	
Ely UK 1992/3 ⁸	EC	1	2.4	-	24	Root	0.3	<0.1	CH-724 -077
	EC	1	2.4	-	43	Root	0.3	0.2	
	EC	2	2.4	-	28	Root	0.4	0.2	
	EC	2	2.4	-	42	Root	0.3	0.2	

Results underlined once or twice are considered comparable with the 4 kg ai/ha EC or WP spray post-planting GAP in The Netherlands

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ Duration of sample storage unspecified

² Some results were missing from the submitted report

³ Only the JMPR residue trial summary sheets were supplied (no study report with further information).

⁴ No detailed study report; only very brief details of the trial and analyses were available.

⁵ Information is taken from residue trial summary sheets submitted by The Netherlands. Full study reports were submitted but were in Dutch

⁶ Residues of apparent chlorfenvinphos in control carrots were 0.03 mg/kg

⁷ High analytical recovery, >120%

⁸ Residues of apparent "acetophenone" in control carrots were 0.02-0.03 mg/kg

Met = 1-(2,4-dichlorophenyl)ethanol

Table 27. Residues of chlorfenvinphos in commercially grown over-wintered field carrots of known treatment history during 1989-92 in the UK. All EC formulations. Roots analysed (Anon., 1989-92).

Soil type	Application		PHI, months	Chlorfenvinphos, mg/kg
	No.	kg ai/ha ¹		
Organic	2	2.4	6	0.20
Silty loam	2	1.2	7	0.20
Sandy loam	1	2.35	5	<0.02
Sandy loam	1	2.4	6	<0.02
Sandy loam	1	2.4	9	0.05
Sandy loam	2	2.4+0.84	6	0.09
Sandy loam	1	2.36	3	0.12
Sandy loam	1	2.35	6	0.13
Sandy loam	1	0.6	5	0.15
Sandy loam	1	2.4	9	0.20
Sandy loam	1	2.35	5	0.36
Sandy loam	1	2.36	5	0.83
Sandy loam	1	2.4	9	1.04
Sandy loam	2	2.4	6	1.30
Peaty loam	1	2.36	3	<0.01
Peaty loam	1	2.4	3	<0.01
Peaty loam	2	2.4+N/S	5	<0.02
Peaty loam	1	2.35	3	0.02
Peaty loam	1	2.4	3	0.04
Peaty loam	2	2.4	6	0.05
Peaty loam	2	2.35	3	0.10
Peaty loam	2	2.4+N/S	5	0.17
Peaty loam	2	2.35	3	0.19
Peaty loam	2	2.4	5	0.19 ²
Peaty loam	2	2.4+N/S	5	0.29
Peaty loam	2	2.4+N/S	5	0.31
Peaty loam	1	2.4	6	0.38
Peaty loam	2	2.4	5	1.4 ²
Peaty loam	2	2.4	5	1.6 ²
Unknown	2	2.4	5	0.01
Unknown	1	2.4	6	0.01
Unknown	1	2.4	6	0.20

¹ Approved in the UK as a spray application up to 2.35 kg ai/ha

² Mean of duplicate results

N/S Not specified

Parsley root. No GAP was reported for parsley root (i.e. Hamburg parsley) although summarized reports of residue trials were available from Germany.

Table 28. Supervised field trials on parsley root, Germany, 1979. All single granular applications, 5.0 kg ai/ha (Anon., 1995).

Location	PHI, days	Sample	Chlorfenvinphos, mg/kg
Stuttgart	93	leaves	<0.02
	128	leaves	<0.02
	170	leaves	0.08
	170	root	0.2
Buttelborn	78	leaves	0.2
	161	leaves	<0.02
	78	root	1.7
	161	root	0.2
Lübeck	132	leaves	0.1
	152	leaves	0.1
	138	root	1.3
	152	root	1.5
Münster	83	leaves	0.03
	111	leaves	<0.02
	83	root	0.4
	111	root	0.3
Hurthfischenich	50	leaves	0.05
	85	leaves	<0.02
	115	leaves	<0.02
	85	root	0.08
	115	root	0.03
	128	leaves	0.02
	128	root	0.21

Only the JMPR residue trial summary sheets were supplied (no study report with further information).

Parsnip. GAP was reported for The Netherlands and the UK. The UK provided government-generated data on residues in overwintered commercial parsnips of known treatment history. Two residues were from treatments according to UK GAP (2.35 kg ai/ha). The residues were 0.14 and 0.16 mg/kg.

Table 29. Residues of chlorfenvinphos in commercially grown overwintered field parsnips of known treatment history during 1989-92 in the UK. All EC. Roots analysed (Anon., 1989-92).

Soil type	Application		PHI, months	Chlorfenvinphos, mg/kg
	No.	kg ai/ha		
Peat	1	4.8	5	<0.02
Flinty sand	1	0.59	3	0.07
Sand	1	2.35	7	<u>0.14</u>
Sand	1	2.36	5	<u>0.16</u>
Sand	N/S	N/S	N/S	0.35

Double underlined residues are from maximum UK GAP treatments (spray application up to 2.35 kg ai/ha) and have been used for estimating the STMR
N/S Not specified

Potatoes. There are registered uses in The Netherlands and Poland.

Residue trials were carried out in the UK, Spain, Australia and Poland, but they were very old and poorly reported with few details.

Table 30. Supervised field trials on potatoes. Tubers analysed.

Location, Country, Year	Application			PHI, days	Residues, mg/kg		Ref.
	Form.	No.	kg ai/ha		Parent	Met	
Kent UK 1963	EC	1	4.5 soil application	112	<0.02	<0.05	CH-601-001
Kent UK 1966	EC	1	0.25 foliar spray	65	<0.02	<0.05	CH-601-001
Spain 1966	EC	1	0.25 foliar spray	13	<0.02	<0.05	CH-601-001
Seville Spain 1965	EC	1	1 foliar spray	28	<0.02	<0.05	CH-601-001 & CH-640-002
Australia undated	EC	8	0.25 foliar spray	5	0.01	----	CH-601-001
Poland undated	FSD	1	0.5 foliar spray	69	0.02	----	CH-601-001
Poland undated	EC	1	0.24 foliar spray	69	0.02	----	CH-601-001

No detailed study reports; only very brief details of the trials and analyses were available.
Met = 1-(2,4-dichlorophenyl)ethanol

Radishes. GAP was reported for Germany, The Netherlands and the UK.

Residue trials (Table 31) were in Germany and Switzerland. Several of the trials were very old and none were reported in detail. In addition the UK provided government-generated data on residues (four results) in overwintered commercial radishes of known treatment history (Table 32). The residues following applications close to GAP were all <0.1 mg/kg.

Table 31. Supervised field trials on radishes. All single applications.

Location Country, year	Application		PHI, days	Portion analysed	Chlorfenvinphos, mg/kg	Ref.
	Form.	kg ai/ha				
Germany 1964 ¹	GR	4	63	root	<0.02	CH-601-001
	GR	8	63	root	<0.02	
	EC	4	63	root	<0.02	
	EC	8	63	root	<0.02	
	GR	4	56	root	<0.02	
	GR	8	56	root	0.05	
Oldenburg Germany	GR	4.0	27	whole plant	0.12	Anon 1995
			33	root	<u>0.08</u>	

Location Country, year	Application		PHI, days	Portion analysed	Chlorfenvinphos, mg/kg	Ref.
	Form.	kg ai/ha				
1983 ²			40	root	<u>0.06</u>	
Braunschweig Germany 1983 ²	GR	4.0	29 42 57	whole plant root root	1.1 <u>0.07</u> <0.02	Anon 1995
Germany 1965 ¹	GR	2	28	root	0.95	CH-601-001
Germany 1966 ¹	GR GR	2 3	35 35	root root	<0.04 <0.05	CH-601 -001
Switzerland 1966 ¹	GR	2	17	root	<0.02	CH-601-001

Residues underlined once or twice are considered comparable with the German GAP for granular applications
Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ No detailed study report; only very brief details of the trial and analyses were available.

² Only the JMPR residue trial summary sheets were supplied (no study report with further information provided)

Table 32. Residues of chlorfenvinphos found in commercially grown field radishes of known treatment history during 1989-92 in the UK, 1989-92. All granular applications at 2.24 kg ai/ha. Roots analysed (Anon., 1989-92).

PHI, months	1	1	1	1
Chlorfenvinphos, mg/kg	<0.1	<0.1	<0.1	<0.1

UK GAP is a granule application up to 2.0 kg ai/ha

Swedes and turnips. GAPs for swedes and turnips was reported for The Netherlands and the UK.

One field trial in the UK on swedes and three in the UK or USA on turnips were reported, but the analytical recovery was high (>120%) in the trial on swedes and the others were old and poorly described with no detailed study reports. The Meeting also received reports of six German trials on swedes or turnips in which the commodity was described as "turnip cabbage". This was an error in translation from the original German and the correct description was "swede/turnip". These trials did not comply with UK or Netherlands GAP.

Table 33. Supervised field trials on swedes and turnips.

Crop, Location Country, year	Application			PHI, days	Sample	Chlorfenvinphos, mg/kg	Ref.
	Form	No.	kg ai/ha				
SWEDE							
Wellesbourne UK 1964 ^{1,2}	GR	1	2.8	109	root	<0.05	CH-724
	GR	1	2.8	109	root	<0.05	-065
	GR	1	2.8	126	root	<0.05	
	GR	1	2.8	126	root	<0.05	
	EC	1	2.8	99	root	<0.05	
TURNIP							
Kent UK undated ³	GR	1	4.5	112	root	<0.02	CH-601
	GR	1	4.5	112	root	<0.02	-001
	EC	1	4.5	112	root	<0.02	
Wellesbourne UK	EC	1	0.84	0 0	foliage root	14 <0.02	CH-640- 002

chlorfenvinphos

Crop, Location Country, year	Application			PHI, days	Sample	Chlorfenvinphos, mg/kg	Ref.
	Form	No.	kg ai/ha				
1965 ³				10	root	<0.02	
				18	root	<0.02	
				30	foliage	<0.02	
				30	root	<0.02	
USA undated ³	GR	1	1.12	70	root	<0.05	CH-601 -001
	GR+ EC	1+ 3	1.12+ 1.12	21	root	<0.21	
	GR+ EC	1+3	1.12 1.12	56	root	0.08	
SWEDE or TURNIP							
Geisenheim Germany 1980 ¹	EC	1+2	4.88 0.144	0	root	0.09	CH-721 -013
				7		<0.02	
				14		<0.02	
				21		<0.02	
				28		<0.02	
Bamberg Germany 1980 ¹	EC	1+2	4.88 0.144	0	root	0.5	CH-721 -013
				7		<0.02	
				14		<0.02	
				21		<0.02	
				28		<0.02	
Frankfurt Germany 1980 ¹	EC	1+2	4.88 0.144	0	root	0.2	CH-721 -013
				7		0.05	
				14		<0.02	
				21		<0.02	
				28		<0.02	
Geisenheim Germany 1980 ¹	GR	1	0.1 kg/m ²	49	root	0.10	CH-721 -016
				56		0.04	
				70		0.02	
	GR	1	0.1 g/plant	49	0.5		
				56	0.2		
				70	0.1		
Bamberg Germany 1980 ¹	GR	1	0.1 kg/m ²	49	root	0.2	CH-721 -016
				63		0.02	
				70		<0.02	
	GR	1	0.1 g/plant	49	0.7		
				63	0.1		
				70	0.06		
Frankfurt Germany 1980 ¹	GR	1	0.1 kg/m ²	49	root	0.10	CH-721 -016
				60		0.02	
				70		<0.02	
	GR	1	0.1 g/plant	49	1.6		
				60	0.6		
				70	0.2		

¹ Duration of sample storage unspecified

² High analytical recovery (>120%)

³ No detailed study report; only very brief details of the trial and analyses were available.

