

FOLPET (41)

EXPLANATION

Folpet was first evaluated in 1969 and has been reviewed several times since, most recently in 1998 for residues in the CCPR Periodic Review Programme. The 1998 JMPR did not receive information on the environmental fate of folpet in soil or in water/sediment systems and (1) agreed that its estimates of maximum residue levels should not be recommended for use as MRLs until these critical supporting studies could be evaluated, and (2) recommended withdrawal of existing CXLs and draft MRLs. The 1998 JMPR was informed at a late stage that studies were available on aerobic and anaerobic degradation and photolysis in soil, field dissipation, adsorption and desorption, soil mobility, leaching of aged residues and aqueous photolysis. Details of the studies were provided to the present Meeting.

Updated information on GAP and new labels have also been provided.

METABOLISM AND ENVIRONMENTAL FATE

Plant metabolism

The Meeting received information on the metabolism of folpet in potatoes to supplement previously evaluated metabolism studies on tomatoes, winter wheat, grapes and avocados.

Crowe *et al.* (1999) applied [U-*phenyl*-¹⁴C]folpet 5 times to potato plants (Maris Piper variety) in pots at the equivalent of 1.86-1.95 kg/ha at 77, 57, 37, 17 and 7 days before harvest. Plant samples were taken 2-4 hours after the first, third and fifth treatments, 3 days before harvest and at harvest.

The potato foliage was washed with acidified acetonitrile, and subsequently homogenized and extracted. Tubers were treated similarly, but the washings were considered to include residues in the soil rather than on the tubers. Levels of ¹⁴C expressed as folpet were in the range 57-110 mg/kg in the foliage (washings + homogenates) and 0.56-1.1 mg/kg in the tuber homogenates, except in the samples taken after the first treatment in which no residue was detected.

Almost all (90-98%) of the ¹⁴C associated with the foliage was washed off the surface by the acetonitrile, and the residues in the washings were almost exclusively folpet. Most of the remaining ¹⁴C in the foliage was extractable. In the tubers, 86-93% of the ¹⁴C was extractable with acetonitrile, and phthalic and phthalamic acids accounted for most of the residue (Table 1); folpet itself constituted only about 0.1%. Conjugated and bound metabolites (about 10% at harvest) were released by hydrolysis and EDTA treatment. Natural incorporation into proteins and sugars accounted for 1.3% of the ¹⁴C in the tubers at harvest.

The Meeting concluded that the metabolism of folpet in potatoes was similar to that in other plants and that folpet itself was not translocated to the tubers.

Table 1. Compounds identified in tubers from potato plants treated with 5 applications of [U-*phenyl*-¹⁴C]folpet at 1.86-1.95 kg ai/ha (Crowe *et al.*, 1999).

Compound or fraction	¹⁴ C expressed as folpet, mg/kg			
	37 days before harvest	7 days before harvest	3 days before harvest	At harvest
Folpet	-	0.001	0.001	0.001
Phthalimide	-	0.005	0.003	0.005
Phthalamic acid	0.14	0.28	0.20	0.27
Phthalic acid	0.28	0.37	0.33	0.60
Acid conjugates	-	0.059	-	0.038
Total ¹⁴ C (by combustion)	0.56	0.86	0.71	1.1

Environmental fate in soil

The Meeting received information on aerobic and anaerobic degradation, leaching characteristics of the aged residue, adsorption and desorption, field dissipation and microbiological mineralization.

Daly (1991a) incubated [U-*phenyl*-¹⁴C]folpet at 11.9 µg/g in a microbiologically active sandy loam soil (pH 5.4, 2.0% organic matter, 17% clay) under aerobic conditions at 25°C in the dark for 12 months. The soil moisture level was maintained at 75-80% of field capacity. The recovery of the ¹⁴C was 92.5%. Unextractable ¹⁴C peaked at 9.2% of the dose on day 15 and decreased to 5.0% after 12 months. A preliminary 14-day study had shown that the half-life of folpet was 8 days.

The fate of folpet during the 12-months aerobic incubation is indicated in Table 2. The depletion of folpet was biphasic, with an estimated half-life of 4.3 days during the first 14 days, but a half-life of 167 days calculated during 14-365 days. Phthalimide, the main degradation product apart from CO₂, accumulated for the first few days, accounting for 65% of the dose on day 5, and then decreased to similar levels to those of folpet after 14 days. Phthalic acid was a minor product, constituting less than 6% of the applied dose and 20-30% of the identified residue after about 2 months. Half of the folpet was converted to CO₂ in the first month, demonstrating mineralization of the benzene ring, but the subsequent rate of formation was much slower.

Table 2. Degradation of folpet during aerobic incubation of [U-*phenyl*-¹⁴C]folpet with soil for one year (Daly, 1991a).

Days	¹⁴ C, % of dose, as			
	Folpet	Phthalimide	Phthalic acid	Evolved CO ₂
0	87	7.7	3.6	0
1	79.6	17.6	2.6	0
2	67.5	31.1	3.1	0
3	35.5	49.4	3	0.3
4	22.3	57.2	3.7	0.5
5	20.9	64.9	5.7	2.4
7	16.2	58.3	2.4	5.7
14	10.1	10.1	1.4	36
31	6.8	6.2	2.4	49
61	4.9	4.1	2.6	56
92	4.1	3.6	2.2	60
122	3.4	2.4	2	63
184	2.9	2.1	1.8	65
273	2.1	1.6	1.4	68
365	2	1.3	1.4	70

Pack (1976) incubated [*carbonyl*-¹⁴C]folpet at 6 µg/g in a sandy loam soil (pH 6.8, 1.8% organic matter, 16% clay) under aerobic conditions at laboratory temperatures for 1 year. About 50%, 90% and 98% of the dose was liberated as ¹⁴CO₂ after 6, 25 and 365 days. Less than 10% of the applied folpet remained intact after 7 days.

Levels of the radioactive compounds identified and assayed by TLC are shown in Table 3. The three identified products reached their highest levels, less than 2% of the applied ¹⁴C, by day 7 and then decreased. The unextractable residues amounted to no more than a few per cent of the dose at any time. *N*-hydroxyphthalimide, 3-hydroxyphthalimide and 4-hydroxyphthalimide were sought but not detected (<0.01 mg/kg).

Table 3. Degradation of folpet during the incubation of [*carbonyl*-¹⁴C]folpet with a sandy loam soil under aerobic conditions (Pack, 1976).

Days	¹⁴ C, % of dose, as			
	Folpet	Phthalimide	Phthalic acid	Phthalamic acid
0	97	1.40		
7	9.9	1.98	1.76	1.09
14	1.6	0.32	0.08	0.11
34	1.35	0.52	0.13	0.16
59	0.40	0.15		0.05
118	0.41	0.18		
181	0.30	0.13		
240	0.32	0.10		
365	0.28	0.06		

Daly (1991b) incubated [*U-phenyl*-¹⁴C]folpet at 9.8 µg/g in a microbiologically active sandy loam soil (pH 5.4, 2.0% organic matter, 17% clay) under aerobic conditions at 25°C in the dark for 4 days, after which the soil was flooded and the system purged with nitrogen to remove oxygen and incubation was then continued anaerobically for 60 days. The recovery of the ¹⁴C was 98.9%. The results are shown in Table 4. Unextractable residues did not exceed 3.3% of the dose. A high proportion of the phthalimide and phthalic acid was present in the water rather than on the soil.

After the aerobic incubation phthalimide was the main component of the residue and remained so throughout the anaerobic phase. The estimated half-life of folpet during the anaerobic phase was 15 days. The rate of mineralization was slower than in the aerobic incubation. Phthalimide and phthalic acid were quite persistent under anaerobic conditions. Phthalamic acid was not detected.

Table 4. Degradation of folpet during anaerobic incubation of [*U-phenyl*-¹⁴C]folpet with soil for 60 days, after preliminary aerobic ageing for 4 days (Daly, 1991b).

