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

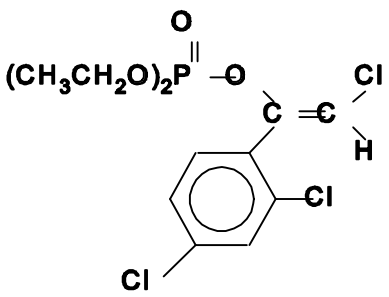
CA: 2-chloro-1-(2,4-dichlorophenyl)ethenyl diethyl phosphate

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

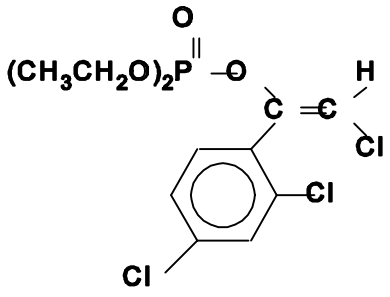
CIPAC No: 88

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

Structural formula:



Z-isomer



E-isomer

Ratio	8.4	1

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:	(*Z*)- isomer 0.37 x 10^{-3} Pa
	(*E*)- isomer 5.4 x 10^{-5} Pa

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

Auto-flammability: 542.6°C ± 1.1°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-â-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-â-D-glucopyranosidyl]uronic acid	47	4
2,4-dichlorohippuric acid	5	absent
2,4-dichloromandelic acid	8	5
2-chloro-l-(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-^{14}C]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*-^{14}C]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.

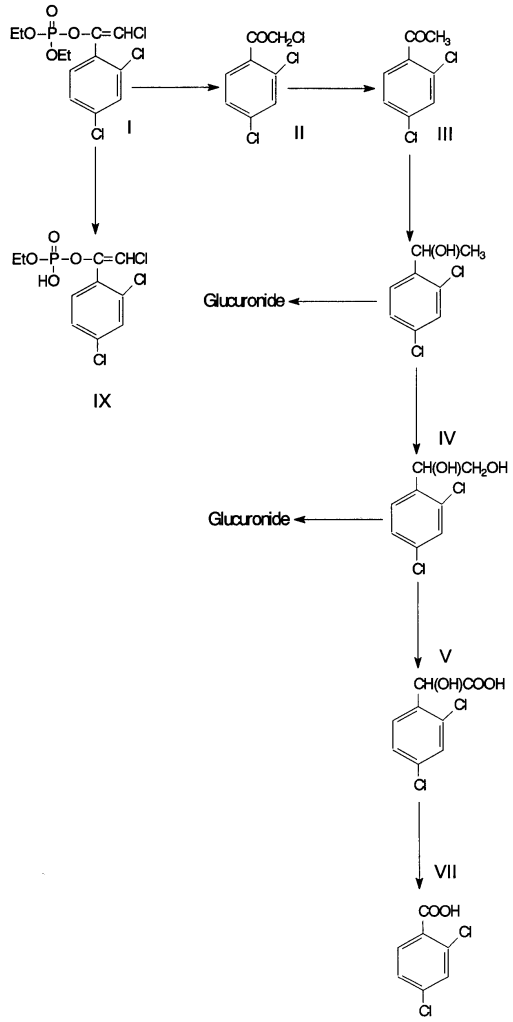
In a second investigation, two calves were similarly treated dermally with 2 litres of a spray emulsion, one at 0.25% and the other at 0.5% concentration. Both animals were killed 7 days after treatment and samples of renal and omental fat, heart, kidney, and muscle were taken for radiometric analysis. 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
0mental 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 ^{32}P-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 ^{32}P-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 [^{32}P]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) [^{14}C]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*-^{14}C]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*-^{14}C]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	0.02

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

Table 11. Residues of (*E*)-[*vinyl*-^{14}C]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 [^{14}C]chlorfenvinphos at approximately 0.7 mg/kg was 90-95%. Control plants showed ^{14}C 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 [^{14}C]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 ^{14}C 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.

