FOLPET (41)

EXPLANATION

Folpet was first evaluated in 1969 and has been reviewed several times since, most recently in 1990. The 1987 JMPR recommended that a detailed review of all aspects of the use of folpet should be carried out at the 1989 Meeting or as soon as possible.

The 1990 Meeting required, by 1992, the results of supervised trials on apples, cherries, cucumbers, grapes, bulb onions, strawberries and tomatoes, as well as information on current GAP relevant to those crops and to the supervised trials. At the 23rd (1991) Session of the CCPR it was decided (ALINORM 91/24A, para 95) to propose withdrawal of the CXLs for blueberries; currants, black, red, white; raspberries, red, black, and watermelon, and to maintain the CXLs for all the other commodities, regarding them as temporary until 1992.

The 24th (1992) Session of the CCPR was informed that folpet was scheduled for toxicological review by the 1993 JMPR because of the temporary ADI (ALINORM 93/24, para 89). The CCPR was informed that residue studies on citrus fruits, lettuce, melons and potatoes were in progress and data would be available for the 1994 JMPR. The CCPR decided to maintain the CXLs as temporary for all commodities.

The 25th (1993) Session of the CCPR was informed that the manufacturer had provided information for all commodities with temporary MRLs except cherries and onions (ALINORM 93/24A, para 66). Folpet was on the agenda of the 1993 JMPR.

The basic manufacturer provided information to the Meeting on the registered uses of folpet and data from supervised trials on fruit and vegetable crops. MRLs for bulb onion and cherries will not be supported by new supervised field trials.

Information on GAP, residue trials and national MRLs was made available by Canada, the EEC, The Netherlands and Spain.

USE PATTERN

Folpet is a broad-spectrum fungicide used on both food and non-food crops. The major uses are on grapes, apples and various vegetables. The registered uses in many countries are summarized in Tables 1 and 2.

Table 1. Registered uses of folpet on fruits and nuts.

Crop	Country	Form	Application				PHI, days[1]
			Type	Rate per application, kg ai/ha	Spray concentration kg ai/hl	Number	
Almond	Greece	WP	foliar	1.5-3.2	0.1-0.12	3-4	7
Apple	Argentina	WP SC	foliar		0.1-0.12	3	20
Apple	Canada	WP	foliar	0.75-1.0			1
Apple	Greece	WP	foliar	2.0-3.2	0.1-0.13	4-5	7
Apple	Israel[2]	WP	foliar	2.0		every 14 days	21
Apple	Portugal	WP	foliar		0.13	10	21
Apple	Spain	WP	foliar	1.5	0.13	4-6	10
Apple	Spain	SC	dip or drench	-	0.1 (dip)	1	Post harvest 2 months
Blackberries	Netherlands	WP	foliar	1.3-1.6	0.13	4-6	4
Cherries	Netherlands	WP	foliar	1.3-2.0	0.13	2	4
Citrus	Israel[2]	WP	foliar		0.15		21
Cranberries	Canada	WP	foliar	5.0	0.25	2	30
Currants	Denmark	WP		1.5			21
Currants, red, white, black	Netherlands	WP	foliar	1.3-1.6	0.13	4-6	10
Grapes	Argentina	WP SC	foliar		0.1-0.13		7 T 20 W
Grapes	Canada	WP	foliar	1.0			1
Grapes	France	SC		1.5	0.15	2	28
Grapes	France			1.5	0.5-0.7	5-7	28
Grapes	Greece	SC	foliar	0.5-1.9	0.1-0.125	3	30
Grapes	Israel[2]	WP	foliar		0.15	every 14 days	8
Grapes	Italy	WP	foliar	0.35-0.40		3	10 T 40 W
Grapes	Portugal	WP	foliar	1.5-2	0.1-0.15	4-5	21 T 42 W
Grapes	Spain	WP	foliar	1.5-2	0.13-0.20	4	21
Medlar	Portugal	WP	foliar		0.125	3-4	21
Olive	Spain	WP	foliar	1.6	0.16		10
Peach	France	WP	foliar		0.15		15
Pear	Portugal	WP	foliar		0.13	10	21
Pear	Spain	SC	dip or drench		0.1 (dip)	1	Post-harvest 2 months
Pome fruit	Denmark	WP	foliar	1.3-2			21
Pome fruit	France			1.5	0.1	4-5	14
Pome fruit	Italy	WP	foliar	0.35-0.4		3	10
Pome fruit	Spain	WP	foliar	2.4	0.16		10
Stone fruit	Denmark	WP	foliar	1.25-2.0			21
Stone fruit	Greece	WP	foliar	1.5-3.0	0.1-0.13	3-4	7
Stone fruit	Italy	WP	foliar	0.35-0.40		3	10
Stone fruit	Spain	WP	foliar	2.4	0.16	3	10
Strawberry	Belgium	WP	pl dr[3]	-	0.048	1	56
Strawberry	Belgium	WP	foliar	0.6			56
Strawberry	Brazil	WP	foliar	0.35-0.54	0.14		1
Strawberry	Canada	WP	foliar	1.0			1
Strawberry	Denmark	WP	foliar	3			21

Crop	Country	Form	Application				PHI, days[1]
			Type	Rate per application, kg ai/ha	Spray concentration kg ai/hl	Number	
Strawberry	France	SC		4			30
Strawberry	Israel[2]	WP	foliar	2.0		weekly	17
Strawberry	Netherlands	WP	foliar	0.85-1.3	0.13	4-6	4
Strawberry	Netherlands	WP	foliar	0.85-1.3	0.13	2G[4]	14
Strawberry	Portugal	WP	foliar		0.1-0.15	3	7
Strawberry	Spain	WP	foliar	1-1.5	0.15	4	21

[1] T: table grapes. W: wine grapes.
[2] Proposed regiestration.
[3] Drench or dip at planting
[4] Glasshouse use.