Days	¹⁴ C, % of dose, as			
	Folpet	Phthalimide	Phthalic acid	Evolved CO ₂
AEROBIC				
0	88.0	8.7	0	0
1	77.2	19.1	0	0
2	63.8	27.7	3.8	0.11
3	41.6	41.7	5.4	1.8
4	28.1	46.4	4.9	6.1
ANAEROBIC				
0	27.6	50.6	5.0	6.2
3	20.4	47.5	6.4	6.5
15	11.0	50.2	3.8	14.4
30	7.6	46.4	9.2	21.6
45	5.1	46.0	5.6	25.1
60	3.6	36.3	13.3	26.4

Days	Residues, mg/kg, at depths of									
	0-15 cm		15-30 cm		30-45 cm		45-60 cm		60-90 cm	
	Folpet	Phthalimide	Folpet	Phthalimide	Folpet	Phthalimide	Folpet	Phthalimide	Folpet	Phthalimide
120	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr
SEMINOLE COUNTY										
Application 1										
0	0.25	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr
Application 2										
0	0.30	0.05	0.25	ndr	0.05	ndr	ndr	ndr	ndr	ndr
Application 3										
0	0.16	ndr	0.23	0.05	0.10	ndr	ndr	ndr	ndr	ndr
1	0.13	ndr	0.07	ndr	0.20	ndr	ndr	ndr	ndr	ndr
3	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr
7	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr
14	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr
21	ndr	ndr	0.05	ndr	ndr	ndr	ndr	ndr	ndr	ndr
28	ndr	ndr	0.12	ndr	ndr	ndr	ndr	ndr	ndr	ndr
60	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr
120	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr	ndr

ndr: no detected residues (<0.05 mg/kg)

Ver Hey (1988) measured the adsorption and desorption of [U-*phenyl*-¹⁴C]folpet on four soils. Soil (1 g) was mixed with 5 ml of a solution of folpet (0.04, 0.1, 0.2 or 1 µg/ml) in 0.01 M calcium chloride and shaken for 24 hours at 25°C in the dark. ¹⁴C levels were measured in the clear aqueous layer separated by centrifuging. To measure desorption the residual soil was mixed with 5 ml of 0.01 M calcium chloride and shaken for 24 hours at 25°C in the dark, and ¹⁴C levels were again determined in the aqueous phase. The organic carbon content of the soil was taken as 1/1.7 x (% organic matter) in calculating K_{oc}. K_{oc} = 100 × K_d/(% organic carbon). The soil characteristics and adsorption and desorption constants are shown in Table 7. Folpet was strongly adsorbed to the soils and was not readily desorbed.

It is quite likely that much of the folpet had been hydrolysed to phthalimide and phthalic acid during the 24 hours in solution, so the calculated K_d and K_{oc} do not necessarily apply to folpet itself but to the mixture of folpet and its hydrolysis products.

Table 7. Soil characteristics and adsorption-desorption properties for [U-*phenyl*-¹⁴C]folpet on four soils (Ver Hey, 1988).

Soil	% organic matter	CEC meq/100 g	pH	% sand	% silt	% clay	adsorption		desorption	
							K _d	K _{oc}	K _d	K _{oc}
Loamy sand	3.0%	2.6	5.1	86%	10%	4%	0.22	12	0.11	6.3
Sandy loam	2.9%	2.9	5.3	68%	18%	14%	0.13	7.4	0.042	2.5
Loam	1.3%	8.7	6.9	52%	29%	19%	0.17	22	0.042	5.5
Silt loam	1.4%	11.2	8.0	16%	65%	19%	0.17	21	0.066	8.0

Pack (1977) rated folpet as very slightly mobile after TLC on 5 soils (a silty clay loam, a clay loam, an adobe clay, a sandy loam and a clay loam). From the data he calculated the corresponding K_d values, which ranged from 6 to 67 (Pack, 1987). However, the measured R_f values were small and the report did not state whether the system was checked for overloading with folpet. If the amount of folpet exceeded its solubility in the aqueous phase much would remain at the origin, and the relationship between the measured R_f and K_d:

$$K_d = \frac{\frac{1}{R_f} - 1}{d_s - 1}$$

when d_s is the density of the soil (= 2.5) would be invalid.

Rhoads (1991b) examined the leaching of aged residues of [U-*phenyl*- ^{14}C]folpet (30 days aerobic incubation of 10 mg/kg at 25°C) in a sandy loam (68% sand, 18% silt, 14% clay, 2.9% organic matter, pH 5.3). At the end of the 30 days about 40% of the ^{14}C had been lost as CO_2 . After the aerobic incubation, 10 g portions of treated soil were applied to untreated soil columns and followed by an overlay of untreated soil. During 45 days leaching the columns of soil were treated 3 times a week with 0.02 N calcium chloride solution equivalent to 12.5 mm rain and twice a week with 25 mm. At the end of the 45 days the columns were sectioned in 25 mm lengths and assayed for ^{14}C .

Less than 0.06% of the applied ^{14}C was found in the leachate in the first 10 days of leaching and essentially none thereafter. Most of the residue remained in the top soil segment (Table 8), showing low mobility of folpet and its degradation products in this soil.

Table 8. Vertical distribution of ^{14}C in soil columns after 45 days leaching of aerobically aged [U-*phenyl*- ^{14}C]folpet (Rhoads, 1991b).

	Soil segment, mm depth											
	0-25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	200-225	225-250	250-275	275-300
^{14}C , % of applied	64	11	1.5	0.20	0.20	0.36	0.12	0.06	0.49	0.08	0.07	0.12

Jenkins (1994) showed that 27.5 mg technical folpet/l (10 mg carbon/l) did not significantly inhibit bacterial degradation of the reference material sodium benzoate in a 5-day test and therefore folpet could be tested for bacterial degradation in a modified Sturm Test. However, the pH of the test mixtures was in the range 7.2-7.7, so folpet would be converted abiotically in hours to phthalimide and further to phthalic acid, and so would not be present to exert any biological effect. The report suggests that folpet was not significantly degraded under the conditions of the test, but the suggestion is based on lack of oxygen consumption by the biological system and has not taken into account possible abiotic hydrolysis.

The production of CO_2 from technical folpet and sodium benzoate by the bacterial inoculum at the same carbon concentration was compared in parallel tests for 29 days. The degradation of folpet was slow but progressive, with about 12% of theoretically available carbon released as CO_2 after 7 days and 41% after 29 days; folpet may be classed as inherently degradable. Sodium benzoate, classed as readily degradable, released 70% and 97% of its carbon as CO_2 after 7 and 29 days respectively.

Jenkins *et al.* (1998) tested the biodegradability of [U-*phenyl*- ^{14}C]folpet in a modified Sturm Test. The ring carbons were labelled as they were the most stable part of the molecule and production of $^{14}\text{CO}_2$ would indicate mineralization of the folpet. The reaction medium was three litres of aqueous mineral salts solution inoculated with activated sewage sludge and containing 3 mg folpet. The pH of the test and control mixtures was 7.5-7.8. The evolved $^{14}\text{CO}_2$ was monitored for 28 days with the reaction mixture held at 20-24°C.

At the pH of the test mixture folpet would have been converted abiotically to phthalimide and further to phthalic acid within hours. The test should then parallel a test on phthalic acid.

Degradation was quite rapid from 4 to 14 days, with the evolved $^{14}\text{CO}_2$ increasing from about 10% to 60% of the dose, with slower degradation after 19 days. Some 16-18% of the ^{14}C had been incorporated into sewage solids by day 28.

Table 9. Degradation of [U-phenyl- ^{14}C]folpet and the reference sodium benzoate in a modified Sturm test (Jenkins *et al.*, 1998).