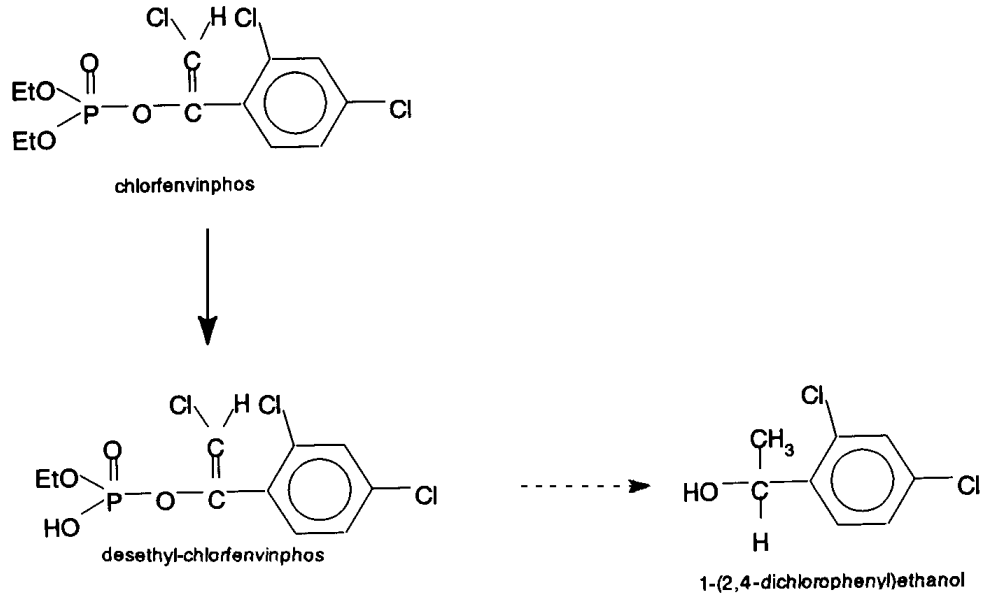
Table 12. Metabolites found after foliar treatment of glasshouse crops with [^{14}C]chlorfenvinphos.

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*-^{14}C]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*-^{14}C]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