Table 2. Registered uses of folpet on vegetables and cereals. All foliar applications.

Crop	Country	Form	Application			PHI, days
			Rate per application, kg ai/ha	Spray concentration kg ai/hl	Number	
Barley	France		1.5			21
Beans	Greece	WP	0.6-1.5	0.1-0.25	3-4	7
Beans	Portugal	WP		0.13	1-2	7
Beans, green	Spain	WP	1.6	0.16		21
Brassica vegetables	Italy	WP	0.35-0.40			10
Brassica vegetables	Spain	WP	0.75	0.075		7
Broad beans	Spain	WP	1.6	0.16		10
Bulb vegetables	Italy	WP	0.35-0.40			10
Bulb vegetables	Spain	WP	0.75	0.075		7
Carrots	Greece	WP	0.6-1.3	0.1-0.13	3-4	7
Chickpeas	Spain	WP	1.6	0.16		10
Cucumber	Canada	WP	1.0-2.0			1
Cucumber, gherkin	France		0.5-1			3
Cucumber	Mexico	WP	1.2-1.7			0
Cucurbits	Greece	WP	0.45-1.9	0.075-0.13	3	7
Cucurbits	Italy	WP	0.35-0.40			10
Cucurbits	Spain	WP	0.75	0.075		7
Egg plant	Greece	WP	0.45-1.3	0.075-0.13	3-4	7
Egg plant	Spain	WP	1.6	0.16		10
Leeks	Greece	WP	0.45-1.3	0.025-0.13	3-4	7
Legume vegetables	Italy	WP	0.35-0.40			10
Lettuce	Brazil	WP	0.34-0.54	0.14		1
Lettuce	France	WP	0.64			21, 41[1]
Lettuce	Israel[2]	WP	2.0		weekly	11
Lettuce	Italy	WP	0.35-0.40			10
Lettuce	Portugal	WP		0.13	1-2	14
Lettuce	Spain	WP	0.75-1.5	0.13-0.16	4	21
Melon	Canada	WP	1.0-2.0			1
Melon	France			0.15		8
Melon	Israel[2]	WP	2.0		weekly	7
Melon	Portugal	WP		0.13-0.15	1-3	28
Onion	Greece	WP	0.45-1.3	0.075-0.13	3-4	7
Onion	Portugal	WP		0.1-0.13	2-3	7
Peas	France		1.5	0.1-0.25	3	15
Peas	Greece	WP	0.6-1.5		3-4	7
Peas, green	Spain	WP	1.6	0.16		10
Peppers	Greece	WP	0.45-1.3	0.075-0.13	3-4	7
Potato	France		1.5		7	7-15
Potato	Greece	WP	0.45-1.3	0.075-0.13	3-4	7
Potato	Israel[2]	WP		0.15	weekly	14
Potato	Portugal	WP		0.13	5-6	7
Potato	Spain	WP	1-1.2	0.15	4	10
Potato	Uruguay	WP SC		0.13		0
Pumpkin	Canada	WP	1.0-2.0			1
Root and tuber vegetables	Italy	WP	0.35-0.40		3	10
Root and tuber vegetables	Spain	WP	0.75	0.075		7

Crop	Country	Form	Application			PHI, days
			Rate per application, kg ai/ha	Spray concentration kg ai/hl	Number	
Solanaceae	Italy	WP	0.35-0.40			10
Solanaceae	Spain	WP	0.75	0.075		7
Squash	Canada	WP	1.0-2.0			1
Stem vegetables	Italy	WP	0.35-0.40			10
Stem vegetables	Spain	WP	0.75	0.075		7
Tomato	Canada	WP	2.0			1
Tomato	France		0.5-1			3
Tomato	Greece	WP	0.45-1.3	0.075-0.13	3-4	7
Tomato	Hungary	WP	1.3	0.25		14
Tomato	Israel[2]	WP	2.0		weekly	14
Tomato	Mexico	WP	1.5-2.0			0
Tomato	Portugal	WP		0.13	2, 6 G[3]	7
Tomato	Spain	WP	1-1.5	0.13-0.5	4	10
Tomato	Uruguay	WP SC	1.3			0
Watermelon	Portugal	WP		0.13	1-2	7
Wheat	France		1.5			21
Witloof	Italy	WP	0.35-0.40			10
Witloof	Spain	WP	0.75-1.6	0.075-0.16		7-21

[1] Summar 21 days, winter 41 days.
[2] Proposed registration.
[3] Glasshouse use.

RESIDUES RESULTING FROM SUPERVISED TRIALS

Residues of folpet and phthalimide, a metabolite, found in supervised trials on horticultural crops are shown in Tables 3 to 7.

Table 3. Mandarins, oranges. *Spain, Israel.*
Table 4. Apples. *Chile, France, Israel, Portugal.*
Table 5. Grapes. *Argentina, Chile, France, Israel, Italy, Spain.*
Table 6. Strawberries. *Brazil, Hungary, Israel, Spain, Uruguay.*
Table 7. Melons, squash, lettuce, potatoes, tomatoes. *Brazil, Denmark, France, Greece, Hungary, Israel, Netherlands, Spain, UK, Uruguay.*

Most supervised residue trials were fully or adequately described. Residues in the Tables are not adjusted for analytical recoveries. Since recoveries were mostly in the 80-120% range, this should not influence interpretations. Attention is drawn to cases where recoveries were excessively high or less than 70%.

Where residues were not detected, they are recorded in the Tables as less than the limit of detection or the limit of determination e.g. <0.1 mg/kg. Residues have generally been rounded to 2 significant figures or, near the limit of determination, to 1 significant figure. Residues were not detected in control samples, but controls are not included in the Tables. Most of the trials were based on three or four replicate plots and the analyses of samples from each replicate are recorded in the Tables.