Incubation time, days	Sodium benzoate, % degradation	Folpet, cumulative % of applied ^{14}C evolved as $^{14}\text{CO}_2$ - duplicate runs	
1	2	0.077	0.12
2	22	0.40	0.53
4	44	11.6	13.7
6	62	30	33
9	75	49	51
12	82	58	60
14	84	62	63
19	86	67	68
22	88	69	71
26	90	71	73
28	91	72	74

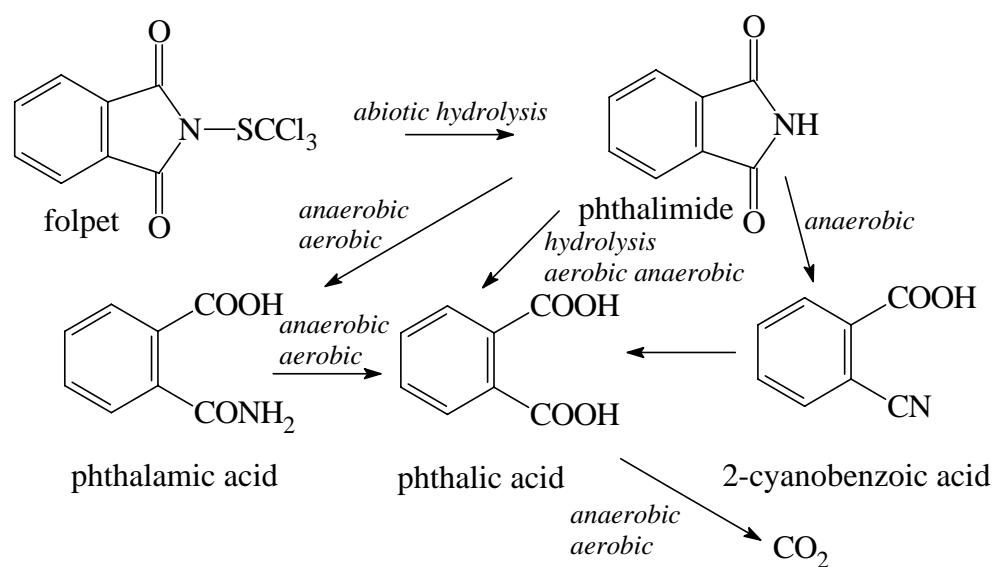


Figure 1. Degradation of folpet in soil.

Environmental fate in water/sediment systems

The Meeting received reports of the aqueous hydrolysis and photolysis of folpet, and a summary report of a recently completed study of the fate of folpet in a water/sediment system.

Ruzo and Ewing (1988) incubated [carbonyl- ^{14}C]folpet at approximately 1 mg/l in sterile aqueous buffered solutions (ionic strength 0.01) at 25°C in the dark. The folpet was dissolved in

acetonitrile and added to the buffers, 1 ml to 150 ml. The hydrolysis half-lives were 2.6 hours at pH 5, 1.1 hours at pH 7 and 67 seconds at pH 9. The solubility of folpet in water was quoted from previous work as 1.25 mg/l at 25°C. One product was described as 'phthalimic acid', but appeared to be phthalamic acid.

Table 10. Hydrolysis of folpet at pH 5, 7 and 9 (Ruzo and Ewing, 1988).

pH	Time	% of ¹⁴ C due to			
		folpet	phthalimide	phthalamic acid	phthalic acid
5	24 hours	0.5	91	0.6	8.5
7	8 hours	3.0	44	2.5	46
9	10 minutes	0.25	15	0.7	78

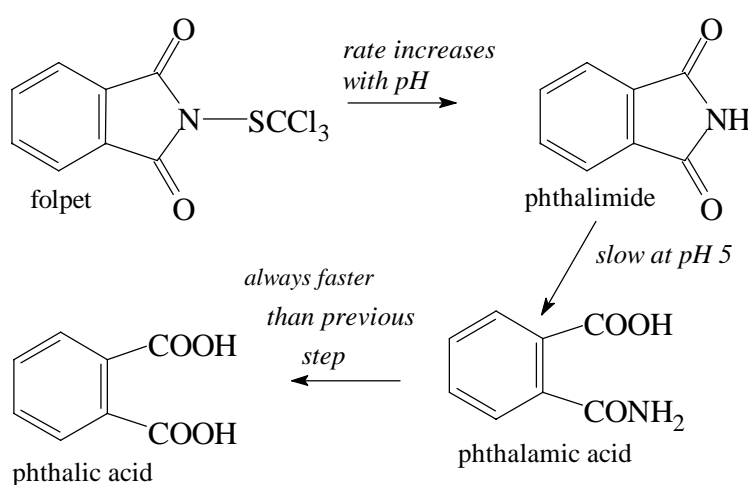


Figure 2. Folpet products of hydrolysis (Ruzo and Ewing, 1988).

Concha and Ruzo (1992) hydrolysed [*trichloromethyl*-¹⁴C]folpet at approximately 1 mg/l in sterile aqueous buffered solutions at 25°C in the dark. At pH 5 47% and 15% of the ¹⁴C remained as folpet after 1 and 24 hours, and at pH 7 52% after 1 hour and 1.1% after 24 hours. No folpet remained after 1 hour at pH 9. The products of decomposition apart from CO₂ were not definitely identified, but probably included trichloromethanethiol (at pH 7) and COS.

Ruzo (1989) exposed [*carbonyl*-¹⁴C]folpet at about 1 mg/l in aqueous pH 3 buffer to natural sunlight and ultraviolet light (maximum intensity at 350 nm) for 8 hours at 25°C. The rates of breakdown and the products were the same for samples kept in the dark and those exposed to UV light, indicating that hydrolysis is a more important mechanism of breakdown than photolysis.

Crowe (1999) provided a brief summary report of a study of the fate of [*U-phenyl*-¹⁴C]folpet in two water/sediment systems, one with a silty clay sediment (pH 6.8, 4.4% organic C) and the other with a sandy loam sediment (pH 5.9, 1.2% organic C). The nominal folpet dose was equivalent to 1.6 kg/ha. The systems were incubated in the dark. Folpet was converted to CO₂, phthalimide, phthalamic acid, phthalic acid, polar material and several unidentified compounds. Folpet itself disappeared very quickly.

USE PATTERN

Folpet is a broad spectrum, non-systemic fungicide used on both food and non-food crops. The major uses are against diseases of grapes, pome and stone fruit and vegetables. The Meeting was provided with updated information on registered uses of folpet and labels from many countries. Table 11 summarizes the new information and also includes much of the information on GAP provided to the 1998 JMPR.

Table 11. Registered uses of folpet.

Crop	Country	Form	Application				PHI, days
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No.	
Apples	Argentina	WP	foliar		0.12		15
Apples	Canada	WP	foliar		0.075-0.10		1
Apples	Chile	WP	foliar	1.5-2.0	0.09-0.11		7
Apples	France	WP	foliar		0.1		
Apples	Hungary	WP	foliar	1.5			10
Apples	Mexico	WP	foliar		0.10-0.13		7
Apples	Portugal	WP	foliar		0.13		21
Apples	Spain	WP	foliar		0.13-0.15		10
Apples	Switzerland	WG	foliar		0.08		21
Avocado	Mexico	WP	foliar		0.10-0.12		30
Celery	Honduras	WP	foliar	0.64			3
Celery	Mexico	WP	foliar	1.0-2.0			7
Citrus fruits	Mexico	WP	foliar		0.10-0.12		7
Cranberries	Canada	WP	foliar	5.0	0.25		30
Cucumbers	Argentina	WP	foliar		0.12		7
Cucumbers	Canada	WP	foliar	1.0-2.0	0.10-0.20		7
Cucumbers	Cyprus	WP	foliar	1.0	0.1		2
Cucumbers	Hungary	WP	foliar		0.10-0.13		14
Cucumbers	Israel	WP	foliar	2.0			7
Cucumbers	Mexico	WP	foliar	1.2-1.7			3
Garlic	Mexico	WP	foliar	1.0-1.4			7
Grapes	Canada	WP	foliar		0.10		1
Grapes	Chile	WP	foliar	1.5-2.0	0.10-0.15		14
Grapes	France	WP	foliar		0.15		
Grapes	France ¹	SC	foliar	1.0-1.5			21, 30
Grapes	France ¹	WG	foliar	1.0-1.5			21, 28
Grapes	France ¹	WP	foliar	1.0-1.8			28
Grapes	Mexico	WP	foliar	1.0-1.2			10
Grapes	Spain	WP	foliar		0.15-0.20		21
Grapes, table	Argentina	WP	foliar		0.10-0.13		7
Grapes, table	Italy	WG	foliar		0.16		10
Grapes, wine	Argentina	WP	foliar		0.10-0.13		20
Grapes, wine	Germany ²	WP	foliar		0.06	3	35
Grapes, wine	Italy	WG	foliar		0.16		40
Lettuce	Greece	SC	foliar		0.13-0.16		
Lettuce	Hungary	WP	foliar		0.10-0.13		14
Lettuce	Mexico	WP	foliar	1.2			7
Lettuce	Portugal	WP	foliar		0.10-0.13		14
Lettuce	Spain	WP	foliar		0.13-0.15		21
Melons	Argentina	WP	foliar		0.12		7
Melons	Canada	WP	foliar	2.0-4.0	0.10-0.20		1
Melons	Costa Rica	WP	foliar	0.10-0.13	0.10-0.13		7
Melons	El Salvador	WP	foliar	0.10-0.13	0.10-0.13		7
Melons	Greece	SC	foliar		0.13-0.16		20
Melons	Guatemala	WP	foliar	0.38			3
Melons	Honduras	WP	foliar	0.64	0.16		3