Sweet potatoes. No GAP was reported although reports of residue trials in Trinidad were submitted.

Table 34. Supervised field trials on sweet potatoes in Trinidad. All EC applications. Tubers analysed. Duration of sample storage was not specified.

Location, year	Application		PHI, days	Residues, mg/kg		Ref.
	No.	kg ai/ha		Parent	Met	
Shell Station Trinidad 1971	1	4	168	<0.02	<0.05	CH-790 -027
	1	8	168	<0.02	<0.05	
Sell Station Trinidad 1972	1	4	532	<0.02	<0.02	CH-790 -030
	2 ¹	4	196	<0.02	<0.02	
	1	8	532	<0.02	<0.02	
	2 ¹	8	196	<0.02	<0.02	
Shell Station Trinidad 1973	1	4	868	<0.02	<0.02	CH-790 -032
	3 ¹	4	154	<0.02	<0.02	
	1	8	868	<0.02	<0.02	
	3 ¹	8	154	<0.02	<0.02	

¹ Only one application was made in any one year. Met = 1-(2,4-dichlorophenyl)ethanol

Celery. There is a registered use in The Netherlands.

One group of residue trials was reported, at an unspecified location. It was poorly described, with no detailed study report.

Table 35. Supervised field trials on celery (undated). Stems analysed.

Application				PHI, days	Residues, mg/kg		Ref.
Form.	No.	kg ai/ha	kg ai/hl		Parent	Met	
GR	1	2	-	112	0.2	ND	CH-601 -001
GR	1	2	-	112	0.02	ND	
GR	1	1	-	91	0.03	ND	
GR	1	2	-	91	0.05	ND	
undated	1	17 mg/plant	root dip	77	0.5	ND	

No detailed study report; only very brief details of the trial and analyses were available.
Met = 1-(2,4-dichlorophenyl)ethanol

Rape seed. GAP for rape was reported for Austria, Germany, The Netherlands and Poland.

Several field trials were carried out in France and Germany. Six German trials complied with German GAP for EC spray. Residues in all the trials were <0.02 mg/kg. There were no trials with the broadcast application of granules at 3 kg ai/ha used in The Netherlands, although in two French trials with an application rate of 1 kg ai/ha the residues were <0.02 mg/kg.

Table 36. Supervised field trials on rape.

Location, Country, year	Application			PHI, days	Sample	Residues, mg/kg		Ref.
	Form.	No.	kg ai/ha			Parent	Met	
Mornay France 1988	GR	1	1.0	322	Seed	<0.02	----	CH-750-011
Saulz-le-Duc France 1988	GR	1	1.0	336	Seed	<0.02	----	CH-750 -011
	GR	1	1.0	322	Seed	<0.02	----	
Villefargeu France 1991	EC	1	0.6	126	Seed	<0.02	----	CH-750 -013
Buscieres sur Are France 1991	EC	1	0.6	105	Seed	<0.02	----	CH-750-013
Saulay France 1991	EC	1	0.6	133	Seed	<0.02	----	CH-750-013
Le Mee France 1991	EC	2	0.6	147	Seed	0.09	----	CH-750-013
Lübeck Germany 1973	EC	1	0.144	77	Seed	<u>≤0.02</u>	<u>≤0.02</u>	CH-750-007
Ansbach Germany 1974	EC	1	0.192	70	Seed	<0.02	----	CH-750 -008
				77	Seed	<0.02	----	
Frankfurt Germany 1980	EC	2	0.144	35	Seed	<u>≤0.02</u>	<u>≤0.02</u>	CH-750-009
München Germany 1989	EC	2	0.144	0	plant	3.12	----	CH-750 -012
				34	plant	0.025	----	

Location, Country, year	Application			PHI, days	Sample	Residues, mg/kg		Ref.
	Form.	No.	kg ai/ha			Parent	Met	
				44	Seed	<u><0.02</u>	-----	
Solms Oberbiel Germany 1989	EC	2	0.144	0 38 50	plant plant Seed	1.68 0.02 <u><0.02</u>	----- ----- -----	CH-750 -012
Hanau Germany 1989	EC	2	0.144	0 28 39	plant plant Seed	2.74 0.055 <u><0.02</u>	----- ----- -----	CH-750 -012
Bad Segeberg Germany 1989	EC	2	0.144	0 50 62	plant plant Seed	2.22 <0.02 <u><0.02</u>	----- ----- -----	CH-750 -012

Duration of sample storage was not specified.

Results underlined once or twice are considered comparable with German GAP for EC sprays.

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR
Met = 1-(2,4-dichlorophenyl)ethanol

Parsley. There are registered uses in The Netherlands and the UK with WP or EC spray applications.

Summarized reports of residue trials were available from Germany, but all the trials were with granular formulations whereas the reported GAP applications are by spraying.

Table 37. Supervised field trials on parsley in Germany. All single GR applications at 5.0 kg ai/ha. Leaves analysed (Anon., 1995).

Location, year	PHI, days	Chlorfenvinphos, mg/kg
Oldenburg 1979	89	0.1
	96	0.04
	104	0.04
Berlin 1979	69	0.07
	79	0.04
	90	0.04
	128	<0.02
Nahermittenhausen 1979	83	<0.02
Hurthfischenich 1979	50	0.06
	85	<0.02
Buttelborn	70	0.2
	70	0.03
Münster 1975	88	0.01
Stenkamp Asche 1975	96	0.03

Only the JMPR residue trial summary sheets were supplied (no study report with further information provided).

Maize. GAP was reported for The Netherlands.

Residue trials were carried out in France but were very old and poorly described with no detailed study reports.

Table 38. Supervised field trials on Maize in France. All EC applications. Cobs analysed.

Location, year	Application		PHI, days	Residues, mg/kg		Ref.
	No.	kg ai/ha		Parent	Met	
Sauveterre 1965	1	1	14	<0.02	----	CH-640-002
	1	2	14	<0.02	----	
1965	1	1	98	<0.02	<0.02	CH-601-001
1966	2	0.6	45	<0.02	<0.02	CH-601-001

There were no detailed study reports; only very brief details of the trials and analyses were available.
Met = 1-(2,4-dichlorophenyl)ethanol

Wheat. There are registered uses in the UK. Two residue trials in the UK were very old and poorly reported with inadequate detail.

Table 39. Supervised field trials on wheat in the UK. Single applications. Grain analysed. Undated.

Location	Application		PHI, days	Residues, mg/kg		Ref.
	Form.	kg ai/ha		Parent	Met	
Lincolnshire	GR	1.75	310	<0.02	<0.02	CH-601-001
	DS	22.8kg/ tonne seed		<0.02	<0.02	
Cambridgeshire	GR	1.75	310	<0.02	<0.02	CH-601-001
	DS	22.8kg/ tonne seed		<0.02	<0.02	

Met = 1-(2,4-dichlorophenyl)ethanol

A limited number of poorly reported trials on pasture, sorghum, peanuts, cotton seed, apples, tangerines and sugar beet were also submitted (Anon undated; Beynon, 1966). They have not been reviewed as no GAP is reported for these crops.

Residues in following crops

Lettuce. No GAP was reported for lettuce, but measurable residues could occur in lettuce planted as a following crop as a result of treatment of the primary crop.

Rotational crop trials on lettuce and lamb's lettuce were reported from Germany. The lettuce or lambs lettuce was planted 1-4 months after the treatment of radishes as the primary crop at 4 kg ai/ha. The dates of harvest of the radish crop and the residue levels in the soil were not recorded. The residues in lamb's lettuce at harvest were <0.04 (4) and 0.19 mg/kg, and in lettuce <0.04 (5), 0.05, 0.07 and 0.11 mg/kg. The trials data were submitted in JMPR summary format only with no accompanying study reports.

German GAP for radishes is a “spreading” application at 3 kg ai/ha (field) or 4 kg ai/ha (glass). Similar GAP for soil treatment was reported at comparable application rates for several other crops in a number of countries.

Table 40. Residues in lettuce and lamb's lettuce planted in the field as rotational crops following a single treatment of radishes as the primary crop with granules at 4.0 kg ai/ha. Leaves analysed. Germany, 1983 (Anon., 1995).

CROP Location	PHI, days ¹	Chlorfenvinphos, mg/kg
LAMB'S LETTUCE		
Oldenburg	168	<0.04
	189	<u>0.19</u>
	217	<u>0.16</u>
Braunschweig	144	<0.04
	161	<0.04
	179	<0.04
München	71	<0.04
	90	<0.04
	105	<0.04
Hurth-Fischenich	183	<0.04
	190	<0.04
	197	<0.04
Mainz-Bretzenheim	118	<0.04
HEAD LETTUCE		
Mainz-Bretzenheim	118	<0.04
Hurth-Fischenich	126	<0.04
	134	<0.04
	141	<0.04
Lübeck	118	<u>0.11</u>
	127	<0.04
	135	<0.04
München	36	<0.04
	50	<0.04
	64	<0.04
Freiburg	91	<0.04
	105	<u>0.05</u>
	114	<0.04
Frankfurt	69	<0.04
	82	<0.04
	90	<0.04
	62	<0.04
	75	<0.04
	83	<0.04
Stuttgart	73	<0.04
	84	<0.04
	93	<0.04
Oldenburg	75	<u>0.06</u>
	84	<u>0.07</u>
	92	<0.04

Only the JMPR residue trial summary sheets were supplied (no study report with further information provided).

Residues underlined once or twice are considered to reflect possible commercial practice.

Double underlined residues are from maximum GAP treatments and have been used for estimating the STMR

¹ The PHIs are from the last treatment of the radish crop to the harvesting of the secondary lettuce or lamb's lettuce crop.

Livestock feeding or topical treatment trials

In a 1966 Australian study designed to find out whether residues occur in the milk of cattle grazing on treated pasture, chlorfenvinphos was applied once to grass at 0.42 kg ai/ha and lactating cows were admitted to the pasture two days after treatment (Elgar, 1966e). The mean residues of chlorfenvinphos in the grass four days, 1 week, 2 weeks and 3 weeks after treatment were 17, 5.7, 4.4 and 2.5 mg/kg respectively.