In the laboratory reports from trials in Argentina, Brazil and Uruguay there was some confusion between the units of concentration ng/kg, ìg/kg and mg/kg. Limits of determination were not clearly expressed but appeared to be 0.01 mg/kg and 0.1 mg/kg for folpet and phthalimide respectively in most cases.

Plot sizes in the Argentine trials were grapes 300-500 m^2, apples 4 trees.

Plot sizes in the Brazilian trials were strawberries 61 plants, lettuce 133 plants. Lettuces were irrigated by sprinkler 5 days after transplanting, and then every 3 days. Strawberries were sprinkler-irrigated once a week.

In Chile plot sizes for grapes and apples were 4 rows of 12 m and 18 trees respectively.

In France the experimental plot sizes were grapes 20-120 m^2, apples 3 or 5 trees, tomatoes 22 m^2, tomatoes under glass 18 plants, and cantaloupes 30 plants. Folpet was applied to grapes using a pneumatic sprayer. Analysis of cantaloupes (melons) was on a whole-fruit basis and no residues were detected (<0.01 mg/kg). The laboratory reported low recoveries from tomatoes (36%) and melons (15%) if the samples were spiked before chopping, but good recoveries (tomatoes 107% and 100%, melons 98%) if the samples were spiked immediately before analysis. No laboratory reports were available for the French trials on apples (FR104-91 and FR105-91) or lettuce (FR108/91).

The experimental plot size for the squash trials in Greece was 15 m^2. Folpet was applied to the strawberry plots (300 m^2) in Hungary with a back-pack sprayer, and to the tomato plots (200 m^2) with a 10 m boom spray. Recoveries were generally good except that at the LOD in tomato there was one low recovery of folpet and one of phthalimide and in strawberries, also at the LOD, one folpet result was very high (175%) and one phthalimide was low (<70%).

Folpet was applied to experimental plots of lettuce, potatoes, tomatoes, melons, grapes and strawberries in Israel with a motorised back-pack sprayer, and to apples and citrus with motorised orchard-spraying equipment. Plot sizes for lettuce, potatoes, tomatoes and melons were 50-60 m^2, for strawberries 14 m^2, for apples and citrus 18 trees, and for grapes 18 vines. Recoveries were generally satisfactory except for individual recoveries at the LOD which could be marginally low or too high. In melons recoveries of phthalimide at higher levels (2 mg/kg) were marginally low.

In the Italian grape trials folpet was applied to plots of 160-370 m^2. Recoveries were satisfactory, but those of phthalimide appear to have been tested only at the relatively high level of 2 mg/kg.

A gas-powered knapsack sprayer was used to apply folpet in the Netherlands potato trials. The plot size was 25 m^2. In Denmark a gas-pressurised 3 m boom spray was used for potatoes; the plots were 36 m^2.

In apple trials in Portugal the plot size was 6 trees. The trees were treated using a motor-driven sprayer with hand-gun application.

In Spain folpet was applied with a knapsack sprayer to experimental plots of grapes (75 m^2), strawberries (204 plants), and melons (44 plants). In citrus trials an experimental plot comprised 30 trees. The reports of the citrus trials in Spain in 1991 were vague about the LODs of folpet and phthalimide. The limits were assumed to be 0.02 and 0.1 mg/kg respectively.

In Uruguay strawberry plots were 4.2 $\times$ 20 m and potato plots were 5.6 $\times$ 20 m. Folpet was applied with a knapsack sprayer.

There were 6 replicates in the UK potato trials and each plot was 2 $\times$ 6 m. Folpet was applied with a boom spray.

Table 3. Folpet residues in citrus fruit from supervised trials in Israel and Spain.

Country, year (Variety)	Application				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
Mandarins								
Spain, 1991	WP	4.5	0.15	1	0 7	1.1, 0.47, 1.4 0.13, 0.14, 0.21	0.1 (2), <0.1 <0.1 (3)	203/91

Country, year (Variety)	Application				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
(Clementine)					14	0.15, 0.08, 0.14	<0.1 (3)	
					21	<0.02, 0.02, 0.09	<0.1 (3)	
					28	0.02, <0.02, 0.07	<0.1 (3)	
					42	<0.02, <0.02, <0.02	<0.1 (3)	
					56	<0.02, 0.05, 0.05	<0.1 (3)	
Spain, 1988 (Clementine)	SC	6.0	0.13	1	0	0.98, 1.2, 1.2		MAPA 7/5/91
					7	0.93, 0.88, 0.82		
					14	0.77, 0.75, 0.65		
					21	0.75, 0.67, 0.65		
					28	0.50, 0.70, 0.68		
Oranges								
Israel, 1992 (Shamuti)	WP	14	0.14	1	0	3.0, 2.8, 3.1, 3.8	<0.1 (4)	FP/29/92
					7	1.0, 2.0, 1.6, 1.6	<0.1, 0.1, <0.1 (2)	
					23	1.3, 1.0, 1.3, 0.64	<0.1 (4)	
Israel, 1992 (Shamuti)	WP	29	0.29	1	0	7.1, 9.9, 7.6, 4.1	0.1 (3), <0.1	FP/29/92
					7	2.9, 2.2, 1.9, 2.1	<0.1 (4)	
					23	1.5, 2.5, 3.1, 2.6	<0.1 (4)	
Spain, 1988 (Navel)	SC	6.5	0.13	1	0	0.40, 0.38		MAPA 7/5/91
					7	0.20, 0.18, 0.20		
					14	0.10, 0.09, 0.09		
					21	0.09, 0.12, 0.08		
					28	0.05, 0.10, 0.10		
					42	0.10, 0.09, 0.09		
					56	0.08, 0.10, 0.08		
Spain, 1988 (Navel)	SC	6.5	0.13	1	0	0.37, 0.25, 0.39		MAPA 7/5/91
					7	0.20, 0.22, 0.27		
					14	0.11, 0.33, 0.38		
					21	0.18, 0.21, 0.40		
					28	0.19, 0.24, 0.10		
					42	0.17, 0.24, 0.14		
					56	0.14, 0.12, 0.06		
Spain, 1991 (Navelina)	WP	4.5	0.15	1	0	0.67, 0.44, 0.78	<0.1 (3)	204-91
					7	0.60, 0.43, 0.40	0.1, <0.01, 0.1	
					14	0.45, 0.42, 0.42	0.1 (3)	
					21	0.35, 0.39, 0.23	0.1 (2), <0.1	
					28	0.24, 0.21, 0.14	0.1 (2), <0.1	
					42	0.18, 0.14, 0.14	0.1, <0.1 (2)	
					56	0.11, 0.24, 0.18	<0.1, 0.1 (2)	

Table 4. Folpet residues in apples from supervised trials in Chile, Israel, France and Portugal. Underlined residues are from treatments within GAP.