Crop	Country	Form	Application				PHI, days
			Method	Rate, kg ai/ha	Spray conc. kg ai/hl	No.	
Melons	Mexico	WP	foliar	1.2-1.7			7
Onions	Argentina	WP	foliar		0.12-0.13		7
Onions	Chile	WP	foliar	1.5-2.0	0.10-0.13		7
Onions	Costa Rica	WP	foliar	0.10-0.13	0.10-0.13		7
Onions	El Salvador	WP	foliar	0.10-0.13	0.10-0.13		7
Onions	Greece	SC	foliar		0.13-0.16		20
Onions	Honduras	WP	foliar	0.64			3
Onions	Hungary	WP	foliar		0.10-0.13		14
Onions	Mexico	WP	foliar	1.2-1.4			7
Onions	Portugal	WP	foliar		0.10-0.13		7
Potato	Argentina	WP	foliar		0.12-0.18		7
Potato	Chile	WP	foliar	1.0-1.7	0.10-0.15		7
Potato	Israel	WP	foliar	2.0			7
Potato	Mexico	WP	foliar	1.7-1.9			30
Potato	Poland	WG	foliar				23
Potato	Spain	WP	foliar		0.13-0.15		10
Potato	Ukraine	WG	foliar	1.5			20
Strawberries	Argentina	WP	foliar		0.13		7
Strawberries	Canada	WP	foliar	2.0	0.10		1
Strawberries	Chile	WP	foliar	1.5-2.0	0.10-0.15		7
Strawberries	Costa Rica	WP	foliar	0.10	0.10		7
Strawberries	El Salvador	WP	foliar	0.10	0.10		7
Strawberries	Honduras	WP	foliar	0.10	0.10		3
Strawberries	Mexico	WP	foliar	0.72-1.2			2
Strawberries	Netherlands	WP	field		0.13		4
Strawberries	Netherlands	WP	glasshouse		0.13		14
Strawberries	Spain	WP	foliar		0.13-0.15		21
Summer squash	Mexico	WP	foliar	1.2-1.7			3
Tomato	Argentina	WP	foliar		0.13-0.14		7
Tomato	Canada	WP	foliar	4.0	0.20		1
Tomato	Chile	WP	foliar	1.0-1.9	0.10-0.15		7
Tomato	Costa Rica	WP	foliar	0.13	0.13		7
Tomato	El Salvador	WP	foliar	0.13	0.13		7
Tomato	Honduras	WP	foliar	0.13	0.13		3
Tomato	Hungary	WP	foliar		0.10-0.13		14
Tomato	Mexico	WP	foliar	1.4-1.9			2
Tomato	Portugal	WP	foliar		0.13		7
Tomato	Spain	WP	foliar		0.13-0.15		10
Watermelon	Honduras	WP	foliar	0.64			3
Watermelon	Mexico	WP	foliar	1.2-1.7			no limit

¹ In some formulations, folpet is mixed with another fungicide which may influence the PHI.

² Combination product, 40% folpet + 5% metalaxyl

RESIDUES RESULTING FROM SUPERVISED TRIALS

Residue trials reviewed in 1998 (and in a few cases in 1993) have now been re-evaluated in the light of the new information now provided on GAP, and the trials that comply with current GAP are listed in Table 12.

Table 12. Interpretation table for folpet residues in apples, grapes, strawberries, onions, cucumbers, melons, tomatoes, lettuce and potatoes from trials in Tables 13-20 of the 1998 evaluation and Tables 4-7 of the 1993 evaluation. GAP and trial conditions are compared for treatments considered valid for estimation of maximum residue levels and STMRs.

Crop	Country	Use pattern				Trial	Folpet, mg/kg
		kg ai/ha	kg ai/hl	No of appl.	PHI days		
APPLE							
Apple	Argentina GAP		0.12		15		
Apple	Argentina trial	3.6	0.12	3	10	AA950314.07	1.4
Apple	Argentina trial	3.6	0.12	3	10	AA950314.08	2.6
Apple	Chile GAP	2.0	0.11		7		
Apple	Chile trial	2.0	0.11	3	7	AA950314.05	2.0
Apple	Chile trial	2.0	0.11	3	7	AA950314.06	3.7
Apple	Hungary GAP	1.5			10		
Apple	Hungary trial	1.6	0.10	8	10	MAK374-01	8.0
Apple	Portugal GAP		0.13		21		
Apple	¹ Portugal trial	1.3	0.13	10	21	FP/25/91	1.8
Apple	Portugal trial	1.6	0.13	8	21	MAK/374-05	3.2
Apple	Spain GAP		0.15		10		
Apple	Spain trial	1.9	0.16	6	10	MAK/374-04	3.1
Apple	Switzerland GAP		0.08		21		
Apple	Switzerland trial	2.0	0.10	4	21	MAK/374-03	3.4
GRAPES							
Grapes	Argentina GAP		0.13		7		
Grapes	Argentina trial	1.0	0.13	4	7	AA950313.07	1.6
Grapes	Chile GAP	2.0	0.15		14		
Grapes	Chile trial	2.0	0.15	3	14	AA950313.06	2.6
Grapes	Chile trial	2.0	0.15	3	14	AA950313.08	3.0
Grapes	France GAP	1.5			21		
Grapes	France trial	1.5		8	27	R7194	1.9
Grapes	France trial	1.5		7	21	R7194	1.6
Grapes	France trial	1.6	0.50	8	21	R-9146 FR03	2.2
Grapes	France trial	1.4	0.50	8	21	R-9146 FR02	2.4
Grapes	France trial	1.5	0.47	8	21	R-9146 FR01	3.1
Grapes	France trial	1.5	0.60	9	21	R-9146 FR04	2.8
Grapes	France trial	1.9-2.0	0.57-0.76	8	21	R9098	5.8
Grapes	France trial	1.9	0.55-0.78	8	21 (28) ²	R9098	3.5
Grapes	France trial	1.4-1.6	0.57-0.63	8	21	R9098	1.9
Grapes	France trial	1.6-2.0	0.64-0.84	8	21	R9098	4.6
Grapes	France trial	1.7-1.9	0.49-0.76	8	21	R9098	5.7
Grapes	France trial	1.3-1.6	0.54-0.65	8	21	R9098	5.9
Grapes	¹ France trial	1.5	1.1	7	21	101/91	1.2
Grapes	¹ France trial	1.5	1.9	7	21	103/91	1.3
Grapes	Italy GAP		0.16		10		
Grapes	Italy trial	1.6	0.16	5	10	AA950313.03	3.3
Grapes	¹ Italy trial	1.5	0.15	10	10	IT-301-91	0.58
Grapes	Mexico GAP	1.2			10		

¹ From 1993 JMPR

² The residue on day 28 (3.5 mg/kg) exceeded the residue on day 21 (2.6 mg/kg).