No residues of chlorfenvinphos (<0.01 mg/kg), 2,4-dichlorophenacyl chloride (<0.002 mg/kg), 1-(2,4-dichlorophenyl)ethanol (<0.01 mg/kg) or 2,4-dichloroacetophenone (<0.005 mg/kg) were found in milk samples taken from the cows at these times.

In a briefly reported study (Schroder, 1984), two heifers and two steer calves were dipped in an unspecified formulation containing 0.037 kg ai/hl of chlorfenvinphos. At the time of dipping, the dipwash had been in the tank for up to 57 weeks. Tissue samples were taken 7 days after dipping. The residues were all below the LOD in liver (<0.1 mg/kg), muscle (<0.05 mg/kg) and kidney (<0.05 mg/kg). In 'fat' the residues were in the range <0.1 to 0.27 mg/kg.

FATE OF RESIDUES IN STORAGE AND PROCESSING

In storage

No data were submitted.

In processing

The distribution of chlorfenvinphos in carrots with incurred residues following EC treatments was investigated as part of a UK government research programme (Anon., 1989-92). The results are given in Table 41.

The highest concentrations of chlorfenvinphos were in the crowns of the carrots. The distribution varied but the data indicate that most consumers would remove 30% of the residue during preparation.

The results of a preliminary study of the distribution of residues between the core and peel of carrots and the effects of cooking topped but unpeeled carrots are given in Table 42. The effect of peeling and taking the top portion (crown and next 1 cm) from the roots was to remove 97-99% of the residue.

The effect of cooking topped (but not peeled) roots had, at most, a moderate effect on the concentration of chlorfenvinphos.

Table 41. Mean distribution of chlorfenvinphos residues along 7 average-sized carrot roots taken from samples of commercially grown crops.

Sample No	Crown			1 cm slice below crown			Remainder		
	sample wt., g	Residue, mg/kg	Residue, % ¹	Sample wt., g	Residue, mg/kg	Residue, % ¹	sample wt., g	Residue, mg/kg	Residue, % ¹
1	4	11.3	19	25	3.0	34	389	0.27	47
2	4	1.6	24	21	0.33	29 26	450	0.03	48 50
3	6	3.2	39	42	0.32	27 25	621	0.03	34 36
4	5	2.2	34 37	30	0.11	9	391	0.05	57
5	6	9.4	14	28	1.5	11	986	0.29	75
6	2	3.7	21	26	0.51	31	429	0.05	47
7	3	11.6	61	29	0.45	27	363	0.02	12
Mean		1			6			94	
		30			24			46	

¹ % of total residue in carrot

Table 42. The effects of peeling and boiling on residues of chlorfenvinphos in carrots.

Part of root and process	Sample wt., g uncooked	% of carrot wt.	Sample wt., g cooked	chlorfenvinphos, mg/kg	µg in sample	% of residue
Sample No 1 whole root, uncooked	491			0.20		
calc. topped root before cooking ¹	309			0.21	66	
topped root after cooking	408		370	0.19	70	
top slice taken from root, uncooked	4	1		7.7	32	33
peel, uncooked	64	21		0.98	63	64
peeled core, uncooked	245	79		0.01	3	3
Sample No 2 whole root, uncooked	708			0.20		
calc. topped root before cooking ¹	746			0.37	280	
topped root after cooking	738		683	0.11	75	
top slice taken from root, uncooked	8	1		10.4	79	22
peel, uncooked	91	12		3.1	278	77
peeled core, uncooked	655	88		0.003	2	1

¹ Calculated from sum of uncooked peel and uncooked peeled core. Note that the peeled and boiled carrots were different sub-samples, hence results are unlikely to correspond exactly

Carrots - commercial cooking. In a study carried out in 1966 (Elgar, 1966a), carrots grown in soil treated with 'Birlane' were used to investigate the effect that cooking (specifically the process used commercially in preparing baby foods) had on chlorfenvinphos residues. The raw carrots, containing residues of either 0.05 or 0.07 mg/kg, were made into cooked purée by blanching in water, diluting with brine and macerating, then cooking under steam pressure for 35 minutes at 120°C. Samples were analysed for residues of chlorfenvinphos, 2,4-dichloroacetophenone and 2,4-dichlorophenacyl chloride after extraction with acetone and petroleum spirit. The acetone was removed and the petroleum extracts dried by filtering through anhydrous sodium sulfate. After clean-up on Florisil, the residues were determined by GLC with an ECD. Where recoveries were low, an enzyme-inhibition method was used

for the determination of residues, the details of which were not given.

The final chlorfenvinphos residue in the cooked purée from both batches of carrots was 0.02 mg/kg. It was stated that the reduction in the residue from raw carrots to cooked purée was due to two factors, the addition of brine and the cooking. No residues (<0.01 mg/kg) of the metabolites 2,4-dichloroacetophenone or 2,4-dichlorophenacyl chloride were detected in the raw or cooked purée.

Carrots - canning. Carrots treated in June 1966 with 'Birlane' at 2.24 kg ai/ha and harvested in the following December were made into a purée and canned (Elgar, 1967c). Six cans of carrots were analysed by GLC with EC detection. No residues of chlorfenvinphos (<0.01 mg/kg) were found. The treated carrots were not analysed before canning.

RESIDUES IN FOOD IN COMMERCE OR AT CONSUMPTION

National monitoring data were supplied by Australia, The Netherlands, Poland, and the UK.

The results of monitoring analyses of samples taken randomly from export and domestic sources undertaken by Australia from 1 July 1993 to 31 December 1995 are shown in Table 43 (Anon, 1996b).

Table 43. Australian monitoring data for chlorfenvinphos.

Commodity	Australian MRL, mg/kg	Reporting limit	Total samples	No. with residues
Beef fat	0.2	0.01	7151	0
Buffalo fat	0.2	0.1	15	0
Deer fat		0.1	65	0
Emu fat		0.1	10	0
Game goat fat	0.2	0.1	176	0
Goat fat	0.2	0.1	198	0
Game pig fat		0.1	240	0
Horse fat		0.1	259	1 (0.39%) ¹
Kangaroo fat		0.1	223	0
Ovine fat	0.2	0.1	6146	0
Porcine fat		0.1	2060	0
Poultry fat		0.1	244	0
Barley whole		0.01	711	0
Bran from wheat		0.01	129	0
Canola whole		0.01	19	0
Faba beans whole		0.01	9	0
Flour from wheat whole		0.01	129	0
Lupins whole		0.01	184	0
Oats whole		0.01	67	0
Peas whole		0.01	67	0
Sorghum whole		0.01	16	0
Wheat whole	0.05	0.01	2563	0

¹ Determined residue was described as being in the range "Reporting limit - <0.2 x Reporting limit"
Samples described as fat are portions of adhering fat taken from animal carcasses

The results of monitoring in The Netherlands in 1991-1994 are shown in Tables 44 and 45 (Olthof, 1996).

Table 44. Monitoring data for chlorfenvinphos in The Netherlands, 1991-93.

Commodity	Samples analysed	Samples without residues (LOD 0.05 mg/kg)	Samples with residues < MRL	Samples with residues ≥ MRL	Mean, mg/kg	MRL, mg/kg
CITRUS FRUIT						1
Lemons	181	160	19	2	0.09	1
Tangerines	523	504	19	0	<0.05	1
Oranges	958	937	21	0	<0.05	1
MISC. FRUIT						0.05*
Kiwifruit	309	307	2	0	<0.05	0.05*
ROOT AND TUBER VEGETABLES						0.5
Carrots	609	497	106	6	<0.05	0.5
BULB VEGETABLES	106					0.5
Onions		104	2	0	0.05	0.5
BRASSICA VEGETABLES						0.1
Red cabbage	134	131	3	0	<0.05	0.1
STEM VEGETABLES						0.5
Celery	807	805	2	0	<0.05	0.5

Residues <LOD are assumed to be at half the LOD for the calculation of the mean

Table 45. Monitoring data for chlorfenvinphos in The Netherlands, 1994.

Commodity	Samples analysed	Samples without residues (LOD 0.05 mg/kg)	Samples with residues < MRL	Samples with residues ≥ MRL	Mean, mg/kg	MRL, mg/kg
CITRUS FRUIT						1
Grapefruit	111	109	2	0	<0.05	1
Lemons	102	90	12	0	0.09	1
Tangerines	215	208	7	0	<0.05	1
Oranges	348	342	6	0	<0.05	1
STONE FRUIT						0.05*
Peaches	113	112	1	0	<0.05	0.05*
BERRIES AND SMALL FRUIT						0.05*
Grapes	336	335	1	0	<0.05	0.05*
ROOT AND TUBER VEGETABLES						0.5
Carrots	141	94	47	0	0.05	0.5
STEM VEGETABLES						0.5
Celery	84	78	6	0	<0.05	0.5
BRASSICA VEGETABLES						0.1
Kale	47	45	2	0	<0.05	0.1
LEAF VEGETABLES AND FRESH HERBS						0.1
Lettuce	511	1276	1	0	<0.05	0.1
Endive		510	1	0	<0.05	0.1
CEREALS						0.05*
Maize	19	18	1	0	<0.05	0.05*

Residues <LOD are assumed to be at half the LOD for the calculation of the mean.

In 1994, 120 samples of glasshouse and 20 samples of field-grown cucumbers were analysed for chlorfenvinphos residues in Poland (Anon 1996a). No measurable residues were found although the LOD was not reported.

Monitoring in the UK gave the results shown in Table 46 (Anon, 1989-92).

Table 46. Residues of chlorfenvinphos reported during routine UK monitoring in retail samples during 1989-92.

Commodity	Source	No.	LOD, analysed mg/kg	Below LOD, No	%	Residues above LOD, mg/kg
citrus, soft (satsumas, clementines, mandarins and tangerines)	EC	26	0.05	24	92	0.2, 0.3
	Other	41		41	100	
	Unknown	1		1	100	
grapefruit	EC	2	0.05	2	100	
	Other	22		22	100	
	Unknown	1		1	100	
limes	Other	12	0.02	12	100	
lemons	EC	9	0.05	8	89	0.4
	Other	3		2	67	0.2
carrots	EC	13	0.05	12	92	0.3
	Other	2		2	100	
fresh immature carrots	Unknown	32		30	94	0.3 (UK), 0.7
canned immature carrots frozen immature carrots	Unknown	10	0.05	10	100	
	Unknown	14	0.05	14	100	
radishes	Unknown	7	0.1	7	100	
parsnips	UK	20	0.05	20	100	
	Unknown	3		3	100	
sweet corn	UK	15	0.1	15	100	
	EC	3	0.1	3	100	
	Other	1	0.1	1	100	
	Unknown	1	0.1	1	100	
mushrooms	UK	29	0.05	29	100	
	EC	10		10	100	
chicken	UK	90	0.02	90	100	
	EC	7	0.02	7	100	
	Unknown	21	0.02	21	100	
lamb	UK	6	0.02	6	100	
	Other	103	0.02	103	100	
	Unknown	3	0.02	3	100	
paté	UK	11	0.05	11	100	
	EC	23	0.02	23	100	
	Unknown	3	0.02	3	100	
sausages (pork)	Unknown	4	0.05	4	100	

Commodity	Source	No.	LOD, analysed mg/kg	Below LOD, No	%	Residues above LOD, mg/kg
sausages (beef)	Unknown	12	0.05	12	100	
pies and pasties	UK	191	0.05	191	100	
canned meat	UK	13	0.2	13	100	
	EC	15	0.02	15	100	
	Other	8	0.02	8	100	
	Unknown	1	0.02	1	100	
rabbit	UK	7	0.05	7	100	
	Other	11	0.05	11	100	
	Unknown	16	0.05	16	100	
sheep kidney	UK	55	0.02	55	100	
cattle meat	Unknown	41	0.02	41	100	
pig meat	Unknown	37	0.02	37	100	
cattle kidney fat	UK	81	0.02	81	100	
pig kidney fat	UK	77	0.02	77	100	
sheep kidney fat	UK	82	0.02	82	100	

NATIONAL MAXIMUM RESIDUE LIMITS

The national MRLs for chlorfenvinphos shown below were reported.