Country, year (Variety)	Application				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
Chile, 1992 (Red King Oregon)	WP	4.4-7.2	0.24	3	120	0.37, 0.65, 0.28, 0.35	<0.1 (4)	7538/7779
France, 1991 (Golden Delicious)	WP	2.5	1.0	13	3	0.20, 0.20		FR104-91
					22	0.12, 0.10		
					42	0.55		
France, 1991 (Golden Delicious)	WP	5.0	2.0	13	3	0.55, 0.55		FR104-91
					22	0.40, 0.32		
					42	0.25		
France, 1991 (Golden Delicious)	WP	1.3	0.10	10	0	0.23, 0.05, 0.08, 0.02		FR105-91
France, 1991 (Golden Delicious)	WP	2.6	0.20	10	0	0.47, 0.13, 0.13, 0.13		FR105-91
					20	0.005, 0.01 (2), 0.005		
					41	0.005, 0.01 (2), 0.005		
Israel, 1991 (Starking)	WP	2.9	0.14	4	0	2.2, 4.7, 3.4, 2.1	<0.1 (4)	FP/24/91
					23	<u>0.92</u>, <u>0.98</u>, <u>1.4</u>, <u>0.77</u>	<0.1 (4)	
					36	<u>0.82</u>, <u>0.70</u>, <u>0.50</u>, <u>0.56</u>	<0.1 (4)	
				5	7	1.4, 3.0, 1.7, 3.3	<0.1 (4)	
Israel, 1991 (Starking)	WP	5.8	0.29	4	0	8.1, 11, 6.9, 11	0.1 (2), 0.26, 0.23	FP/24/91
					23	1.9, 4.9, 4.3, 4.8	<0.1 (4)	
					36	1.3, 0.49, 0.83, 1.7	<0.1 (4)	
				5	7	5.3, 5.1, 4.8, 7.1	<0.1 (4)	
Portugal, 1991 (Golden Delicious)	WP	1.1-1.3	0.13	10	0	3.0, 1.9, 1.9, 2.9	<0.1 (4)	FP/25/91
					10	1.7, 0.71, 0.85, 1.9	<0.1 (4)	

Country, year (Variety)	Application				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
					21	0.97, 1.4, 0.94, 1.8	<0.1 (4)	

Table 5. Folpet residues in grapes from supervised trials in Argentina, Chile, France, Israel, Italy and Spain. Underlined residues are from treatments within GAP.

Country, year (Variety)	Application				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
Argentina, 1992 (Pedro Ximinéz)	WP	1.3	0.12	3	20	0.057, 0.055, 0.063, <0.01	0.10, <0.1, 0.13, <0.1	JV-wine grape
Argentina, 1992 (Black Cherry)	WP	1.7	0.12	5	7	0.26, 0.57, 0.25	<0.1 (3)	SJ-table grape
Chile, 1992 (Thompson)	WP	2.9-3.6	0.24	4	15	25, 23, 19	1.9, 1.7, 1.9	7538/7779
France, 1991 (Merlot Noir)	SC	1.5	1.0	10	0 11 21 33	2.0, 1.1, 0.35, 0.73 2.1, 2.0, 0.85, 1.3 0.56, 1.7, 0.59, 0.95 0.65, 0.75, 0.68, 0.31	1.1, 0.93, 0.44, 0.45 0.58, 0.88, 0.32, 0.53 0.58, 0.96, 0.32, 0.64 0.21, 0.30, 0.36, 0.25	101/91
France, 1991 (Merlot Noir)	SC	3.0	2.0	10	33	6.0, 8.0, 1.9, 2.0	1.9, 1.5, 1.0, 1.3	101/91
France, 1991 (Gamay Noir)	SC	1.5	1.1	7	0 10 21 45	1.1, 1.2, 2.7, 2.8 1.3, 1.3, 0.7, 0.78 1.2, 1.1, 0.70, 0.79 0.66, 0.27, 0.33, 0.41	0.84, 0.75, 1.0, 1.2 0.33, 0.45, 0.20, 0.41 0.79, 0.83, 0.99, 0.26 0.40, 0.57, 0.56, 0.88	102/91
France, 1991 (Grenache)	WP	1.5	1.9	7	0 10 21 43	0.78, 1.2, 2.0, 0.8 2.2, 1.3, 1.4, 0.52 1.3, 0.41, 0.11, 0.6 0.062, 0.19, 0.097, 0.075	0.64, 0.64, 0.59, 0.64 0.48, 0.53, 1.9, 0.48 0.51, 0.32, 0.19, 0.47 <0.05, 0.2, 0.43, 0.23	103/91
Israel, 1991 (Thompson)	WP	1.4	0.14	3	0 7 14 22	3.2, 1.2, 1.2, 2.0 0.94, 0.21, 0.56, 0.28 1.4, 0.47, 0.27, 0.38 0.66, 0.26, 0.14, 0.14	<0.1 (4) <0.1 (4) <0.1 (4) <0.1 (4)	FP/20/91
Israel, 1991 (Thompson)	WP	2.9	0.29	3	0 7 14 22	4.5, 1.5, 0.92, 1.9 0.96, 0.85, 0.51, 1.4 0.68, 0.69, 1.2, 0.62 1.2, 0.25, 0.32, 0.14	<0.1 (4) <0.1 (4) <0.1 (4) <0.1 (4)	FP/20/91
Italy, 1991 (Dolcetto)	WP	1.5	0.25	7	0 10 20 40	0.82, 0.74, 1.1, 0.79 0.60, 0.40, 0.75, 0.40 0.23, 0.17, 0.16, 0.20 0.12, 0.08, 0.07, 0.15	<0.05 (4) <0.05 (4) <0.05 (4) <0.05 (4)	IT-302-91
Italy, 1991 (Dolcetto)	WP	3.0	0.50	7	0 40	2.6, 5.0, 3.9, 5.9 0.57, 0.50, 0.60, 0.35	0.19, 0.14, 0.17, 0.11 <0.05 (4)	IT-302-91
Italy, 1991 (Merlot)	WP	1.5	0.15	10	0 10 20 40	0.94, 1.3, 0.48, 0.85 0.30, 0.51, 0.30, 0.58 0.17, 0.17, 0.06, 0.10 0.04, 0.03, 0.03, 0.04	<0.05 (4) <0.05 (4) <0.05 (4) <0.05 (4)	IT-301-91
Italy, 1991 (Merlot)	WP	3.0	0.30	10	0 40	2.0, 2.2, 2.6, 2.0 1.2, 0.24, 0.13, 0.13	0.29, 0.40, 0.14, 0.11 <0.05 (4)	IT-301-91
Spain, 1991 (Cabernet Sauvignon)	WP	0.8	0.2	3	0 10 20	6.0, 6.5, 6.0, 7.0 2.2, 1.1, 2.0, 1.4 1.3, 0.6, 2.0, 0.9	0.5, 0.5, 0.6, 0.55 0.55, 0.3, 0.4, 0.4	SP-201-91