Crop	Country	Use pattern				Trial	Folpet, mg/kg
		kg ai/ha	kg ai/hl	No of appl.	PHI days		
Grapes	Mexico trial	1.0	0.14	7	10	AA950313.05	<0.05
Grapes	Spain GAP		0.20		21		
Grapes	¹ Spain trial	0.8	0.2	3	20	SP-201-91	2.0
STRAWBERRY							
Strawberries	Spain GAP		0.15		21		
Strawberries	Italy trial	0.89	0.15	3	21	R-8989	<0.01
Strawberries	Italy trial	0.76	0.13	3	21	R9093	0.04
Strawberries	Italy trial	0.75	0.13	3	21	R9383	0.09
Strawberries	¹ Spain trial	1.29	0.15	4	21		1.1
Strawberries	Mexico GAP	1.2			2		
Strawberries	Mexico trial	1.2	0.62	4	2	950310.01	1.8
Strawberries	Mexico trial	1.2	0.26	4	2	950310.02	1.6
Strawberries	Mexico trial	1.2	0.33	4	2	950310.03	2.2
Strawberries	Netherlands GAP		0.13	g	14		
Strawberries	Netherlands trial	1.4	0.13	2 pt	14	MAK/372.01	1.9
Strawberries	Netherlands trial	1.3	0.13	2 pt	14	MAK/372.01	1.6
Strawberries	Netherlands trial	1.3	0.13	2 pt	14	MAK/372.02	1.4
ONION							
Onions	Chile GAP	2.0	0.13		7		
Onions	Chile trial	2.0	0.13	3	7	AA950307.03	0.36
Onions	Greece GAP		0.16		20		
Onions	Greece trial	0.62	0.12	3	20	MAK/377-07	<0.05
Onions	Greece trial	0.62	0.12	3	20	MAK/377-06	<0.05
Onions	Hungary GAP		0.13		14		
Onions	Hungary trial	0.65	0.13	3	14	MAK/377-02	0.07
Onions	Hungary trial	0.65	0.13	3	14	MAK/377-03	<0.05
Onions	Hungary trial	0.67	0.13	3	14	MAK/377-04	0.21
Onions	Hungary trial	0.65	0.13	3	14	MAK/377-01	0.05
Onions	Mexico GAP	1.4			7		
Onions	Mexico trial	1.5	0.51	4	7	AA950307.01	0.41
Onions	Mexico trial	1.5	0.56	4	7	AA950307.02	0.41
Onions	Portugal GAP		0.13		7		
Onions	Portugal trial	0.54	0.13	3	7	MAK/377-08	5.0
Onions	Spain trial	0.65	0.16	3	10	MAK/377-09	2.5
CUCUMBER							
Cucumber	Cyprus GAP	1.0	0.1		2		
Cucumber	Cyprus trial	1.2	0.12	6	3	CY002/93	0.11
Cucumber	Hungary GAP		0.13		14		
Cucumber	Hungary trial	1.3	0.13	2	14	2/94	<0.02
Cucumber	Mexico GAP	1.7			3		
Cucumber	Mexico trial	1.8	0.50	4	3	AA950312.04	0.11
Cucumber	Mexico trial	1.7	0.76	4	3	AA950312.03	0.36
Cucumber	Mexico trial	1.8	0.67	4	3	AA950312.01	0.70
Cucumber	Mexico trial	1.8	0.79	4	3	AA950312.02	0.56
MELON							
Melons	Greece GAP		0.16		20		
Melons	Greece trial	0.98	0.12	4	20	MAK/373-01	<0.05
Melons	Greece trial	0.97	0.12	4	20	MAK/373-02	<0.05
Melons	Honduras GAP	0.64	0.16		3		

Crop	Country	Use pattern				Trial	Folpet, mg/kg
		kg ai/ha	kg ai/hl	No of appl.	PHI days		
Melons	Guatemala trial	0.49	0.10	6	3	AA950308.06	0.23
Melons	Honduras trial	0.65	0.13	4	3	AA950308.04	0.32
Melons	Honduras trial	0.65	0.13	4	3	AA950308.05	0.41
Melons	Mexico GAP	1.7			7		
Melons	Mexico trial	1.8	0.79	6	7	AA950308.01	2.2
Melons	Mexico trial	1.8	0.55	6	7	AA950308.02	0.89
Melons	Mexico trial	1.8	0.63	6	7	AA950308.03	0.40
TOMATO							
Tomato	Chile GAP	1.9	0.15		7		
Tomato	Chile trial	1.7	1.5	7	7	R-9141t	2.4
Tomato	Hungary GAP		0.13		14		
Tomato	Hungary trial	0.65	0.13	3	14	MAK/375.01	<0.05
Tomato	Hungary trial	0.65	0.13	3	14	MAK/375.04	<0.05
Tomato	Hungary trial	0.65	0.13	3	14	MAK/375.02	<0.05
Tomato	Hungary trial	0.66	0.13	3	14	MAK/375.03	<0.05
Tomato	¹ Hungary trial	0.63	0.12	5	14	FP/26/91	<0.02
Tomato	Mexico GAP	1.9			2		
Tomato	Mexico trial	2.0	0.67	5	2	AA950311.01	1.0
Tomato	Mexico trial	2.0	0.71	5	2	AA950311.04	1.6
Tomato	Mexico trial	2.0	0.66	5	2	AA950311.05	1.8
Tomato	Mexico trial	2.0	0.71	5	2	AA950311.02	0.45
Tomato	Mexico trial	2.0	0.72	5	2	AA950311.03	1.3
Tomato	Portugal GAP		0.13		7		
Tomato	Portugal trial	1.3	0.16	4	7	MAK/375.08	0.34
Tomato	Portugal trial	1.3	0.16	4	7	MAK/375.09	0.58
Tomato	Spain GAP		0.15		10		
Tomato	Italy trial	1.2	0.13	4	10	R-8987	0.60
Tomato	Italy trial	1.3	0.13	4	10	ERSA-DA-14/96	0.70
Tomato	Italy trial	1.3	0.13	4	10 (14) ³	ERSA-DA-08/96	0.80
Tomato	Italy trial	1.2	0.13	4	10	ERSA-DA-11/95	0.43
Tomato	Spain trial	1.6	0.20	6	10	MAK/375.06	1.3
Tomato	Spain trial	2.5	0.16	6	10	MAK/375.07	1.2
LETTUCE							
Lettuce	Hungary GAP		0.13		14		
Lettuce, Head	Hungary trial	0.66	0.13	pt 3	14	MAK/378-01	24
Lettuce, Head	Hungary trial	0.67	0.13	pt 3	14	MAK/378-02	29
Lettuce, Head	Hungary trial	0.65	0.13	pt 3	14	MAK/378-04	12
Lettuce, Head	Hungary trial	0.66	0.13	pt 3	14	MAK/378-03	39
Lettuce, Head	Hungary trial						
Lettuce	Mexico GAP	1.2			7		
Lettuce, Head	Mexico trial	1.3	0.44	5	7	AA950309.03	4.5
Lettuce, Head	Mexico trial	1.3	0.40	5	7	AA950309.02	9.8
Lettuce, Head	Mexico trial	1.3	0.46	5	7	AA950309.04	16
Lettuce	Portugal GAP		0.13		14		

³ The residue on day 14 (0.80 mg/kg) exceeded the residue on day 10 (0.62 mg/kg).