Country	Crop	MRL, mg/kg	Reference
Australia	broccoli	0.05	Anon 1996b
	Brussels sprouts	0.05	Anon 1996b
	cabbages, head	0.05	Anon 1996b
	carrot	0.4	Anon 1996b
	cattle, edible offal of	0.2	Anon 1996b
	cattle meat (in the fat)	0.2	Anon 1996b
	cauliflower	0.1	Anon 1996b
	celery	0.4	Anon 1996b
	cotton seed	0.05	Anon 1996b
	egg plant (aubergine)	0.05	Anon 1996b
	goat, edible offal of	0.2	Anon 1996b
	goat meat (in the fat)	0.2	Anon 1996b
	horsemeat	0.1	Anon 1996b
	leek	0.05	Anon 1996b
	maize	0.05	Anon 1996b
	milks (in the fat)	0.2	Anon 1996b
	mushrooms	0.05	Anon 1996b
	onion, bulb	0.05	Anon 1996b
	peanut	0.05	Anon 1996b
	potato	0.05	Anon 1996b
radish	0.1	Anon 1996b	
rice	0.05	Anon 1996b	
sheep, edible offal of	0.2	Anon 1996b	

chlorfenvinphos

Country	Crop	MRL, mg/kg	Reference
	sheep meat (in the fat)	0.2	Anon 1996b
	swede	0.05	Anon 1996b
	sweet potato	0.05	Anon 1996b
	tomato	0.1	Anon 1996b
	turnip, garden	0.05	Anon 1996b
	wheat	0.05	Anon 1996b
Austria	carrot	0.5	Anon 1996c
	celery	0.4	Anon 1996c
	citrus	1	Anon 1996c
	coffee	0.4	Anon 1996c
	milk	0.05	Anon 1996c
	parsley	0.5	Anon 1996c
	potato	0.1	Anon 1996c
	rape	0.1	Anon 1996c
	sugar beet	0.1	Anon 1996c
Belgium	cabbage	0.1 to 0.5	Anon 1996c
	carrot	0.5	Anon 1996c
	leek	0.1	Anon 1996c
	onions	0.5	Anon 1996c
	potato	0.05	Anon 1996c
France	asparagus	0.5	Anon 1996c
	bean	0.1	Anon 1996c
	cabbage	0.1	Anon 1996c
	carrot	0.5	Anon 1996c
	celery	0.5	Anon 1996c
	cereals	0.05	Anon 1996c
	corn salad	0.1	Anon 1996c
	courgette	0.1	Anon 1996c
	cress	0.1	Anon 1996c
	eggplant	0.1	Anon 1996c
	garlic	0.5	Anon 1996c
	gherkin	0.1	Anon 1996c
	melon	0.1	Anon 1996c
	mushrooms	0.05	Anon 1996c
	onions	0.5	Anon 1996c
	parsley	0.5	Anon 1996c
	potato	0.5	Anon 1996c
	radish	0.5	Anon 1996c
	rape	0.02	Anon 1996c
	shallot	0.5	Anon 1996c
	soya bean	0.1	Anon 1996c
	spinach	0.1	Anon 1996c
	turnip	0.5	Anon 1996c
Germany	cabbage	0.5	Anon 1996c
	carrot	0.5	Anon 1996c
	celery	0.5	Anon 1996c
	citrus	1	Anon 1996c

Country	Crop	MRL, mg/kg	Reference
	citrus juice	0.05	Anon 1996c
	coffee	0.5	Anon 1996c
	cucumber	0.1	Anon 1996c
	leek	0.5	Anon 1996c
	onions	0.5	Anon 1996c
	parsley	0.5	Anon 1996c
	potato	0.05	Anon 1996c
	radish	0.5	Anon 1996c
	rape	0.1	Anon 1996c
	root/tuber veg	0.5	Anon 1996c
	shallot	0.5	Anon 1996c
	sugar beet	0.1	Anon 1996c
	turnip	0.5	Anon 1996c
Ireland	carrot	0.5	Anon 1996c
	parsnip	0.5	Anon 1996c
Italy	cabbage	0.1	Anon 1996c
	carrot	0.5	Anon 1996c
	celery	0.5	Anon 1996c
	maize	0.05	Anon 1996c
	mushrooms	0.05	Anon 1996c
	potato	0.1	Anon 1996c
	rape	0.05	Anon 1996c
	sugar beet	0.1	Anon 1996c
Japan	apricot	0.5	Anon 1996c
	broccoli	0.05	Anon 1996c
	cabbage	0.2	Anon 1996c
	cauliflower	0.1	Anon 1996c
	chestnut	0.2	Anon 1996c
	citrus	3 to 5	Anon 1996c
	cucumber	0.2	Anon 1996c
	eggplant	0.2	Anon 1996c
	kidney bean	0.2	Anon 1996c
	maize	0.05	Anon 1996c
	onions	0.05	Anon 1996c
	peanuts	0.05	Anon 1996c
	pears	0.2	Anon 1996c
	persimmon	0.2	Anon 1996c
	potato	0.1	Anon 1996c
	radish	0.1	Anon 1996c
	rice	0.05	Anon 1996c
	soya bean	0.02	Anon 1996c
	sugar cane	0.05	Anon 1996c
	sweet pot	0.05	Anon 1996c
	wheat	0.05	Anon 1996c
Luxembourg	carrot	0.5	Anon 1996c
	maize	0.05	Anon 1996c
	onions	0.5	Anon 1996c

Country	Crop	MRL, mg/kg	Reference
	potato	0.05	Anon 1996c
Netherlands (manufacturer's submission)	bulb veg	0.5	Anon 1996c
	celery	0.5	Anon 1996c
	cereals	0.05	Anon 1996c
	citrus	1	Anon 1996c
	meat	0.2	Anon 1996c
	milk	0.008	Anon 1996c
	mushrooms	0.05	Anon 1996c
	parsley	0.5	Anon 1996c
	peanuts	0.05	Anon 1996c
	potato	0.05	Anon 1996c
	root/tuber veg	0.5	Anon 1996c
	tea	0.2	Anon 1996c
Netherlands (country submission)	citrus	1	Olthof 1996
	root and tuber vegetables	0.5	Olthof 1996
	bulb vegetables	0.5	Olthof 1996
	parsley	0.5	Olthof 1996
	celery leaves	0.5	Olthof 1996
	celery	0.5	Olthof 1996
	other vegetables	0.1	Olthof 1996
	tea	0.2	Olthof 1996
	meat	0.2	Olthof 1996
	milk	0.008	Olthof 1996
	other food commodities	0.05*	Olthof 1996
Poland	citrus fruit	1.0	Anon 1996a
	fruits (other than citrus)	0.05	Anon 1996a
	root vegetables	0.5	Anon 1996a
	potato	0.05	Anon 1996a
	vegetables, other	0.05	Anon 1996a
	mushroom	0.05	Anon 1996a
	rapeseed	0.2	Anon 1996a
	cereal grains	0.05	Anon 1996a
Portugal	brassica	0.1	Anon 1996c
	bulb veg	0.5	Anon 1996c
	citrus	1	Anon 1996c
	fruity veg	0.1	Anon 1996c
	grapes	0.05	Anon 1996c
	leafy veg	0.1	Anon 1996c
	legumes	0.1	Anon 1996c
	mushrooms	0.05	Anon 1996c
	pome fruit	0.05	Anon 1996c
	root/tuber veg	0.5	Anon 1996c
	stem veg	0.5	Anon 1996c
	stone fruit	0.05	Anon 1996c
Spain	brassica	0.1	Anon 1996c
	bulb veg	0.5	Anon 1996c

Country	Crop	MRL, mg/kg	Reference
	citrus	1	Anon 1996c
	fruity veg	0.1	Anon 1996c
	grapes	0.05	Anon 1996c
	leafy veg	0.1	Anon 1996c
	legumes	0.1	Anon 1996c
	mushrooms	0.05	Anon 1996c
	pome fruit	0.5	Anon 1996c
	root/tuber veg	0.5	Anon 1996c
	stem veg	0.5	Anon 1996c
	stone fruit	0.05	Anon 1996c
Switzerland	cabbage	0.1	Anon 1996c
	carrot	0.3	Anon 1996c
	onions	0.01	Anon 1996c
	radish	0.1	Anon 1996c
UK	citrus fruit	1.0	Anon 1994a
	oranges	1.0	Anon 1994a
	apples	0.05	Anon 1994a
	pears	0.05	Anon 1994a
	peaches and nectarines	0.05	Anon 1994a
	plums	0.05	Anon 1994a
	grapes	0.05	Anon 1994a
	strawberries	0.05	Anon 1994a
	raspberries	0.05	Anon 1994a
	blackcurrants	0.05	Anon 1994a
	bananas	0.5	Anon 1994a
	carrots	0.5	Anon 1994a
	swedes	0.5	Anon 1994a
	turnips	0.5	Anon 1994a
	onions	0.5	Anon 1994a
	tomatoes	0.1	Anon 1994a
	cucumbers	0.1	Anon 1994a
	cauliflower	0.1	Anon 1994a
	Brussels sprouts	0.1	Anon 1994a
	cabbage	0.1	Anon 1994a
	lettuce	0.1	Anon 1994a
	beans	0.1	Anon 1994a
	peas	0.1	Anon 1994a
	celery	0.5	Anon 1994a
	leek	0.1	Anon 1994a
	mushrooms	0.05	Anon 1994a
	milk	0.008	Anon 1994a
	meat, fat and preparations of meat	0.2	Anon 1994a

Only the residue definition applying in the UK, The Netherlands and Poland was specified. In these countries the definition is “the sum of *Z*- and *E*- isomers of chlorfenvinphos”.