Table 6. Folpet residues in strawberries from supervised trials in Brazil, Hungary, Israel, Spain and Uruguay. Underlined residues are from treatments within GAP.

Country, year (Variety)	Application				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
Brazil, 1991 (AGF-80)	WP	0.14	0.02	4	1	1.4, 1.1, 0.24, 0.33	5.5, 3.0, 1.1, 1.6	BRSTMF
Brazil, 1991 (AGF-80)	WP	0.27	0.04	4	1	1.7, 1.1, 1.8, 1.7	1.7, <0.1, 1.2, 2.6	BRSTMF
Hungary, 1991 (Gorella)	WP	1.0	0.10	2 3	14 0 5 10	0.55, 0.21, 0.25, 0.16 0.98, 0.83, 0.83, 0.96 0.47, 0.78, 0.21, 0.34 0.18, 0.22, 0.22, 0.35, 0.21, 0.18, 0.14	<0.1 (4) <0.1 (4) <0.1 (4) <0.1 (7)	FP/27/91
Israel, 1991 (Dorit)	WP	1.4	0.14	3	0 17 24 31	5.8, 7.1, 5.4, 5.6 4.7, 2.4, 4.8, 4.4 2.7, 3.0, 2.4, 0.5 1.7, 2.6, 2.3, 4.2	0.1, <0.1, 0.1, <0.1 <0.1 (4) <0.1 (4) <0.1 (4)	FP/28/92
Israel, 1991 (Dorit)	WP	2.9	0.29	3	0 17 24 31	21, 8.9, 12, 8.6 5.9, 7.6, 10, 6.8 4.4, 3.3, 3.8, 4.5 4.6, 6.4, 5.1, 4.8	0.1, <0.1, 0.1 (2) <0.1 (4) <0.1 (4) <0.1 (4)	FP/28/92
Spain, 1991 (Pájaro)	WP	1.29	0.15	4	0 12 21	1.7, 1.8, 1.0, 1.2 0.64, 1.8, 0.84, 1.0 0.46, 1.1, 0.51, 0.80	1.9, 2.5, 0.96, 1.5 0.68, 0.34, 0.37, 0.4 0.57, 0.87, 0.49, 0.3	
Uruguay, 1991 (Selva)	WP	0.25	0.03	10	7	0.95, 0.7, <0.1 (2)	<0.2 (2), 17, <0.2	#15

Table 7. Folpet residues in vegetables from supervised trials in Brazil, Denmark, France, Greece, Hungary, Israel, The Netherlands, Spain, UK and Uruguay. Underlined residues are from treatments within GAP.

Crop Country, year (Variety)	Application [1]				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
Cucurbits - melons								
France, 1991 (Alpha)	SC	1.5	0.43	3	0 1 3 5 7	<0.01 (2) <0.01 <0.01 (4) <0.01 <0.01		FR109-91
Israel, 1991 (Ein - Dor Ananas)	WP	2.0	0.66	6	0 7 14	0.56, 0.20, 1.7, 1.8 0.32, 0.37, 0.66, 0.28 0.30, 0.15, 0.72, 0.18	0.1 (2), 0.36, 0.1 0.24, 0.1 (3) 0.22, 0.1, 0.24, <0.1	FP/19/91
Israel, 1991 (Ein - Dor Ananas)	WP	4.0	1.3	6	0 7 14	2.8, 0.97, 0.75, 0.77 0.78, 0.32, 1.5, 1.8 0.44, 0.60, 0.25, 0.08	0.34, 0.1 (3) 0.30, 0.22, 0.1, 0.23 0.23, 0.26, 0.29, 0.1	FP/19/91
Spain	WP	1.3	1.6	3	0 6 12	pulp <0.02 (4) pulp <0.02 (4) pulp <0.02 (4)		