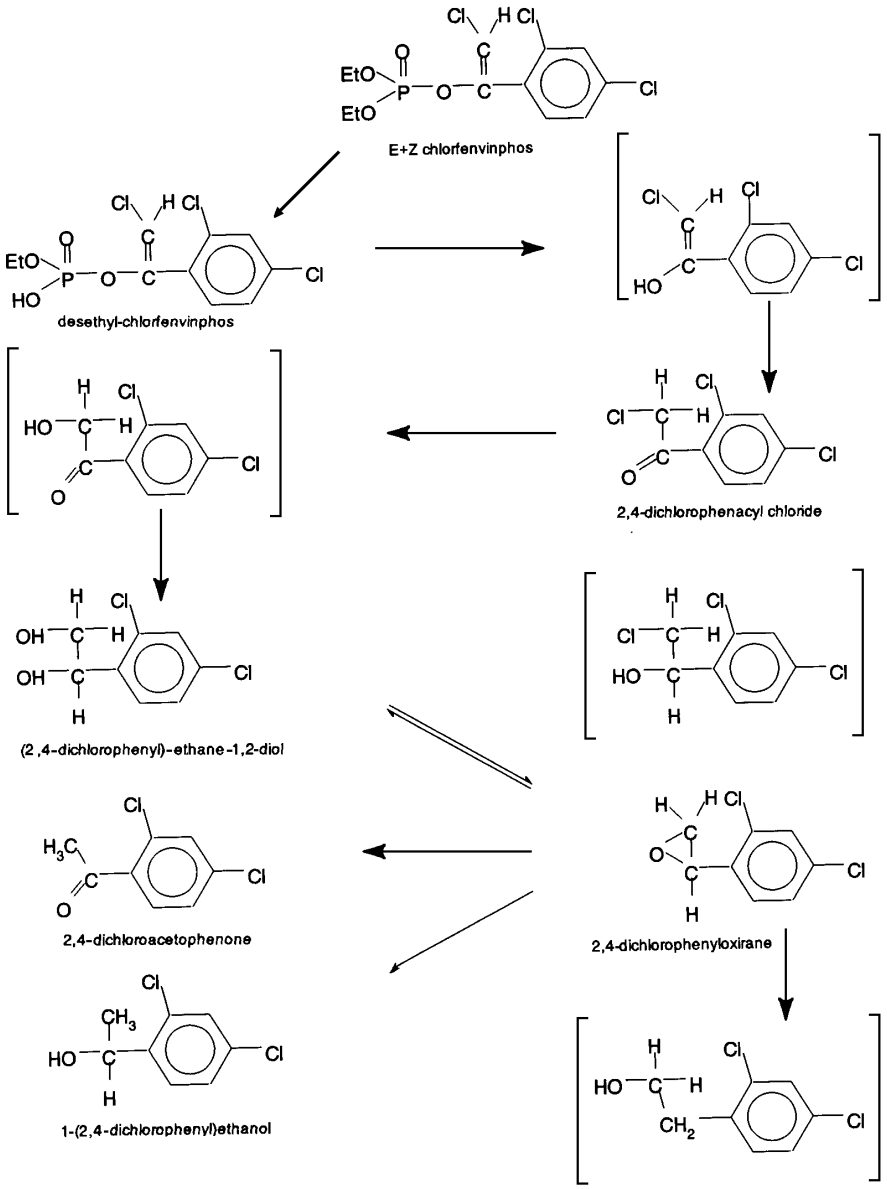
Extracts of the soils were examined for products of degradation by TLC with radio-analysis, with the results shown in Table 14. Radioactivity designated as unextractable was obtained by oxidation of the treated soil by “Van Slyke oxidation”.

Table 14. Residues of [^{14}C]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 $^{14}CO_2$ 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-dichoroacetophenone, 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, kg ai/hl	No.			
										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

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, kg ai/hl	No.			
	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	

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

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 4 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

Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc, kg ai/hl	No.			
	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

Commodity	Country	Form.	F or G	Application				PHI, days	Ref.	Remarks
				Method	Rate kg ai/ha	Spray conc, kg ai/hl	No.			
					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-dichoroacetophenone, 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.

Where residues of the (*E*)- and (*Z*)- isomers were originally reported separately their sum is given in the Tables. The limit of determination of the individual isomers reported in the studies was generally 0.01 mg/kg.

Leeks. GAP for leeks was reported for Germany and The Netherlands. The maximum application rates were 0.144 kg ai/ha at infestation and 6 kg ai/ha pre-sowing, with PHIs of 28 and 60 days respectively.

One trial was available from Germany. It was poorly reported and did not reflect the reported GAP.

Table 19. A supervised field trial on leeks in Germany (undated).[1]

Application				PHI, days	Portion analysed	Residues, mg/kg Parent Met	Ref.
Form.	No.	kg ai/ha	kg ai/hl				
GR	1	3	-	150	stem	ND ND	CH-601-001

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

Onions. GAP was reported for a number of countries. The maximum application rates were 1-13.5 kg ai/ha with PHIs between 7 and 60 days or as governed by pre-planting, pre-sowing or post-emergence treatments.

Residue trials on bulb onions were reported from Canada, France, Germany, Japan, Switzerland, Spain, the USA and the UK, as well as one trial on spring onions from The Netherlands. The application rates in four French trials with residues of <0.02 mg/kg were comparable with the granular application rates 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 (CH-722-007), with a PHI of 175 days, was comparable with the Belgian and Netherlands GAP for pre-planting spray treatment. The residues were <0.02 mg/kg after 175 days. A further five German trials with granules were considered to accord with pre-planting GAP in Belgium, Denmark, Germany and The Netherlands. All showed residues 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 residues of the parent reported were at the higher application rates of 4.8 kg ai/ha in a German spray trial (0.04 mg/kg, 60-day PHI) and 4.48 kg ai/ha in a UK trial (0.07 mg/kg, PHI 61 days) which was poorly reported with no detailed study report. These PHIs imply that the crops were immature and hence that the trials were not comparable with any reported GAP.