In 1994 the US EPA proposed to revoke the tolerances in or on certain raw agricultural commodities, processed foods and animal feeds for 17 pesticide chemicals including chlorfenvinphos. The EPA stated that they were initiating this action for those pesticides which have no food use (national) registrations (Anon, 1994b).

APPRAISAL

Chlorfenvinphos is a contact and soil-applied organophosphorus insecticide available as granules, EC or WP sprays and seed-treatment formulations. It is used for the control of various pests, including wheat bulb fly, cabbage root fly and carrot fly, on a range of crops.

Chlorfenvinphos is present in the form of two configurational isomers and is liquid at 25°C. Data on physico-chemical properties were provided only for the technical material. The data on the solubility of chlorfenvinphos in water, fat and organic solvents and the octanol-water partition coefficient, were not supported by full study reports and have therefore not been included in the evaluation.

In briefly reported studies on humans, rats and dogs, chlorfenvinphos was extensively metabolized, and a number of metabolites were identified.

A number of briefly reported metabolism studies on ruminants were submitted in which cows were treated by injection or spraying, but none in which cattle were treated by oral ingestion. A number of metabolites were identified and a metabolic pathway proposed in which it was postulated that incorporation of some of the metabolites took place by conjugation with glucuronide. Most of the radioactive residue was found in the omental or renal fat, with little or no residue in the liver, kidney or other tissues even at high doses. However, these studies were old and briefly reported with limited experimental detail. The Meeting considered that new data on metabolism in lactating ruminants and/or laying poultry to meet modern standards are required if significant residues occur in relevant feed items. In addition, data on the ruminant metabolism of chlorfenvinphos applied externally are required to support the approved use for dipping in Australia.

In plants two main investigations were conducted, one with foliar applications to potatoes, cabbages and maize and the other with soil applications to cabbages, carrots and onions. Significant residues of parent chlorfenvinphos remained in crops sampled several weeks after treatment. The main metabolite from foliar applications was the conjugate of 1-(2,4-dichlorophenyl)ethanol. Traces of desethyl-chlorfenvinphos were also detected. After soil applications the metabolite 2,4-dichloroacetophenone was identified together with some polar unextractable material. These metabolism studies were old and briefly reported with limited experimental detail: the full metabolic pathway in plants was not elucidated. Although the data appeared to show that chlorfenvinphos was the major component of the residue the Meeting considered that new data on metabolism and translocation in plants according to modern standards are required to confirm this.

In a laboratory study of degradation in soil a number of products were identified and a degradation pathway was proposed. Chlorfenvinphos was the major single compound identified although 1-(2,4-dichlorophenyl)ethanol, the sodium salt of desethyl-chlorfenvinphos, and 2,4-dichloroacetophenone were present in significant concentrations. Degradation was slower in organic than in mineral soils. In the field, half-lives of chlorfenvinphos were 14-84 days in mineral soils and more than 150 days in peat soil.

The analysis of crop and soil samples for chlorfenvinphos and its metabolites was based on GLC with FP, EC or NP detection. The reported limits of determination were 0.01-0.05 mg/kg. Only limited data on validation of the methods were presented.

A definition of the residue as "chlorfenvinphos, sum of (*E*)- and (*Z*)- isomers" was recommended, but the Meeting agreed that the definition might have to be reconsidered when new data on plant and animal metabolism have been reviewed.

The information on GAP supplied by the manufacturer was incomplete. No copies of the product labels were submitted, only summary sheets.

Reports of residue trials on leeks, onions, head cabbage, Savoy cabbage, cauliflower, mushrooms, kale, carrots, parsley root, parsnips, potatoes, swedes, sweet potatoes, radishes, turnips, celery, rape seed, parsley, maize, and wheat were submitted, but as no GAP was reported for parsley root or sweet potatoes the Meeting could not estimate maximum residue levels for these commodities. No residue trials were reported on several crops for which GAP and/or CXLs exist, and the Meeting recommended withdrawal of the unsupported CXLs.

Many of the trials were very old with no detailed study reports. Details such as the method of analysis, the duration of sample storage, analytical recoveries and plot size were lacking. The Meeting agreed that such data were inadequate for the estimation of maximum residue levels. In many other trials the duration of sample storage before analysis was not reported and the Meeting agreed that although the data could be used to estimate maximum residue levels, such levels could not be recommended as MRLs because data on the stability of residues in stored analytical samples of representative substrates were required to confirm the validity of the results.

Onions. GAP was reported for several countries. A number of residue trials on bulb onions together with one on spring onions were reported. Four French trials with residues of <0.02 mg/kg complied with the granular application rate in France, but a PHI of 15 days was reported by the manufacturer as French GAP, whereas the PHIs in the trials were 133-182 days. One German trial according to GAP for pre-planting spray treatment in Belgium and The Netherlands gave residues below 0.02 mg/kg after 175 days (shorter PHIs were not considered to accord with GAP). A further five German trials were considered to comply with GAP for pre-planting granular treatments in Belgium, Denmark, Germany and The Netherlands: all residues were below the LOD (<0.02 mg/kg). Two replicated Japanese trials reflected Japanese foliar GAP (which has a low application rate), with residues of <0.02 mg/kg 7-8 days after treatment. The only measurable parent residues reported were from the higher application rate of 4.8 kg ai/ha in a German spray trial (0.04 mg/kg, at a 60-day PHI) and in one UK trial (0.07 mg/kg, PHI of 61 days) which was very old and poorly described with no detailed study report. These trials were not comparable with any reported GAP.

The Meeting estimated an STMR of 0.02 mg/kg and a maximum residue level of 0.02* mg/kg. These estimates were based partly on trials which lacked information on the duration of sample storage.

Cabbage. Registered uses on head cabbage were reported in Belgium, Denmark, France, Germany, Ireland, Italy, Japan, The Netherlands, Sweden, Switzerland, and the UK, and on Savoy cabbage in Germany and The Netherlands. Residue trials on head cabbage were reported from the UK, Germany, the USA and India, and on Savoy cabbage from Germany. Seven German trials on head cabbage and three on Savoy cabbage complied with GAP for pre-planting soil treatments at 0.1 kg ai/m². Six further trials on head cabbage reflected the German granular seedbed GAP of 2 g/100 plants and three trials on Savoy cabbage the German 2 kg ai/ha GAP. All residues in all these trials were below 0.02 mg/kg. The German granular treatment at 0.1 g/plant (in some cases in combination with an earlier pre-planting soil treatment at 0.1 kg ai/m²) was represented by four acceptable trials on Savoy cabbage and one on head cabbage with residues of 0.02, 0.03, 0.15, 0.3 and 0.9 mg/kg. One UK trial complied with UK Gap for pre-emergence sprays but was very old and poorly reported without details. No trials were considered comparable with the GAP for foliar treatments reported in several countries, which have shorter PHIs. The Meeting agreed that there were insufficient data to estimate a maximum residue level on the basis of the German 0.1 g/plant granular treatment. However in view of the many trials conforming to German GAP for pre-planting and seedbed applications, all with residues below 0.02 mg/kg, the Meeting estimated an STMR of 0.02 mg/kg and a maximum residue level of 0.02* mg/kg. The trials on which these estimates were based included some which lacked information on the duration of sample storage and others for which this information was not clear to the reviewer because the study was not reported in the working language of the Meeting.

Cauliflower. GAP was reported for Germany, Ireland, The Netherlands and the UK. Residue trials were carried out in Germany, India, the USA and the UK. There were three German trials according to each of three different German GAP treatments: 2 g/100 plants nursery granular, the 0.1 g/plant single bed treatment and the 2 kg ai/ha granular “spreading” application. The UK and Dutch spray treatment (ca. 4-5 kg ai/ha) at the time of drilling or transplanting was reflected by four German trials. All the residues in these trials were <0.02 mg/kg.

The Meeting estimated an STMR of 0.02 mg/kg and a maximum residue level of 0.02* mg/kg. Again some of the trials had no information on the duration of sample storage and others were not reported in English.

Mushrooms. GAP was reported only for the UK as either compost or casing incorporation. Only one trial was available which was poorly described with no detailed study report. There were insufficient data to estimate an STMR or maximum residue level and the Meeting recommended that the existing CXL of 0.05 mg/kg should be withdrawn.

Kale. There are registered uses in Germany, The Netherlands, Portugal and Spain, but residue trials were available only from Germany. Five trials were according to the Dutch GAP for spray treatments at planting or before sowing. Residues were all <0.02 mg/kg. In one of these trials the residue of dichlorophenylethanol was 0.07 mg/kg. Three further trials complied with the German granular single plant treatment, and in two others this treatment was combined with soil treatment according to German GAP. Residues in these trials were <0.02 (2), 0.02, 0.07 and 0.09 mg/kg. There were insufficient data to estimate an STMR or maximum residue level.

Carrots. GAP was reported for Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, The Netherlands, Switzerland and the UK. Residue trials were available from Canada, France, Germany, The Netherlands, South Africa, Spain, Sweden, Switzerland, Trinidad and the UK. In addition the UK government provided data on residues in overwintered commercial carrots whose treatment history had been recorded. The highest residues resulted from post-planting EC or WP sprays at *c.* 4 kg ai/ha which corresponds to GAP in The Netherlands and France. Similar treatments at *c.* 2.5 kg ai/ha are GAP in Ireland and the UK. The PHIs reported for these countries ranged between 21 and 60 days which reflects second generation carrot fly control. French GAP was also reported to include an EC spray at 5 kg ai/ha with a PHI of 15 days, but the Meeting was informed that the use in practice was at the time of sowing. Several trials in France, Germany and The Netherlands complied with the higher rate GAP, with residues of <0.02, 0.05, 0.08, 0.12, 0.14, 0.2(3), 0.22, 0.3, 0.37, 0.45, 0.9, 1.2, 1.8, 2.0, and 3.8 mg/kg. In the overwintered commercial carrots treated in accordance with UK GAP the residues were <0.02-1.6 mg/kg.

The Meeting estimated an STMR of 0.22 mg/kg and a maximum residue level of 5 mg/kg. This estimation was based in part on trials for which no information on the duration of sample storage was reported.

Parsnips. GAP was reported for The Netherlands and the UK. The UK provided government-generated data on residues in overwintered commercial parsnips of known treatment history. Two residues were from treatments according to UK GAP (2.35 kg ai/ha). The residues were 0.14 and 0.16 mg/kg. The estimates of the STMR and maximum residue level for carrots are based on the post-planting EC or WP spray at 4 kg ai/ha reported as GAP in The Netherlands. Since GAP for parsnips in The Netherlands is the same as for carrots the Meeting agreed that the data on carrots could be used to estimate maximum and mean residue levels for parsnip by extrapolation.

The Meeting estimated an STMR of 0.22 mg/kg and a maximum residue level of 5 mg/kg. The estimates were based in part on trials for which there was no information on the duration of sample storage.