Crop Country, year (Variety)	Application [1]				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
Cucurbits - squash								
Greece, 1991 (Jedida)	SC	1.1	0.66	2	0 10 20	0.81, 0.22, 0.40, 0.37 <0.02 (4) <0.02 (4)	0.1, <0.1 (3) <0.1 (4) <0.1 (4)	FP/21/91
Greece, 1991 (Jedida)	SC	2.3	1.3	2	0 10 20	0.56, 0.55, 0.60, 0.73 <0.02 (4) <0.02 (4)	<0.1 (2), 0.1, <0.1 <0.1 (4) <0.1 (4)	FP/21/91
Lettuce								
Brazil, 1991 (Floreta)	WP	0.9	0.15	4	7	0.76, 0.95, 1.4, 0.91	0.91, 0.67, 1.0, 1.3	BRLPTMF
Brazil, 1991 (Floreta)	WP	1.8	0.30	4	7	1.4, 1.9, 2.3, 1.4	0.73, 0.49, 0.71, 1.0	BRLPTMF
France, 1991 (Aprilia)	SC	0.75	0.075	3	1 11 15	4.0, 3.5, 3.8, 3.4 0.1, 0.05, 0.1, <0.01 0.03, 0.15, 0.01, 0.05		FR108/91
Israel, 1991 (Nogah)	WP	2.0	0.50	3	0 11	28, 24, 12, 19 3.3, 2.8, 4.1, 3.3	0.86, 1.0, 0.58, 0.72 0.13, 0.1, 0.13, 0.23	FP/17/91
Israel, 1991 (Nogah)	WP	4.0	1.0	3	0 11	49, 49, 29, 56 11, 10, 6.9, 7.2	1.7, 1.4, 0.94, 1.2 0.41, 0.32, 0.25, 0.29	FP/17/91
Potato								
Denmark, 1991 (Bintje)	WG	2.4	1.0	6	0 7 14	<0.02 (3) <0.02 (3) <0.02 (3)	<0.1 (3) <0.1 (3) <0.1 (3)	FP/22/91
Israel, 1991 (Desire)	WP	2.0	0.50	6	0 14	0.02 (4) <0.02 (4)	<0.1 (4) <0.1 (4)	FP/18/91
Israel, 1991 (Desire)	WP	4.0	1.0	6	0 14	0.13, 0.02, 0.05, 0.02 <0.02 (4)	<0.1 (4) <0.1 (4)	FP/18/91
Netherlands, 1991 (Maritiema)	SC	1.9	0.32	11	0 13	<0.02 (4) <0.02 (4)	<0.1 (4) <0.1 (4)	FP/23/91
Netherlands, 1991 (Maritiema)	SC	3.8	0.64	11	0 13	<0.02 (4) <0.02 (4)	<0.1 (4) <0.1 (4)	FP/23/91
UK, 1991	SC	1.3	0.50	6	0 20	<0.01 (4) <0.01 (4)	<0.01 (4) <0.01 (4)	R52593
UK, 1991	SC	2.5	1.0	6	0 20	<0.01 (4) <0.01 (4)	<0.01 (4) <0.01 (4)	R52593
UK, 1991	SC	1.3	0.50	5	0 47	<0.01 (4) <0.01 (4)	<0.01 (4) <0.01 (4)	R52593
UK, 1991	SC	2.5	1.0	5	0 47	<0.01 (4) <0.01 (4)	<0.01 (4) <0.01 (4)	R52593
Uruguay, 1992 (Kennebec)	WP	0.23	0.03	7	7	<0.1, 0.1, 0.49	<0.1 (2)	#14
TOMATO								
France, 1991 (Ferline)	SC	1.5	0.50	3	0 3 6 10	0.08, 0.4 0.03 (3), 0.07 <0.02, 0.06, 0.13 <0.02, 0.02, 0.05		FR106/91
France, 1991 (Ferline)	SC	3.0	1.0	3	0 3 6 10	0.04 0.14 0.13 0.05		FR106/91

Crop Country, year (Variety)	Application [1]				Day	Residues, mg/kg		Ref.
	Form	kg ai/ha	kg ai/hl	No.		Folpet	Phthalimide	
France, 1991 (Trente)	SC	1.5	0.50	g 1	0 4 6 10	0.10, <0.01, 0.01 (2) 0.15, <0.01, 0.01, 0.08 0.15, 0.03, 0.05, 0.01 0.01, 0.05, 0.01, 0.04	0.05 (3), 0.10 0.10, <0.05, 0.05, 0.08 0.10, 0.05 (2), <0.05 <0.05, 0.10, <0.05, 0.06	FR110-91
France, 1991 (Trente)	SC	3.0	1.0	g 1	0 4 6 10	0.30 0.10 0.45 0.40	0.15 0.10 0.12 0.12	FR110-91
France, 1991 (Trente)	SC	1.5	0.50	g 3	4	1.0, 1.2, 0.25, 0.20	1.2, 0.4, 0.20, 0.15	FR110-91
Hungary, 1991 (Korall)	WP	0.63	0.12	5	0 7 14	0.05, 0.06, 0.06, 0.05 <0.02 (4) <0.02 (4)	<0.1 (4) <0.1 (4) <0.1 (4)	FP/26/91
Israel, 1991 (Var 182)	WP	2.0	1.0	3	0 4 11	0.33, 0.38, 0.71, 0.47 0.28, 0.29, 0.26, 0.10 0.21, 0.18, 0.17, 0.17	0.1 (4) 0.1 (4) 0.1 (4)	FP/16/91
Israel, 1991 (Var 182)	WP	4.0	2.0	3	0 4 11	0.80, 1.3, 0.92, 1.0 0.84, 0.65, 0.53, 0.43 0.23, 0.26, 0.30, 0.23	0.22, 0.25, 0.25, 0.22 0.24, 0.1 (3) 0.1 (4)	FP/16/91

g: glasshouse use (Tomato, column 5).