Table 20. Supervised field trials on bulb and spring onions. Bulbs analysed.

Location, Country, year	Application				PHI, days	Residues, mg/kg Parent Met	Reference
	Form	No.	kg ai/ha	kg ai/hl			
Bulb onions							
Guelph Canada 1969[1]	GR	1	1.1	-	154	<0.02 ----- <0.02 ----- <0.02 ----- <0.02 ----- <0.02 ----- <0.02 ----- <0.02 ----- <0.02 -----	CH-722 -002

Location, Country, year	Application				PHI, days	Residues, mg/kg Parent	Met	Reference
	Form	No.	kg ai/ha	kg ai/hl				
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	<0.02	<0.02a	
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	<0.02	<0.02b	
Freising Germany 1973[1]	GR	1	5	-	49	0.72	-----	CH-722 -009
					77	<0.02	-----	
					147	<0.02	<0.02b	
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 Parent	Met	Reference
	Form	No.	kg ai/ha	kg ai/hl				
					114	≤0.02b	-----	
Bonn Bad Godesberg Germany[1]	GR	1	5.0	-	35	<0.02	-----	CH-722-013
					69	<0.02	-----	
					83	≤0.02b	-----	
Bad Segeberg Germany[1]	GR	1	5.0	-	55	<0.02	-----	CH-722-013
					69	<0.02	-----	
					83	≤0.02b	-----	
Germany 1965[1]	GR	1	3	-	120	<0.02	-----	CH-722-001
Chuo Japan 1972[1]	EC	5	0.32	0.032	8	≤0.02	<0.02c	CH-722-005
					8	≤0.02	<0.02c	
					14	<0.02	<0.02	
					14	≤0.02	<0.02c	
	EC	9	0.32	0.032	8	≤0.02	<0.02c	
					8	≤0.02	<0.02c	
					14	≤0.02	<0.02c	
					14	≤0.02	<0.02c	
Kimitami Japan 1972[1]	EC	6	0.32	0.032	7	≤0.02	<0.02c	CH-722-005
					7	≤0.02	<0.02c	
					14	≤0.02	<0.02c	
					14	≤0.02	<0.02c	
	EC	9	0.32	0.032	7	≤0.02	<0.02c	
					7	≤0.02	<0.02c	
					14	≤0.02	<0.02c	
					14	≤0.02	<0.02c	
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 Netherlands 1982[3]	GR	1	6	-	90	0.01 ----- 0.01 ----- 0.04 ----- 0.03 ----- 0.04 -----	J. W. Dornseiffen 1985

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/m^2 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 Parent Met	Ref.
	Form.	No.	kg ai/ha	kg ai/hl			
Wellesbourne UK 1965[1]	EC	1	0.84	-	0 4 10 20	4.2 ----- 2.89 ----- 0.29 ----- <0.02 -----	CH-640-002
Unknown UK undated[1]	GR GR	1 1	4.48 8.96	- -	112 112	<0.05 ---- <0.05 ----	CH-601-001
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 74 94	0.2 ----- 0.05 ----- <u><u>≤0.02a</u></u> -----	CH-721 -014
Bamberg Germany 1980[2]	GR	1	0.1kg/m^2	-	70 84 98	0.3 ----- 0.10 ----- <u><u>≤0.02a</u></u> -----	CH-721 -014
Frankfurt Germany 1980[2]	GR	1	0.1kg/m^2	-	70 84 98	0.4 ----- 0.2 ----- <u><u>≤0.02a</u></u> -----	CH-721 -014
Frankfurt Germany 1989[2]	GR GR	1 1	100g/m^2 2g/100 plants	- -	144 180 190 144	<0.02 ----- <0.02 ----- <u><u>≤0.02a</u></u> ----- <0.02 -----	CH-721 -018