Potatoes. There are registered uses in The Netherlands and Poland. Residue trials were carried out in the UK, Spain, Australia and Poland, but they were very old and poorly reported with few details. There were insufficient data to estimate an STMR or maximum residue level and the Meeting recommended that the existing CXL of 0.05 mg/kg should be withdrawn.

Radishes. GAP was reported for Germany, The Netherlands and the UK. Residue trials were in Germany and Switzerland. Several of the trials were very old and none were reported in detail. In addition the UK provided government-generated data on residues (four results) in overwintered commercial radishes of known treatment history. The residues following applications close to GAP were all <0.1 mg/kg. There were insufficient data to estimate an STMR or maximum residue level and the Meeting recommended that the existing CXL of 0.1 mg/kg should be withdrawn.

Swedes and turnips. GAP for swedes and turnips was reported for The Netherlands and the UK. One field trial in the UK on swedes and three in the UK or USA on turnips were reported, but the analytical recovery was high (>120%) in the trial on swedes and the others were old and poorly described with no detailed study reports. The Meeting also received reports of six German trials on swedes or turnips in which the commodity was described as "turnip cabbage". This was an error in translation from the original German and the correct description was "swede/turnip". These trials did not comply with UK or Netherlands GAP.

There were insufficient data to estimate an STMR or maximum residue level and the Meeting recommended that the existing CXLs of 0.05 mg/kg should be withdrawn.

Celery. There is a registered use in The Netherlands. One group of residue trials was reported, at a unspecified location. It was poorly described, with no detailed study report.

There were insufficient data to estimate an STMR or maximum residue level and the Meeting recommended that the existing CXL of 0.4 mg/kg should be withdrawn.

Rape seed. GAP for rape was reported for Austria, Germany, The Netherlands and Poland. Several field trials were carried out in France and Germany. Six German trials complied with German GAP for EC spray. Residues in all the trials were <0.02 mg/kg. There were no trials with the broadcast application of granules at 3 kg ai/ha used in The Netherlands, although in two French trials with an application rate of 1kg ai/ha residues were <0.02 mg/kg.

The Meeting estimated an STMR of 0.02 mg/kg and a maximum residue level of 0.02* mg/kg. The estimates were based on trials without information on the duration of sample storage.

Parsley. There are registered uses in The Netherlands and the UK with WP or EC spray applications. Summarized reports of residue trials were available from Germany, but all the trials were with granular formulation whereas the reported GAP applications are by spraying.

There were insufficient data to estimate an STMR or maximum residue level.

Maize. GAP was reported for The Netherlands. Residue trials were carried out in France but were very old and poorly described with no detailed study reports.

There were insufficient data to estimate an STMR or maximum residue level and the Meeting recommended that the existing CXL of 0.05 mg/kg should be withdrawn.

Wheat. There are registered uses in the UK. Two residue trials in the UK were very old and poorly reported with inadequate detail.

There were insufficient data to estimate an STMR or maximum residue level and the Meeting recommended that the existing CXL of 0.05 mg/kg should be withdrawn.

Lettuce and lamb's lettuce as rotational crops. Trials were carried out in Germany, but the data were submitted in JMPR summary format only with no accompanying study reports.

The lettuce or lamb's lettuce was planted 1-4 months after the treatment of radishes as the primary crop at 4 kg ai/ha. The dates of harvest of the radish crop and the residue levels in the soil were not recorded. The residues in lamb's lettuce at harvest were <0.04 (4) and 0.19 mg/kg, and in lettuce <0.04 (5), 0.05, 0.07 0.11 mg/kg. German GAP for radishes is a "spreading" application at 3 kg ai/ha (field) or 4 kg ai/ha (glass). Similar GAP for soil treatment was reported at comparable application rates for several other crops in a number of countries.

Although no GAP was reported for chlorfenvinphos on lettuce or lamb's lettuce, the trials demonstrated that significant residues may occur in these crops when grown in rotation following soil applications of chlorfenvinphos. Since the trials were reported only in summary form, the Meeting agreed not to estimate a maximum residue level for lamb's lettuce or head lettuce.

Livestock. In a briefly reported trial calves were dipped in a chlorfenvinphos solution at a concentration of 0.037 kg ai/hl. Residues in liver, muscle and kidney were below the LODs of 0.1, 0.05 and 0.05 mg/kg respectively, but residues in the fat were in the range <0.1-0.27 mg/kg. In a trial in which cattle were grazed on treated pasture containing residues of 2.5-17 mg/kg the residues of chlorfenvinphos in the milk were all below 0.01 mg/kg.

The Meeting concluded that there were insufficient data on residues in ruminant feed items to estimate maximum residue levels for the meat, milk or edible offal of ruminants and that the existing CXLs for meat and milk should be withdrawn.

Domestic preparation and processing trials indicated that most of the residue in carrots treated with an EC spray is associated with the crown and the top 1 cm of the root. Removal of the crown alone was reported to lead to the loss of approximately 30% of the residue. Domestic boiling was found to have only a moderate effect on residues, but when carrots were peeled and the top of the roots (crown and next 1 cm) removed only 1-3% of the total residue remained. In a further study residues of 0.07 mg/kg in raw carrots were reduced to 0.02 mg/kg by commercial cooking, which included the addition of brine.

National monitoring data were supplied from Australia, Poland, The Netherlands and the UK.

The Meeting agreed that in view of the lack of studies according to modern standards on metabolism, the stability of residues in stored analytical samples, the mobility of chlorfenvinphos in soil and the residues found in following crops, the estimated maximum residue levels could not be recommended as MRLs. For any further future consideration of MRLs, submission of data on such studies would be needed.

RECOMMENDATIONS

1. The Meeting estimated the following maximum residue levels and STMRs, but the maximum residue levels are not recommended for use as MRLs.

Definition of the residue for compliance with MRLs and for estimation of dietary intake: chlorfenvinphos, sum of (*E*)- and (*Z*)- isomers.

The residue is fat-soluble.

Commodity		Maximum residue level, mg/kg	STMR, mg/kg
CCN	Name		
VB 0041	Cabbages, head	0.02*	0.02
VR 0577	Carrot	5	0.22
VB 0404	Cauliflower	0.02*	0.02
VA 0385	Onion, Bulb	0.02*	0.02
VR 0588	Parsnip	5	0.22
SO 0495	Rape seed	0.02*	0.02

2. The Meeting recommended that the following existing CXLs should be withdrawn.

Commodity		Existing CXL, mg/kg
CCN	Name	
VB 0400	Broccoli	0.05
VB 0402	Brussels sprouts	0.05
VB 0041	Cabbages, Head	0.05
VR 0577	Carrot	0.4
VB 0404	Cauliflower	0.1
VS 0624	Celery	0.4
FC 0001	Citrus fruits	1
SO 0691	Cotton seed	0.05
VO 0440	Egg plant	0.05
VR 0583	Horseradish	0.1
VA 0384	Leek	0.05
GC 0645	Maize	0.05
MM 0095	Meat (from mammals other than marine mammals)	0.2 (fat) V
ML 0107	Milk of cattle, goats and sheep	0.008 F V
VO 0450	Mushrooms	0.05
VA 0385	Onion, Bulb	0.05
SO 0697	Peanut	0.05
VR 0589	Potato	0.05
VR 0494	Radish	0.1
GC 0649	Rice	0.05
CM 1205	Rice, polished	0.05
VR 0497	Swede	0.05
VR 0508	Sweet potato	0.05
VO 0448	Tomato	0.1
VR 0506	Turnip, Garden	0.05
GC 0654	Wheat	0.05

FURTHER WORK OR INFORMATION

Desirable

1. The following physico-chemical properties of the pure active ingredient:

vapour pressure, melting point, octanol/water partition coefficient, solubility in organic solvents, solubility in water, specific gravity.

2. If significant residues occur in relevant feed items, a study of metabolism and distribution in a lactating ruminant and/or in laying poultry carried out according to modern standards in which treatment is made through oral ingestion.

3. Data on metabolism in a ruminant after the external application of chlorfenvinphos to support the reported approved dipping use in Australia.

4. Plant metabolism and translocation studies carried out according to modern standards.
5. Studies on the stability of pesticide residues in representative analytical samples stored for at least two years. These would help to support data evaluated by the Meeting on residue trials for which the duration of sample storage was not reported.
6. Studies to assess the nature and levels of residues in representative rotational crops other than lettuce and lamb's lettuce.
7. If significant residues are found in animal feed, a transfer study on ruminants according to modern standards (see 1993 JMPR report, Section 2.7).
8. A study of the mobility of chlorfenvinphos in soil, including leaching, adsorption and desorption, according to modern standards.
9. Copies of the product labels supporting the information submitted on GAP.
10. The full reports of the rotational crop studies on lamb's lettuce and lettuce.