Crop	Country	Use pattern				Trial	Folpet, mg/kg
		kg ai/ha	kg ai/hl	No of appl.	PHI days		
Lettuce, Head	Portugal trial	0.52	0.13	3	14	MAK/378-09	4.3
POTATO							
Potato	Spain GAP		0.15		10		
Potato	Italy trial	1.3	0.13	4	10	R8988	0.08
Potato	Italy trial	1.2	0.13	3	10	R9094	<0.01
Potato	Italy trial	1.3	0.13	3	10	R9261	<0.01
Potato	Italy trial	1.3	0.13	4	10	R9374	<0.01
Potato	Mexico GAP	1.9			30		
Potato	Mexico trial	2.4	0.48	5	30	AA960303	0.01
Potato	Mexico trial	5.2	0.96	5	30	AA960303	0.01
Potato	Mexico trial	2.5	0.61	5	30	AA960303	<0.01
Potato	Mexico trial	4.8	1.2	5	30	AA960303	<0.01
Potato	Ukraine GAP	1.5			20		
Potato	Poland trial	1.6		3	21	R9711	<0.01
Potato	Russia trial	1.5	0.5	3	12	R9772	<0.1
Potato	Russia trial	1.5	0.38	3	12	R9772	<0.1
Potato	Russia trial	1.5	0.38	3	20	R9790	<0.04
Potato	Russia trial	1.5	0.38	3	20	R9790	<0.04

g: glasshouse use

pt: plastic tunnel use

APPRAISAL

Folpet was evaluated in 1998 for residues in the CCPR Periodic Review Programme. The 1998 Meeting did not receive information on the environmental fate of folpet in soil and in water/sediment systems and (1) agreed that its estimates of maximum residue levels should not be recommended for use as MRLs and (2) recommended withdrawal of existing draft MRLs until these critical supporting studies could be evaluated.

The 1998 Meeting noted that farm animal feeding studies had not been provided, but would be needed before MRLs could be recommended for cereal grain, fodder and forage. The Meeting re-examined this requirement in the light of the results of a metabolism study in which goats had been dosed with [¹⁴C]folpet at the equivalent of 24 ppm in the feed for 6 days. Folpet itself was not present in the milk and tissues, but metabolites were identified at levels of 0.001-0.02 mg/kg.

The FAO Manual (Chapter 3.1.5.1) states that livestock processing studies are required where significant residues (>0.1 mg/kg) occur in commodities fed to animals and where significant residues (>0.01 mg/kg) may occur in edible tissues. The Meeting agreed that the metabolism study satisfied the need for a ruminant feeding study up to the feed level tested because no significant residues occurred in the tissues. The Meeting noted that no studies of poultry metabolism had been evaluated.

The Meeting received information on the environmental fate of folpet in soil and on aqueous hydrolysis and photolysis which satisfied the requirements for these critical supporting studies. A study of potato metabolism was also made available.

The metabolism of folpet applied to the foliage of potatoes was similar to that in other plants with the main metabolites in the tubers identified as phthalic and phthalamic acids. Folpet itself was not translocated into the tubers.

The disappearance of folpet incubated with soil under aerobic conditions was biphasic, with initial half-lives of below 10 days but with extended half-lives in the longer term. Phthalimide was the only major degradation product. Half of the folpet was mineralized in the first month.

The estimated half-life of folpet in anaerobic soil was 15 days.

In a field dissipation study folpet and phthalimide were detected mainly in the surface soils and had disappeared within one week of the final treatment. Folpet and its soil degradation products showed low mobility in a soil column leaching study.

The half-lives of folpet dissolved at 1 mg/l in sterile aqueous buffered solutions at 25°C in the dark were 2.6 hours, 1.1 hours and 67 seconds at pH 5, 7 and 9 respectively. Hydrolysis at pH 3 was not accelerated by exposure to natural sunlight or a UV lamp, showing that photolysis played little part in breakdown.

Folpet itself disappeared very quickly from a water/sediment system incubated in the dark, as would be expected from its rate of abiotic hydrolysis. The study was recently completed and a brief summary was provided.

Residue trials were reviewed in 1998. New information has now been provided on GAP, which has assisted re-evaluation. Current GAP and relevant data from the supervised trials are summarized in an interpretation table in the 1999 Evaluation.

Apples. Folpet is registered in Argentina for use on apples with a spray concentration of 0.12 kg ai/hl and a PHI of 15 days. The residues in apples from 2 trials where the spray concentration matched GAP but the PHI was 10 days (sufficiently close for a persistent residue) were 1.4 and 2.6 mg/kg.

In two trials in Chile where the conditions corresponded to Chilean GAP (2.0 kg ai/ha and PHI 7 days) the residues were 2.0 and 3.7 mg/kg.

In a Hungarian trial according to GAP (application at 1.6 kg ai/ha and a PHI of 10 days) the folpet residue on apples was 8.0 mg/kg. In a Swiss trial according to GAP (spray concentration 0.10 kg ai/hl and a PHI of 21 days) the residue was 3.4 mg/kg, and in a Spanish trial also according to GAP (spray concentration 0.16 kg ai/hl and a PHI of 10 days) the residue was 3.1 mg/kg.

Folpet may be sprayed at 0.13 kg ai/hl on apples in Portugal with harvest 21 days after the final application. In a trial meeting these conditions the residue was 3.2 mg/kg. In a trial recorded in the 1993 Evaluations folpet was applied 10 times at a concentration of 0.13 kg ai/hl and the resulting residue 21 days after the final application was 1.8 mg/kg

In summary, the residues in apples from trials according to GAP were Argentina 1.4, 2.6 mg/kg, Chile 2.0, 3.7 mg/kg, Hungary 8.0 mg/kg, Switzerland 3.4 mg/kg, Spain 3.1 mg/kg and Portugal 1.8, 3.2 mg/kg. The residues in rank order (median underlined) in the 9 trials were 1.4, 1.8, 2.0, 2.6, 3.1, 3.2, 3.4, 3.7 and 8.0 mg/kg.

The Meeting estimated a maximum residue level of 10 mg/kg and an STMR of 3.1 mg/kg for folpet on apples. The estimated maximum residue level supports the existing draft MRL.

Grapes. In two trials in Chile corresponding to Chilean GAP (2.0 kg ai/ha and PHI 14 days) the residues were 2.6 and 3.0 mg/kg, and in a Mexican trial according to GAP (1.0 kg ai/ha, PHI 10 days) the residue was <0.05 mg/kg.

In 12 French trials according to GAP (1.5 kg ai/ha and 21 days PHI) the residues were 1.6, 1.9, 1.9, 2.2, 2.4, 2.8, 3.1, 3.5, 4.6, 5.7, 5.8 and 5.9 mg/kg.

The 1993 JMPR reported 4 trials according to national GAP, 2 French (1.5 kg ai/ha, PHI 21 days), 1 Italian (0.16 kg ai/hl, 10 days PHI) and 1 Spanish (0.20 kg ai/hl, 21 days PHI). The residues were 1.2, 1.3, 0.58 and 2.0 mg/kg respectively.

The trial in Mexico may have been from a different population and was excluded from the evaluation.

In summary, the residues in grapes from trials according to GAP were Argentina 1.6 mg/kg, Chile 2.6, 3.0 mg/kg, France 1.2, 1.3, 1.6, 1.9, 1.9, 2.2, 2.4, 2.8, 3.1, 3.5, 4.6, 5.7, 5.8 and 5.9 mg/kg, Italy 0.58, 3.3 mg/kg and Spain 2 mg/kg. The residues in rank order (median underlined) in the 20 trials were 0.58, 1.2, 1.3, 1.6, 1.6, 1.9, 1.9, 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.1, 3.3, 3.5, 4.6, 5.7, 5.8 and 5.9 mg/kg.

The Meeting estimated a maximum residue level of 10 mg/kg and an STMR of 2.5 mg/kg for folpet on grapes. The estimated maximum residue level supports the existing draft MRL.

Strawberries. Folpet is registered in Spain at a spray concentration of 0.15 kg ai/hl and a PHI of 21 days. The residues were <0.01, 0.04 and 0.09 mg/kg in three trials in Italy and 1.1 mg/kg in one Spanish trial (1993 JMPR) according to Spanish GAP.