FATE OF RESIDUES

Stability of pesticide residues in stored analytical samples

Schlesinger (1991a, FP/15/91) tested the storage stability of folpet and phthalimide residues in analytical samples (25 g) separately fortified with each compound at 1 mg/kg and then held in plastic bags in a freezer at -18◦C. The results (Table 8) suggest that 10-20% of the residues may be lost during 6 months freezer storage; analytical variation makes it difficult to be precise.

Table 8. Stability of folpet and phthalimide residues in analytical samples fortified at 1 mg/kg and held in frozen storage at -18◦C (Schlesinger, 1991a, FP/15/91).

Commodity	Storage interval, months	% remaining

		folpet	phthalimide
Lettuce	6	91	76
	7	87, 100, 112	73, 71, 74
Potato	6	92	57
	7	58, 59, 76	53, 49
Tomato	6	68	67
	7	78, 63, 81	61, 63
Melon	5	64	-
	6	68, 58	57
	7	-	67, 75

METHODS OF RESIDUE ANALYSIS

Schlesinger (1991a, FP/15/91) described in detail a method for the analysis of folpet and its metabolite phthalimide in non-oily crops.

Samples were chopped and extracted with ethyl acetate (+ sodium sulphate and phosphoric acid), then cleaned up on a Florisil column for folpet, or by solvent partition (hexane, phosphate buffer) for phthalimide. Gas liquid chromatography on a megabore column was used for the final determination, with a ^{63}Ni electron-capture detector for folpet and a thermionic nitrogen-specific detector for phthalimide.

The method was validated for apples, grapes, strawberries, lettuce, melons, potatoes, squash and tomatoes. Recoveries were determined at levels of 0.02, 0.05, 0.25 mg/kg and higher (folpet) and 0.1, 0.2, 1.0 and 2 mg/kg (phthalimide) with 11 or 12 analyses on each crop. Mean recoveries from each crop were 89-100% for folpet and 75-96% for phthalimide. Individual recoveries, except 2, were in the ranges 60-135% for folpet and 60-130% for phthalimide.

Limits of determination were 0.05 mg/kg for folpet and 0.2 mg/kg for phthalimide. Limits of detection were lower by factors of 2-2.5.

No interference was caused by 25 common pesticides which might occur in crop samples.

This method and variations of it were used for the supervised residue trials. Acetone was used as an extracting solvent. A mixed activated carbon and silica gel column assisted the clean-up of folpet. Florisil was used for phthalimide clean-up.

Folpet is included in the lists of compounds determined by Multi-Residue Methods 1 and 12 published by the Ministry of Welfare, Health and Cultural Affairs, The Netherlands (1988).

NATIONAL MAXIMUM RESIDUE LIMITS

The Meeting was aware of the following national MRLs for folpet.

Country	MRL, mg/kg	Commodities
Canada	15	citrus, cucumbers, garlic, melons, pumpkins, squash
	25	apples, avocado, blackberry, blueberry, boysenberry, cherries, crabapples, cranberries, currants, dewberry, gooseberry, grapes, huckleberry, leeks , lettuce, loganberry, onion, raspberry, strawberries, tomatoes
	30	celery
EC	3	apple, grapes, lettuce, tomato
Hungary	5	fruits, table grapes, vegetables
Netherlands[1]	0.1	other fruits, other vegetables, other food commodities 0* (0.1)
	2	cherries, leafy vegetables group I, leek, legume vegetables, stone fruits, witloof chicory (sprouts)
	3	berries and other small fruits, blackberries, red, white and black currants, pome fruits, strawberry, tomato
USA	15	citrus, melon, squash
	25	apple, grapes, potato, strawberries, tomato
	50	lettuce

[1] residue definition: sum of captan and folpet.

APPRAISAL

Folpet was evaluated first in 1969, and several times since. The 1987 JMPR recommended that a detailed review of all aspects of the use of folpet be carried out at the 1989 Meeting or as soon as possible. At the 23rd (1991) Session of the CCPR it was decided (ALINORM 91/24A, para 95) to maintain CXLs for apple, cherries, cucumbers, grapes, bulb onions and strawberries, regarding them as temporary until 1992 when the results of current and planned supervised trials could be reviewed.

The 25th (1993) Session of the CCPR was informed that the manufacturer had provided information for all commodities with temporary MRLs except cherries and onions (ALINORM 93/24A, para 66).

The Meeting received information on registered uses of folpet and data from supervised trials on fruit and vegetables. MRLs for bulb onions and cherries will not be supported by new supervised field trials. Residue data from supervised trials on the following crops were reviewed:

mandarins (*Spain*), oranges (*Israel, Spain*), apples (*Chile, France, Israel, Portugal*), grapes (*Argentina, Chile, France, Israel, Italy, Spain*), strawberries (*Brazil, Hungary, Israel, Spain, Uruguay*).

melons (*France, Israel*), squash (*Greece*), lettuce (*Brazil, France, Israel*), potatoes (*Denmark, Israel, Netherlands, UK, Uruguay*), tomatoes (*France, Hungary, Israel*).

The Meeting was informed that the proposed GAP for folpet in Israel would probably become official in the near future. Only current official GAP is used in the evaluation of residue data.

There are no current registered uses for folpet on citrus, so the Meeting could not estimate a maximum residue level for citrus fruits. If the proposed use in Israel becomes registered, supervised trials data from Israel and Spain would suggest an MRL of 2 mg/kg.

The registered use of folpet on apples in Portugal requires a spray concentration of 0.13 kg ai/hl and a PHI of 21 days. Trials in Portugal and Israel conformed with this use pattern; the highest residues of folpet were

1.4 and 1.8 mg/kg. The Meeting was also aware of supervised trials on apples in France currently awaiting a final report. Because of the limited number of trials currently available within GAP the Meeting recommended withdrawal of the temporary MRL for apples.