REFERENCES

- Anon undated. Birlane breakdown studies in soils and plants. CTMCR; SICC Agrochemicals regulatory division London. CH-601-001. Unpublished.
- Anon 1964. SD7859 Residues on swedes and cauliflowers. TM.64.196 CH-724-065. Dec. 1964. Unpublished.
- Anon 1966. The determination of birlane insecticide in crops and soil - gas liquid chromatographic method. Woodstock analytical method series. WAMS 25-2. Unpublished. 14th February 1966.
- Anon 1969. Determination of residues of non conjugated breakdown products of chlorfenvinphos in crops and soil GLC method. SRC Sittingbourne SAMS 57-2. CH-244-002. Unpublished.
- Anon 1972. Residues in soil and uptake into crops 1972 trial. Shell Chimie Berre BEGR 0012.73. CH-790-031. Unpublished.
- Anon 1973. Residue trials carried out in 1973. Shell Chimie Berre BEGR.74.024 CH-750-007. Unpublished.
- Anon. 1975. Determination des teneurs residuaires en chlorfenvinphos dans le carottes. Centre de recherches de phytopharmacy report ref 75.5, Gembloux, Belgium. Unpublished
- Anon 1985. Chlorfenvinphos residue review occurrence and fate of residues in soil. CTMCR; SICC. Agrochemicals regulatory division London. CH-620-001. Unpublished.
- Anon 1988a. Multi-residue method 2, Cholinesterase Inhibitors, part 1, 24 - 32, "Analytical Methods for Residues of Pesticides", 5th edition (1988) Ministry of Welfare, Health and Cultural Affairs, Rijswijk, The Netherlands. SDU Publishers, The Hague, NL; ISBN 90 12 06712 5. Submitted to the JMPR by The Netherlands.
- Anon 1988b. Multi-residue method 5, Organophosphorus Compounds, Submethod 1, part 1, 53 -56 and 64 -70, "Analytical Methods for Residues of Pesticides", 5th edition (1988); Ministry of Welfare, Health and Cultural Affairs, Rijswijk, The Netherlands. SDU Publishers, The Hague, NL; ISBN 90 12 06712 5. Submitted to the JMPR by The Netherlands.
- Anon 1988c. Multi-residue method 12, Gel permeation clean-up, part I, 115 -119; "Analytical Methods for Residues of Pesticides", 5th edition (1988), Ministry of Welfare, Health and Cultural Affairs, Rijswijk, The Netherlands. SDU Publishers, The Hague, NL; ISBN 90 12 06712 5. Submitted to the JMPR by The Netherlands.
- Anon 1989-92. UK government study of residues of organophosphorous residues in carrot, turnips and radish of known treatment history. Study references PR 871, FV 42 and PR 896. Submitted to the JMPR by the UK.
- Anon 1990. Determination of residues of chlorfenvinphos E and Z isomers in crops and soil GLC method. SEP/3. SRC Sittingbourne SAMS 253. CH-244-001. Unpublished.
- Anon 1994a. The Pesticides (Maximum Residue Levels in Crops, Food and Feedingstuffs) Regulations 1994, Statutory Instrument. London, HMSO.
- Anon 1994b. United States Federal Register, Vol.59 No. 72, April 14, 1994.
- Anon 1995. Residues Data Summary from supervised trials, chlorfenvinphos. Federal Biological Research Centre for Agriculture and Forestry Chemistry Division. Braunschweig. Submitted to the JMPR by Germany. Unpublished.
- Anon 1996a. Information supplied to the JMPR by Poland. Unpublished.
- Anon 1996b. Information supplied to the JMPR by Australia. Unpublished.
- Anon 1996c. Submission to the FAO panel of the JMPR - Working Paper/Monograph. American Cyanamid 1996. Unpublished.
- Anon 1996d. Information supplied to the JMPR by Germany. Unpublished.
- Anon 1996e. Information supplied to the JMPR by the UK. Unpublished.
- Beynon, K. Feb. 1966. Analysis of crops for residues of birlane 1965 field trials metabolism in cabbage. ARD Princeton NJ USA IRR ACD/6/66 CH-640-002. Unpublished
- Beynon K. and Wright, A. Nov. 1965. Metabolism of birlane 1. The analysis of glasshouse crops and soils for 14C birlane and its metabolites. SRC Sittingbourne PPR-AD.65.055. CH-620-002. Unpublished
- Beynon K. and Wright, A. 1967. The breakdown of 14C chlorfenvinphos in soils and in crops grown in the soils. J. Sci. Food and agriculture v 18 P 143-150 CH-905-111.
- Beynon, K. and Wright, A. 1968. Breakdown of 14C chlorfenvinphos insecticide on crops. J. Sci. Food and agriculture V 19 P 146-153. CH-905-112.

- Beynon, K., Hutson, D. and Wright, A. 1973. The metabolism and degradation of phosphate insecticides. Residue reviews v 47 p 55-142. CH-905-023.
- Bosio, P. Mar. 1970. Residues of birlane in carrots from France part 3. Shell Chimie Berre BEGR.70.007. CH-724-011. Unpublished
- Bosio, P. Sept. 1970. Residues of birlane in carrots from France 1970 trials. Shell Chimie Berre BEGR.70.060. CH-724-012. Unpublished
- Bosio, P. May 1971. Residues of birlane in carrots from Spain 1970 trials. Shell Chimie Berre BEGR.71.020. CH-724-013. Unpublished
- Bosio, P. Aug. 1971. Trinidad birlane trials persistence of residues in soil and uptake into crops 70/71 trials. Shell Chimie Berre BEGR 0054.71. CH 790-027. Unpublished.
- Bosio, P. Nov. 1971. Residues of birlane in carrots from Canada 1970 trials. Shell Chimie Berre BEGR.71.059. CH-724-014. Unpublished
- Bosio, P. Apr. 1972. Residues of birlane and its metabolites in onions from Spain 1971 trials. Shell Chimie Berre BEGR-72.024. CH-722-004. Unpublished
- Bosio, P. June 1972. Long term residue trial with birlane in France - persistence of residues in soil and uptake into crops 1971 trial. Shell Chimie Berre BEGR 0033.72. CH-790-029. Unpublished.
- Bosio, P. June 1972. Long term residue trial with birlane in France - persistence of residues in soil and uptake into crops 1971 trial. Shell Chimie Berre BEGR 0033.72. CH-790-029. Unpublished.
- Bosio, P. Jul. 1972. Residues of birlane and its metabolites in carrots from Canada 1971 trials. Shell Chimie Berre BEGR.72.045. CH-724-015. Unpublished
- Bosio, P. Nov. 1972. Trinidad birlane trials persistence of residues in soil and uptake into crops 71/72 trials. Shell Chimie Berre BEGR 0065.72. CH-790-030. Unpublished
- Bosio, P. Feb. 1973. Residues of birlane and its metabolites in carrots from Spain 1972 trials. Shell Chimie Berre BEGR-73.007. CH-724-016. Unpublished.
- Bosio, P. Feb. 1973. Residues of birlane and its metabolites in onions from Japan 1972 trials. Shell Chimie Berre BEGR.73.005. CH-722-005. Unpublished.
- Bosio, P. Feb. 1973. Residues of birlane and its metabolites in onions from Spain 1972 trials. Shell Chimie Berre BEGR.73.008. CH-722-006. Unpublished.
- Bosio, P. Mar. 1973. Long term residue trial with birlane in France - persistence of residues in soil and uptake into crops 1972 trial. Shell Chimie Berre BEGR 0012.73. CH-790-031. Unpublished
- Bosio, P. Sept. 1973. Trinidad birlane trials persistence of residues in soil and uptake into crops 72/73 trials. Shell Chimie Berre BEGR. 0051.73. CH-790-032. Unpublished
- Bosio, P. May 1974. Residues of birlane and its breakdown products in Savoy cabbage from Germany 1973 trials. Shell Chimie Berre BEGR-74.051. CH-721-003. Unpublished.
- Bosio, P. May 1974. Residues of birlane and its breakdown products in kale cabbage from Germany 1973 trials. Shell Berre BEGR.74.050. CH-726-001. Unpublished
- Bosio, P. Feb. 1974. Residues of birlane and its breakdown products in rape seed from Germany
- Bosio, P. Mar. 1974. Residues of birlane and its metabolites in onions from Germany 1973 trials part 3 granule formulation treatment. Shell Chimie Berre BEGR.74.033. CH-722-009. Unpublished.
- Bosio, P. Apr. 1974. Residues of birlane and its breakdown products in carrots from Germany 1973 trials part 1 liquid formulation treatment. Shell Chimie Berre BEGR.74.038. CH-724-017. Unpublished.
- Bosio, P. Apr. 1974. Residues of birlane Dichlorvos and their breakdown products in Carrots from Germany 1973 trials part 2 granule formulation treatment. Shell Chimie Berre BEGR-74.039. CH-724-018. Unpublished.
- Bosio, P. Aug. 1974. Long term residue trial with birlane in France - persistence of residues in soil and uptake into crops 1973 trial. Shell Chimie Berre BEGR 0067.74. CH-790-033. Unpublished.
- Bosio, P. Aug. 1974. Residues of birlane and its metabolites in carrots from Spain 1973 trials. Shell Chimie Berre BEGR.74.068. CH-724-019. Unpublished.
- Bosio, P. Aug. 1974. Residues of birlane and its metabolites in onions from Spain 1973 trials. Shell Chimie Berre BEGR.74.069. CH-722-010. Unpublished

- Bosio, P. Nov. 1974. Residues of birlane breakdown products in Savoy from Germany 1977 trials part 1 soil treatment EC formulation. Shell Chimie Berre BEGR.77.080. CH-721-005. Unpublished.
- Bosio, P. Nov. 1974. Residues of birlane breakdown products in Savoy from Germany 1977 trials part 2 treatment with G formulation. Shell Chimie Berre BEGR.77.082. CH-721-007. Unpublished.
- Bosio, P. Nov. 1974. Residues of birlane in Savoy from Germany 1977 trials part 2 treatment with G formulation. Shell Chimie Berre BEGP-77.081. CH-721-006. Unpublished.
- Bosio, P. Nov. 1974. Residues of birlane in Savoy from Germany 1977 trials part 1 soil treatment with EC formulation. Shell Chimie Berre BEGR.77.079. CH-721-004. Unpublished
- Bosio, P. Feb. 1975. Residues of birlane in carrots from Spain 1974 trials. Shell Chimie Berre BEGR 75.006. CH-724-021. Unpublished
- Bosio, P. Apr. 1975. Residues of birlane in rape from Germany 1974 trials. Shell ChimieBerreBEGR-75.033 CH-750-008. Unpublished
- Bosio, P. Feb. 1975. Residues of birlane in carrots from Switzerland 1974 trials. Shell Chimie Berre BEGR-75.005. CH-724-020. Unpublished.
- Bosio, P. Feb. 1975. Residues of birlane in onions from Spain 1974 trials. Shell Chimie Berre BEGR-75.007. CH-722-011. Unpublished
- Bosio, P Nov. 1977. Residues of birlane in kale from Germany 1977 trials part 2 treatment with G formulation. Shell Chimie Berre BEGR.77.077 CH-726-004. Unpublished
- Bosio, P. Nov. 1977. Residues of birlane breakdown products in kale from Germany 1977 trials part 1 soil treatment with EC formulation. Shell Chimie Berre BEGR-77.076 CH-726-003. Unpublished.
- Bosio, P. Nov. 1977. Residues of birlane breakdown products in kale from Germany 1977 trials part 2 treatment with G formulation. Shell Chimie Berre BEGR-77.078 CH-726-005. Unpublished.
- Bosio, P. Nov. 1977. Residues of birlane in kale from Germany 1977 trials part 1 soil treatment with EC formulation. Shell Chimie Berre BEGR-77.075. CH-726-002. Unpublished
- Bosio, P. Sept. 1978. Residues of birlane in cabbage from Germany 1978 trials. Shell Chimie Berre BEGR.78.070. CH-721-008. Unpublished.
- Bosio, P. Sept. 1978. Residues of birlane in Savoy from Germany 1978 trials. Shell Chimie Berre BEGR.78.071 CH-721-009. Unpublished
- Bosio, P. Nov. 1978. Residues of birlane breakdown products in cabbage from Germany 1978 trials. Shell Chimie Berre BEGR-78.073. CH-721-010. Unpublished.
- Bosio, P. Nov. 1978. Residues of birlane breakdown products in Savoy from Germany 1978 trials. Shell Chimie Berre BEGR.78.074. CH-721-011. Unpublished.
- Bosio, P. 1981a. Residues of birlane in Savoy from Germany granule 1980 trials Shell Chimie Berre BEGR-81.065. CH-721-015. Unpublished.
- Bosio, P. 1981b. Residues of birlane in cabbage from Germany granule 1980 trials. Shell Chimie Berre BEGR.81.061. CH-721-014. Unpublished.
- Bosio, P. 1981c. Residues of birlane in carrots from Germany EC 1980 trials. Shell Chimie Berre BEGR.81.050. CH-724-022. Unpublished.
- Bosio, P. 1981d. Residues of birlane in carrots from Germany granule 1980 trials. Shell Chimie Berre BEGR.81.062. CH-724-023. Unpublished.
- Bosio, P. 1981e. Residues of birlane in rapeseeds from Germany EC 1980 trials. Shell Chimie Berre BEGR-81.055. C-750-009. Unpublished.
- Bosio, P. 1981f. Residues of birlane in Savoy from Germany EC 1980 trials. Shell Chimie Berre BEGR-81.058. CH-721-012. Unpublished.
- Bosio, P. 1981g. Residues of birlane in turnip cabbage from Germany EC 1980 trials. Shell Chimie Berre BEGR.81.060. CH-721-013. Unpublished.
- Bosio, P. 1981h. Residues of birlane in turnip cabbage from Germany granule 1980 trials. Shell Chimie Berre BEGR.81.066. CH-721-016. Unpublished.
- Bosio, P. 1981i. Residues of birlane in cauliflower from Germany EC 1980 trials. Shell Chimie Berre BEGR-81.051. CH-721-022. Unpublished
- Bosio, P. 1981j. Residues of birlane in cauliflower from Germany G 1980 trials. Shell Chimie Berre BEGR.81.063. CH-721-023. Unpublished
- Bosio, P. Jan. 1982. Residues of birlane in cauliflowers from Germany 1981 trials. Shell Chimie Berre BEGR.82.008 CH-721-024. Unpublished.
- Bosio, P. Jan. 1982. Residues of birlane in Savoy from Germany 1981 Trials Shell Chime