Mexican GAP permits application of folpet to strawberries at 1.3 kg ai/ha 2 days PHI. The residues in 3 Mexican trials complying with GAP were 1.6, 1.8 and 2.2 mg/kg.

In 3 trials in plastic tunnels according to glasshouse GAP in The Netherlands (spray concentration of 0.13 kg ai/hl and 14 days PHI) the residues were 1.4, 1.6 and 1.9 mg/kg.

In summary, the residues in strawberries from trials according to GAP were Italy <0.01, 0.04 and 0.09 mg/kg, Mexico 1.6, 1.8 and 2.2 mg/kg, The Netherlands 1.4, 1.6 and 1.9 mg/kg and Spain 1.1 mg/kg. The Meeting agreed that the residues in Italy appeared to be a different population from the others and should be excluded. The residues in rank order (median underlined) in the remaining 7 trials were 1.1, 1.4, 1.6, 1.6, 1.8, 1.9 and 2.2 mg/kg.

The Meeting estimated a maximum residue level of 5 mg/kg and an STMR of 1.6 mg/kg for folpet on strawberries. The estimated maximum residue level supports the existing draft MRL.

Onions. The residue in onions from a trial in Chile in accordance with GAP (application of 2 kg ai/ha and 7 days PHI) was 0.36 mg/kg. The residues in 2 trials in Mexico (application at 1.5 kg ai/ha) were 0.41 and 0.41 mg/kg with conditions complying with GAP (1.4 kg ai/ha and 7 days PHI).

Portuguese GAP for onions allows a folpet spray concentration of 0.13 kg ai/hl and a 7 days PHI. The residues in one trial in Portugal and one in Spain (0.16 kg/hl, PHI 10 days) complying with this were 5.0 and 2.5 mg/kg respectively. Two trials in Greece (0.12 kg ai/hl and 20 days PHI) were acceptably close to Greek GAP (0.16 kg ai/hl with a 20 days PHI) and produced no detectable residues (<0.05 mg/kg).

Four Hungarian trials according to Hungarian GAP (0.13 kg ai/hl and 14 days PHI) produced residues of <0.05, 0.05, 0.07 and 0.21 mg/kg.

In summary, the residues in onions from trials according to GAP were Chile 0.36 mg/kg, Greece <0.05, <0.05 mg/kg, Hungary <0.05, 0.05, 0.07 and 0.21 mg/kg, Mexico 0.41, 0.41 mg/kg, Portugal 5.0 mg/kg and Spain 2.5 mg/kg. The Meeting agreed that the residues in the Portuguese and Spanish trials appeared to be from a different population from the remainder and that only 9 trials would be used for the evaluation. The residues in onions in rank order (median underlined) in the 9 trials were <0.05 (3), 0.05, 0.07, 0.21, 0.36, 0.41 and 0.41 mg/kg.

The Meeting noted that the three highest values suggested that residues would sometimes exceed 0.5 mg/kg and estimated a maximum residue of 1 mg/kg and an STMR of 0.07 mg/kg for folpet in onions.

Cucumbers. In Cyprus folpet is registered for use on cucumbers at 1.0 kg ai/ha with a 2 days PHI. The residues in cucumbers were 0.11 mg/kg in a Cyprus trial sufficiently close to GAP (1.2 kg ai/ha and 3 days PHI).

In Hungary the residues in cucumbers were <0.02 mg/kg in a trial according to Hungarian GAP (0.13 kg ai/ha and 14 days PHI).

Folpet may be used on cucumbers in Mexico at 1.7 kg ai/ha with a 3 days PHI. In the 4 trials in Mexico according to GAP the residues were 0.11, 0.36, 0.56 and 0.70 mg/kg.

A Canadian trial could not be used because the trial conditions (application rate 1.0 kg ai/ha and spray concentration 0.10 kg ai/hl) did not match maximum GAP (2.0 kg ai/ha, 0.20 kg ai/hl)

In summary the residues in cucumbers from trials according to GAP were Cyprus 0.11 mg/kg, Hungary <0.02 mg/kg and Mexico 0.11, 0.36, 0.56 and 0.70 mg/kg. The trial in Hungary may have been from a different population and was excluded from the evaluation. The residues in rank order (median underlined) in the 5 trials were 0.11, 0.11, 0.36, 0.56 and 0.70 mg/kg.

The Meeting estimated a maximum residue level of 1 mg/kg and an STMR of 0.36 mg/kg for folpet in cucumbers. The estimated maximum residue level is recommended to replace the draft MRL of 0.5 mg/kg.

Melons. In Greece folpet is registered for use on melons with a spray concentration of 0.16 kg ai/hl and a PHI of 20 days. The residues were below the LOD (<0.05 mg/kg) in melons from 2 Greek trials meeting these conditions (0.12 kg ai/hl and 20 days PHI).

Honduras permits a spray concentration of 0.16 kg ai/hl and harvest 3 days after the final application. Melons were harvested 3 days after the final application in one trial in Guatemala (0.10 kg ai/hl) and 2 trials in Honduras (0.13 kg ai/hl) where the residues were 0.23, 0.32 and 0.41 mg/kg.

Mexican GAP permits application of folpet to melons at 1.8 kg ai/ha and harvest 7 days later. The residues were 0.40, 0.89 and 2.2 mg/kg in melons from 3 Mexican trials according to GAP.

In summary, the residues in melons from relevant trials were Greece <0.05, <0.05 mg/kg, Guatemala 0.23 mg/kg, Honduras 0.32, 0.41 mg/kg and Mexico 0.40, 0.89, 2.2 mg/kg. The trials in Greece may have been from a different population and were excluded from the evaluation. The residues in rank order (median underlined) in the 6 trials were 0.23, 0.32, 0.40, 0.41, 0.89 and 2.2 mg/kg.

The Meeting estimated a maximum residue level of 3 mg/kg and an STMR of 0.41 mg/kg for folpet in melons. The estimated maximum residue level supports the draft MRL.

Tomatoes. Data were available from supervised trials according to GAP in Chile, Hungary, Italy, Mexico, Portugal and Spain. Trials in the USA and The Netherlands and trials in plastic greenhouses in Italy could not be evaluated because no relevant GAP was reported. The evaluated trials were as follows.

The residue in a trial in Chile (application rate 1.7 kg ai/ha, GAP 1.9 kg ai/ha and 7 days PHI) was 2.4 mg/kg.

In Hungary folpet is registered for use on tomatoes at a spray concentration of 0.13 kg ai/hl with harvest permitted 14 days after the final application. In 4 Hungarian tomato trials reported in 1998 and 1 reported in 1993, the residues were all below the LOD (<0.02 and <0.05 mg/kg).

Mexican GAP permits application of folpet to tomatoes at 1.9 kg ai/ha and harvest 2 days later. The residues from 5 Mexican trials were 0.45, 1.0, 1.3, 1.6 and 1.8 mg/kg.

In 2 Portuguese trials (0.16 kg ai/hl and 7 days PHI) in compliance with Portuguese GAP (0.13 kg ai/hl and 7 days PHI) the residues were 0.34 and 0.58 mg/kg.

The registered use in Spain permits a spray concentration of 0.15 kg ai/hl and a 10 days PHI. The residues in 2 Spanish and 4 Italian trials in substantial agreement with Spanish GAP were 1.2 and 1.3 mg/kg in Spain and 0.43, 0.60, 0.70 and 0.80 mg/kg in Italy.

In summary, the residues in tomatoes from the relevant trials were Chile 2.4 mg/kg, Mexico 0.45, 1.0, 1.3, 1.6, 1.8 mg/kg, Hungary <0.02, <0.05 4 mg/kg, Portugal 0.34, 0.58 mg/kg, Spain 1.2, 1.3 mg/kg and Italy 0.43, 0.60, 0.70, 0.80 mg/kg. The residues in tomatoes in rank order in the 19 trials were <0.02, <0.05 (4), 0.34, 0.43, 0.45, 0.58, 0.6, 0.7, 0.80, 1.0, 1.2, 1.3, 1.3, 1.6, 1.8 and 2.4 mg/kg

The residues from the Hungarian trials appear to be a different population from the others. The residues in the remaining 14 trials (median underlined) were 0.34, 0.43, 0.45, 0.58, 0.6, 0.7, 0.80, 1.0, 1.2, 1.3, 1.3, 1.6, 1.8 and 2.4 mg/kg

The Meeting estimated a maximum residue level of 3 mg/kg and an STMR of 0.90 mg/kg for folpet in tomatoes. The estimated maximum residue level supports the draft MRL.