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

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

Results underlined once or twice are considered comparable with

a - German GAP for pre-planting soil treatments at 100 g/m^2

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/m^2

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

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

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

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

Results underlined once or twice are considered comparable with
a - the German 0.1 kg ai/m^2 soil treatment
b - the German 0.1 g/plant granular nursery bed treatment
c - a combination of the German 0.1 kg ai/m^2 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+ 0.14	- -	0 7 14 28	<0.02 <0.02 <0.02 <0.02	CH-721 -022
Geisenheim Germany 1980[1]	GR	1	4 g/200 plants	-	49 77 84 91	0.10 <0.02 <0.02 <u><0.02</u>a	CH-721 -023
	GR	1	0.1 g/ plant	-	49 77 84 91	0.5 <0.02 <0.02 <u><0.02</u>b	
	GR	1	2	-	49 77 84 91	0.1 <0.02 <0.02 <u><0.02</u>c	
Bamberg Germany 1980[1]	GR	1	4 g/200 plants	-	70 77 84	<0.02 <0.02 <u><0.02</u> a	CH-721 -023
	GR	1	0.1 g/ plant	-	70 77 84	<0.02 <0.02 <u><0.02</u>b	
	GR	1	2	-	70	<0.02	

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 77 84 91	0.3 <0.02 <0.02 <u>≤0.02a</u>	CH-721 -023
	GR	1	0.1 g/ plant	-	49 77 84 91	1.9 0.02 <0.02 <u>≤0.02b</u>	
	GR	1	2	-	49 77 84 91	0.4 <0.02 <0.02 <u>≤0.02c</u>	
Bad Segeberg Germany 1981[1]	EC	1+ 2	4.9 + 0.17	-	0 7 14 21	1.0 0.1 0.05 0.07	CH-721 -024
Vorwohl Germany 1981[1]	EC	1+2	4.9 + 0.17	-	0 7 14 21	0.80 0.10 0.06 <0.02	CH-721 -024
Frankfurt Germany 1989[1]	EC	2	0.144	0.019	0 14 21 28	<0.02 <0.02 <0.02 <0.02	CH-721 -025
	EC	1	4.8	1.2	119 126 140	<0.02 <0.02 <u>≤0.02d</u>	
Bonn Germany 1989[1]	EC	1	4.8	1.2	91 98 112	<0.02 <0.02 <u>≤0.02</u>d	CH-721 -025
USA undated[2]	GR	1.1 2	1.12	-	20 48	<0.05 <0.05	CH-601-001
USA undated[2]	GR + EC	1+ 3	1.12+ 1.12	- -	 20 48	 1.3 <0.05	CH-601-001
Nasik India 1972[1]	EC EC	3 3	0.25 0.50	- -	7 7	0.1 0.2	CH-721 -019
Wellesbourne UK 1964[1,3]	WP WP EC EC	1 1 1 1	root dip root dip root dip root dip	0.05 0.05 0.1 0.1	88 88 88 88	<0.05 <0.05 <0.05 <0.05	CH-724 -065
Bonn Germany 1990[4]	EC	2	0.144	0.024	0 14 21 28	0.55 0.16 0.06 <0.02	CH-721 -030

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><0.02</u>d	CH-721 -031
Bonn Germany 1990[4]	EC	1	4.8	0.48	129 136 150	<0.02 <0.02 <u><0.02</u>d	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

<u>Mushrooms</u>. 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

<u>Kale</u>. 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 Parent	Met	Ref.
	Form	No.	kg ai/ha				
Lübeck 1973	EC	1	4.8	56 63 140	<0.02 <0.02 <u><0.02</u>a	----- ----- <u><0.02</u>	CH-726 -001
Kiel	EC	1	4.8	0	1.58	-----	CH-726