- Berre BEGR-82.010. CH-721-017. Unpublished.
- Bosio, P. May 1984. Residues of chlorfenvinphos in onions from Germany treated with birlane 1983 trials. Shell Chimie Berre BETR-84.022. CH-722-013. Unpublished
- Bosio, P. Jan. 1989. Residues of chlorfenvinphos in rape from France treated with birlane 1988 trials. Shell Chimie Berre BETR-89.003 CH-750-011. Unpublished.
- Bosio, P. Jun. 1990. Residues of chlorfenvinphos in cabbages from Germany Treated with birlane 1989 trials. Shell Chimie Berre BETR.90.013. CH-721-018. Unpublished.
- Bosio, P. Jun. 1990. Residues of chlorfenvinphos in cauliflowers from Germany treated with birlane 1989 trials. Shell Chimie Berre BETR-90.014. CH-721-025. Unpublished
- ten Broeke, R., Dornseiffen, J. W. & Enzler, K. 1979. Residuen van chloorfenvinfos in winterpeen. Food Inspection Service report no 215, Amsterdam. Submitted by The Netherlands. Unpublished
- Calmels, R. Oct. 1992. Chlorfenvinphos test to evaluate physicochemical properties of autoflammability, and flash point. Sepc Sarcey France report COO5. CH-330-001. Unpublished
- Carlou, R. 1992. Residues of chlorfenvinphos in rapeseeds from France 1991 trials. Shell Chimie Berre BETR-92.001 CH-750-013. Unpublished.
- Carlou, R. 1990. Residues of chlorfenvinphos in rape from Germany treated with birlane 1989 trials. Shell Chimie Berre BETR.90.004. CH-750-012. Unpublished
- Carlou, R. May 1990. Residues of chlorfenvinphos in carrots from Germany treated with birlane 1989 trials. Shell Chimie Berre BETR 90.006. CH-724-024. Unpublished.
- Chamberlain, W. F. Hopkins, P.E 1962. Adsorption and elimination of general chemical 4072 applied dermally to cattle. J. Econ. ENT 55, 86-88. Unpublished.
- Cole, E. May 1971. Residues of birlane and free and conjugated 1-(2, 4 -Dichlorophenyl) ethan-1-ol in crops and soil field trials 1969. Shell Research Limited. WKGR.0098.71 CH-790-026. Unpublished.
- Dorlijn, W. L., Greve, P. A. & Krijgsman. 1977. Residuen van diazinon, chloorfenvinfos en trichloronaat op wortelen. Rijks Instituut Voor De Volksgezondheid report number 226/77 Tox-RoB, Bilthoven. Submitted by The Netherlands. Unpublished.
- Dornseiffen, J.W. & Enzler, K. 1985. Residuen van chloorfenvinfos in stengelui. Food Inspection Service report 245, Amsterdam. Submitted by The Netherlands. Unpublished.
- Dutton, A. June 1974. Residues of birlane in cabbage from India. SRC Sittingbourne WKGR.74.071. CH-721-002. Unpublished.
- Edwards, V., Gibb, G. Dec. 1981. The degradation of ¹⁴C birlane in a laboratory fresh water aquatic system. SRC Sittingbourne SBGR.81.237. CH-630-003. Unpublished.
- Elgar, K. 1965a. Residues of SD7859 in carrots from Holland. SRC Sittingbourne TW7/65 CH-724-001. Unpublished.
- Elgar, K. 1965b. Residues of SD7859 in carrots from Holland. SRC Sitingbourne TW7/65 CH-724-001. Unpublished.
- Elgar, K. 1966a. Effect of cooking on birlane residues in carrots. SRC Sittingbourne TMM/66. CH-790-005. Unpublished
- Elgar, K. 1966b. Residues of birlane in onions radishes and leeks from Germany. SRC Sittingbourne TSN/66/66. CH-722-001. Unpublished
- Elgar, K. 1966c. Residues of birlane in carrots from Holland. SRC Sittingbourne TSN/122/66. CH-724-002. Unpublished.
- Elgar, K. 1966d. Residues of birlane in carrots from Holland. SRC Sittingbourne TSN/122/66. CH-724-002. Unpublished.
- Elgar, K. 1966e. Residues of birlane and its metabolites in milk and grass from Australia. SRC Sittingbourne TSN/147/66. CH-731-002. Unpublished.
- Elgar, K. 1967a. Residues of birlane in carrots from UK. SRC Sittingbourne TSN/53/67. CH-724-003. Unpublished
- Elgar, K. 1967b. Residues of birlane in carrots from Sweden. SRC Sittingbourne TSN/81/67. CH-724-004. Unpublished
- Elgar, K. 1967c. Residues of birlane in canned carrots from Heinz. SRC Sittingbourne TSN/1 12/67. CH-790-006. Unpublished.
- Elgar, K. Nov. 1971. Residues of birlane and conjugated 1-(2,4-dichlorophenyl)ethan-1 ol in carrots from the UK. SRC Sittingbourne WKGR.71.175. CH-724-007. Unpublished.

Eschle J. L., Mann, H.P, Oehler, D.D. 1971. Residues of compound 4072 in milk and meat of cattle held in barns treated with residual sprays. Unpublished.

Furr, H. Oct.1993. Chlorfenvinphos: the determination of residues and nonconjugated metabolites in carrots from the UK. Hazelton Europe. 71713IB-1012. CH-724-077. Unpublished.

Gilham, J. Nov. 1972. Residues of birlane in carrots from South Africa. SRC Sittingbourne WKGR.72.186. CH-724-008. Unpublished.

Greve, P. A. & Ramlal, M. 1987. Residuen van diazinon en chloorfenvinfos in winterwortel. Rijksinstituut Voor Volksgezondheid En Milieuhygiene report 638201009, Bilthoven. . Submitted by The Netherlands. Unpublished

Herbst, J, Herbst, M. May 1995. Toxizitats-und metabolismusuntersuchungen mit chlorfenvinphos und formlierungen (birlane granulat, birlane fluid). Unpublished.

Hunter C. Aug. 1969. Excretion of metabolites of chlorfenvinphos supona in the milk of a cow. SRC Sittingbourne TLTR.69.009. CH-849-002. Unpublished.

Hutson, D., Hathway, D. Feb. 1966. The metabolism of chlorfenvinphos in the dog and rat. SRC Sittingbourne RM.66.002. CH-440-001. Unpublished

Hutson, D. Jan. 1969. The metabolism of 14C chlorfenvinphos in man. SRC Sittingbourne TLGR.69.006. Ch-440-003. Unpublished.

Hutson, D., Hoadley, E. Aug. 1969. Excretion of metabolites of chlorfenvinphos in the milk of a cow treated with supona. SRC Sittingbourne TLTR-69.009. CH-440-002. Unpublished

Ivey, M.C. *et al.* 1966. Residues of shell compound 4072 in the body tissues of sprayed cattle. ECON.ENT.59,379-382. Unpublished.

Mathews, B. Jan. 1971. Residues of birlane in onions from Canada. SRC Sittingbourne WKGR171.004. CH-722-002. Unpublished.

Mathews, B. Oct. 1972. Residues of birlane in cauliflowers in India SRC Sittingbourne WKGR-72.155 CH-721-019. Unpublished.

Olthof, P.D.A, 1996. Information supplied to the JMPR by The Netherlands in letter dated 24th April 1996 . Personal Communication.

Roberts, R.H., Rodeleff, R. D., Clotont H.V. 1961. Residues in the milk of dairy cows sprayed with P-labelled general chemical 4072. Journal Of Economic Entomology 54 (5) 1053-1054.

Robson, M. Apr. 1992. Determination of the vapour pressure of chlorfenvinphosbirlane according to EEC requirements amendment 1. Hazelton Harrogate UK HUK 6920-579197. CH-306-003. Unpublished.

Robson, M. Feb. 1993. Determination of physico-chemical properties of chlorfenvinphos, birlane according to EEC requirements, melting boiling point density surface tension. Hazelton Harrogate UK HUK 7242-57WI30-A. CH-301-001. Unpublished

Robson, M. Sept. 1994. Determination of the stability of chlorfenvinphos hydrolysis and photolysis. Hazelton Europe Harrogate UK HE 5791130-C-1014. CH-320-001. Unpublished

Schroder, J. June 1984. Cattle tissue residue test: unpublished report, South African bureau of standards, Pretoria. Unpublished.

Schulz, H. Apr. 1992. Determination of the residues of chlorfenvinphos in cabbage. (FRG-0003) RCC Project 275398 CH-721-033. Unpublished.

Schulz, H. Apr. 1992. Determination of the residues of chlorfenvinphos in cabbage (red) (FRG-0006) RCC Project 275422. CH-721-032. Unpublished.

Schulz, H. Apr. 1992. Determination of the residues of chlorfenvinphos in cauliflower (FRG-0005) RCC Project 275411. CH-721-030. Unpublished.

Schulz, H. Apr. 1992. Determination of the residues of chlorfenvinphos in cabbage (white and red). (FRG-0001) RCC Project 275376. CH-721-035. Unpublished.

Schulz, H. Apr. 1992. Determination of the residues of chlorfenvinphos in cabbage (white and red) (FRG-0002) RCC Project 275387. CH-721-034. Unpublished

Schulz, H. May 1992. Determination of the residues of chlorfenvinphos in cauliflower (FRG-0010) RCC Project 275466. CH-721-031. Unpublished

Wable, U. Mar. 1993. Chlorfenvinphos degradation in water sediment systems. Fraunhofer Inst., Schmallberg, Germany. CH-630-004. Unpublished.