Head lettuce. Eight trials according to national GAP were reported.

Four trials in plastic tunnels in Hungary (0.13 kg ai/hl and 14days PHI) produced residues of 12, 24, 29 and 39 mg/kg. The residues in 3 Mexican trials (1.3 kg ai/ha and 7 days PHI) were 4.5, 9.8 and 16 mg/kg. The residue from a trial in Portugal in accordance with GAP (0.13 kg ai/hl spray and 14 days PHI) was 4.3 mg/kg.

In summary, the residues in head lettuce from the 8 trials were Hungary 12, 24, 29 and 39 mg/kg, Mexico 4.5, 9.8 and 16 mg/kg and Portugal 4.3 mg/kg. The residues in rank order (median underlined) were 4.3, 4.5, 9.8, 12, 16, 24, 29 and 39 mg/kg.

The Meeting estimated a maximum residue level of 50 mg/kg and an STMR of 14 mg/kg for folpet in head lettuce.

Potatoes. Supervised trials on potatoes were reported from Italy, Mexico, Poland, Russia and South Africa. Translocation of folpet to the tubers from foliar application would not be expected from such a water-insoluble compound as folpet, and this was borne out by the potato metabolism study. Occasional residues could occur if a tuber is exposed above the soil surface to direct spray.

Spanish GAP (spray concentration 0.15 kg ai/hl and PHI 10 days) was used to evaluate 4 Italian trials (0.13 kg ai/hl, 10 days PHI) where the residues were 0.08 and <0.01 (3) mg/kg.

Mexican GAP specifies application at 1.9 kg ai/ha with harvest 30 days later. The residues in potatoes were below the LOD (0.01 mg/kg) in 2 trials with application rates of 2.5 and 4.8 kg ai/ha and were 0.01 mg/kg in 2 trials with application rates of 2.4 and 5.2 kg ai/ha. Trials with exaggerated rates can be included in the evaluation because the chance of residues occurring depends more upon spray contacting exposed tubers than upon the application rate.

GAP in the Ukraine allows application of 1.5 kg ai/ha with 20 days PHI. Trials in Poland and Russia were evaluated against Ukrainian GAP. The residues in one Polish and 4 Russian trials where application was at 1.5-1.6 kg ai/ha with harvest 12-21 days later were <0.01, <0.04 (2) and <0.1 mg/kg.

In summary, the residues in potatoes from the 13 trials effectively according to GAP were Italy <0.01 (3), 0.08 mg/kg, Mexico <0.01 (2), 0.01 mg/kg (2), Poland <0.01 mg/kg and Russia <0.04 (2), <0.1 mg/kg (2). The residues in rank order (median underlined) were <0.01 (6), 0.01 (2), 0.04 (2) 0.08 and <0.1 (2) mg/kg.

The Meeting estimated a maximum residue level of 0.1 mg/kg and an STMR of 0.01 mg/kg for folpet in potatoes.

Processing

The 1998 JMPR reported processing factors of 2.6 and 0.035 for wet apple pomace and apple juice respectively. The Meeting estimated STMRs of 8.1 mg/kg (2.6 x 3.1) for wet pomace and 0.11 mg/kg (0.035 x 3.1) for juice.

The 1998 Meeting reported a processing factor of 3.2 for producing dried grapes (raisins) and estimated a maximum residue level of 40 mg/kg for folpet residues in dried grapes. The Meeting confirmed this estimate, which agrees with the existing draft MRL. By applying the processing factor (3.2) to the STMR for grapes (2.5 mg/kg) the Meeting estimated an STMR of 8.0 mg/kg for dried grapes. The same processing factor applied to the HR found in the trials on grapes (5.9 mg/kg) produced an HR-P of 18.9 mg/kg for dried grapes (raisins).

The calculated processing factor for grape juice was 0 (<0.003); folpet was not detected in the juice. The Meeting estimated an STMR for grape juice of 0.0075 mg/kg (0.003 x 2.5).

Folpet was not detected (<0.05 mg/kg) in wine in 10 processing trials, providing good evidence that the residues do not occur in wine, which is implied by the rapid hydrolysis of folpet in solution and the removal of insolubles in the process and that the processing factor for wine is 0. The Meeting estimated an STMR of 0 mg/kg for folpet residues in wine.

The calculated processing factor for the transfer of the residues from tomatoes to purée and paste is 0 (<0.028); residues in the processed commodities were below the LOD, 0.05 mg/kg. The Meeting estimated STMRs of 0.025 mg/kg (0.028 x 0.90) for tomato purée and paste.

RECOMMENDATIONS

On the basis of the data from supervised trials the Meeting estimated the maximum residue levels and STMRs listed below. The maximum residue levels are recommended for use as MRLs.

Definition of the residue (for compliance with MRLs and for the estimation of dietary intake): folpet.

Commodity		MRL, mg/kg		STMR, mg/kg	HR or HR-P ¹ , mg/kg
CCN	Name	New	Previous		

Commodity		MRL, mg/kg		STMR, mg/kg	HR or HR-P ¹ , mg/kg
CCN	Name	New	Previous		
FP 0226	Apple	10	10 ²	3.1	8.0
JF 0226	Apple juice			0.11	
	Apple pomace, wet			8.1	
VC 0424	Cucumber	1	0.5 ³	0.36	0.70
DF 0269	Dried grapes (Currants, Raisins and Sultanas	40	40 ²	8.0	18.9
FB 0269	Grapes	10	10 ²	2.5	5.9
JF 0269	Grape juice			0.0075	
VL 0482	Lettuce, Head	50	-	14	39
VC 0046	Melons, except watermelon	3	3 ³	0.41	2.2 ⁴
VA 0385	Onion, Bulb	1	-	0.07	0.41
VR 0589	Potato	0.1	0.02 ^{*3}	0.01	0.08
FB 0275	Strawberry	5	5 ²	1.6	2.2
VO 0448	Tomato	3	3 ²	0.90	2.4
	Tomato paste			0.025	
	Tomato purée			0.025	
	Wine			0	

¹HR: highest residue (edible portion) from supervised trials. HR-P: highest residue in the processed commodity, calculated from the HR of the raw agricultural commodity and the processing factor.

²The 1998 JMPR recommended withdrawal because critical supporting studies on the environmental fate of folpet were not provided.

³The 1998 JMPR recommended withdrawal because there were too few appropriate residue trials.

⁴Melons HR is expressed on a whole fruit basis.

DIETARY RISK ASSESSMENT

Chronic intake

New and revised MRLs for folpet have been recommended for apples, cucumbers, dried grapes, grapes, head lettuce, melons, onion, potato, strawberry and tomato. STMRs have been estimated for the primary commodities and some processed commodities. The dietary intake of folpet is shown in Annex III.

International Estimated Daily Intakes for folpet for the 5 GEMS/Food regional diets, based on estimated STMRs, were in the range of 0-9% of the ADI. The Meeting concluded that the intake of

residues of folpet resulting from its uses that have been considered by the JMPR is unlikely to present a public health concern.

Acute intake

The international estimate of short-term intake (IESTI) for folpet was calculated as described in Section 3 of this report for commodities for which MRLs were recommended and STMRs estimated and for which consumption data (large portion consumption, unit weight) were available. The results are shown in Annex IV. The IESTI ranged from 0 to 0.15 mg/kg bw in the total population and from 0 to 0.49 mg/kg bw in children. As no acute reference dose has been established, the acute risk assessment for folpet was not finalized.

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