Folpet is registered for use on grapes in Argentina, France, Italy and Spain. Supervised trials data were available from these countries. Trials were also available from Israel and were evaluated against GAP for grapes in Portugal and Spain. Residues arising from use according to GAP commonly fall in the 0.5-1 mg/kg range but residues of 1.3 and 2.0 mg/kg were recorded in a Spanish trial. The Meeting estimated a maximum residue level of 2 mg/kg for folpet in grapes.

Residue trial data on strawberries were provided from Brazil, Hungary, Israel, Spain and Uruguay, but there was no GAP for Hungary, Israel or Uruguay. Most of the residues in the Brazilian trials within GAP were in the 1-2 mg/kg range. The highest folpet residue in the Spanish trial within GAP was 1.1 mg/kg.

A folpet trial on strawberries in Israel (where registration is proposed) was evaluated against Portuguese GAP. Residues were consistently in the 2-5 mg/kg range, and were quite persistent. The highest residues were 4.7 and 4.8 mg/kg. The Hungarian trial was evaluated against Netherlands GAP; the highest folpet residue was 0.78 mg/kg. The Meeting estimated a maximum residue level of 5 mg/kg for folpet in strawberries.

No folpet was detected (<0.01 mg/kg) in melons from a French trial where an exaggerated spray concentration, approximately threefold, had been used. The laboratory had reported some problems with folpet recoveries when the sample was spiked before chopping. The fact that no residues were detected on samples taken the same day as the final application also throws doubt on the validity of the trial results.

No residues were detected (<0.02 mg/kg) in the pulp of melons in the Spanish trial. Data are required on a whole fruit-basis for MRL purposes. Trial data from the melon trials in Israel could not be evaluated because there is, as yet, no registered use in Israel.

The Meeting was unable to estimate a maximum residue level for folpet residues in winter squash because the data were too limited. The Meeting was informed that cucumber trial data would become available in the future from Turkey, Israel and Cyprus.

Folpet residues in lettuce treated according to Brazilian GAP ranged up to 1.4 mg/kg. Trial data on lettuce from Israel could not be evaluated because there is no registered use of folpet on lettuce in Israel, although it is proposed. The Meeting was also aware of supervised trials on lettuce in France currently awaiting a final report. Because of the limited number of trials available at present within GAP the Meeting recommended withdrawal of the temporary MRL for lettuce.

Supervised trials data for folpet on potatoes were available from Denmark, Israel, The Netherlands, the UK and Uruguay. The only country in this list which has registered uses for folpet on potatoes is Uruguay. Folpet residues in the trials from these countries were mostly not detectable (<0.01, <0.02 mg/kg). The pattern of residues expected for potatoes from the foliar use of a non-systemic pesticide is the occasional detection where a tuber has been directly exposed, but with no residues in most tubers. This pattern would not be much affected by the rate of application. The highest residue detected was 0.49 mg/kg in one plot in the Uruguay trial.

The Meeting noted that residues were generally undetectable in potatoes from application rates of 1.3 to 4.0 kg ai/ha in a number of different countries. The Meeting estimated a maximum residue level of 0.02* mg/kg for folpet in potatoes.

The maximum application rate for folpet on tomatoes in France is 1 kg ai/ha, but the rates used in the supervised trials were 1.5 and

3.0 kg ai/ha, so the data could not be used to estimate maximum residue levels. Folpet is not registered for use on tomatoes in Israel (although there is a proposed registration) so the data from trials in Israel could not be used. Folpet residues in tomatoes in Hungary treated according to GAP were not detectable (<0.02 mg/kg) 14 days after the final application. The Meeting considered the data were insufficient to estimate a maximum residue level for tomatoes.

Phthalimide residue data were also provided for most of the supervised trials. Phthalimide is the major primary metabolite of folpet. In many cases phthalimide residues were not detected in the trials, but in some cases they were of the same order as those of folpet, or even exceeded them. Phthalimide levels were generally not well related to the use of folpet and should not be included in the residue definition as an indicator of compliance with GAP.

The stability of folpet and phthalimide residues in stored analytical samples (lettuce, potato, tomato, melon), separately fortified with each compound at 1 mg/kg, was tested at -18°C. About 10-20% of the residues were lost during 6 months freezer storage.

In the analytical methods used for many of the trials, samples were chopped and extracted with ethyl acetate, then cleaned up on a Florisil column for folpet, or by solvent partition (hexane, phosphate buffer) for phthalimide. Gas-liquid chromatography on a megabore column with a ^{63}Ni electron-capture detector for folpet and with a thermionic nitrogen-specific detector for phthalimide was used for the final determination. No interference was caused by 25 common pesticides which might occur in crop samples. The limits of determination were 0.05 mg/kg for folpet and 0.2 mg/kg for phthalimide. Limits of detection were lower by factors of 2-2.5.

The Meeting received information on national MRLs for folpet from Canada, the EEC, Hungary, The Netherlands and the USA.

RECOMMENDATIONS

On the basis of the data from supervised trials the Meeting concluded that the residue levels listed below are suitable for establishing maximum residue limits.

Definition of the residue: folpet.

Commodity		Recommended MRL, mg/kg		PHI on which based, days
CCN	Name	New[1]	Previous	
FP 0226	Apple	W	10 T	
FS 0013	Cherries	W	15 T	
FC 0001	Citrus fruits	W	10 T	
VC 0424	Cucumber	W	2 T	
FB 0269	Grapes	2	25 T	21
VL 0482	Lettuce, Head	W	15 T	
VC 0046	Melons, except Watermelon	W	2 T	
VA 0385	Onion, Bulb	W	2 T	
FB 0275	Strawberry	5	20 T	7
VR 0589	Potato	0.02*		
VO 0448	Tomato	W	5 T	

[1] W: the previous recommendation is withdrawn.

FURTHER WORK OR INFORMATION

Desirable

1. Full details and results of the French trials on apples and lettuce now awaiting final reports, together with full details of the relevant French GAP.

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