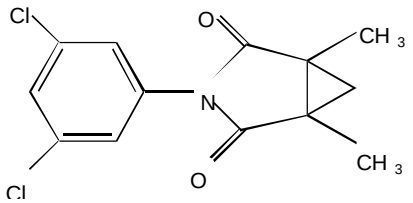
PROCYMIDONE (136)

EXPLANATION

Procymidone was reviewed by the JMPR in 1981, 1989, 1990 and 1993. Recommendations from the 1993 review included the withdrawal of draft MRLs for apples, currants (black, red and white), egg plant, kiwifruit, melons, except watermelon, potatoes and rice (polished and husked). These recommendations were confirmed by the CCPR at the 27th (1995) Session.

At the 1996 CCPR, MRLs for nectarines and peaches were withdrawn in the absence of new data (ALINORM 97/24). The Committee was informed by the manufacturer that new data on kiwifruit, peaches, plums, peas and brassica vegetables would be available for evaluation in 1998 (ALINORM 95/24A, para 131, 132, 133 and 134). In addition, residue data for pears have been reported. Information on analytical methods and monitoring was provided by The Netherlands.



Structure of procymidone

METHODS OF RESIDUE ANALYSIS

Analytical methods

Validated methods for the quantification of procymidone in pears, peaches, plums, cabbages and peas were provided (Provot, 1996a,b,c, 1997, 1998). All analytical reports were validations of Method No. BA-70-0020 (Sumitomo Reference No. BA-70-0220). Various methods were reported in the 1981 monograph and reviewed by Ambrus *et al.* (1991). Validation of the methods used for the determination of procymidone in kiwifruit was not provided, and recoveries in all kiwifruit trials were either not or inadequately reported.

The validated methods are all similar. The sample is homogenized with acetone and filtered through celite and the extraction with acetone is repeated with the filter cake. The combined filtrates are washed with 10% aqueous NaCl solution and hexane. The hexane layer is collected, dried and evaporated to near-dryness. The remaining residues are transferred to a Florisil column, eluted with 10:1 hexane/ethyl acetate and evaporated to dryness. The remaining procymidone residues are re-dissolved in hexane for quantification by GLC with a thermionic nitrogen detector (NPD). The limit of determination in all crops is 0.02 mg/kg; recoveries were 70-110%, as shown in Table 1.

Table 1. Recoveries of procymidone from in pears, peaches, plums, cabbages and peas.

Sample	Fortification levels, mg/kg [1]	Recovery range, %	Mean % ± SD
Pears	0.02, 0.2, 2.0	78-109	88 ± 11.6
Peaches	0.02, 0.2, 2.0, 3.0, 4.0	70-108	90 ± 13.2
Plums	0.02, 0.2, 2.0	80-110	95 ± 8.7
Cabbages	0.02, 0.2, 10	75-109	94 ± 12
Peas, seeds	0.02, 0.2, 2.0	83-110	100 ± 8
Empty pods	0.02, 0.2, 2.0	73-102	88 ± 10
Whole plants (early harvest)	0.2, 10, 30	72-115	93 ± 16
Whole plants (late harvest)	0.2, 10, 30	78-110	94 ± 12

[1] Triplicate samples at each concentration.

A multi-residue method was provided by The Netherlands government (1996). Residues in fruits and vegetables may be extracted by homogenising the commodity with ethyl acetate and sodium sulfate, followed by gravity filtration, or by extraction with acetone followed by CH_2Cl_2 and petroleum ether and separation of the organic phases. The extracts are cleaned on an alumina column, eluted with hexane and ethyl acetate (9:1) and the residue determined by GLC with an ECD, NPD or ion trap detector. The limits of determination ranged from 0.001 to 0.1 mg/kg with recoveries above 80%. Recoveries from lettuce were 98-111% at fortification concentrations from 0.12 to 1.0 mg/kg.

Stability of residues in stored analytical samples

Negligible degradation of residues was found in strawberry samples which were fortified with procymidone at concentrations of 0.05 and 0.5 mg/kg, stored at -26°C and analysed after 0, 6 and 12 months. Recoveries ranged from 77 to 110% at 0.05 mg/kg and from 81 to 96% at 0.5 mg/kg over the 12-month period (Halasz-Laky, 1992).

Procymidone residues were stable in field-treated and fortified cherry samples for 12 months (Kadenczki, 1993). Treated samples were collected 21 days after application of a 50 WP formulation at 0.7 kg ai/ha and stored whole. Untreated samples were pipped and homogenised, then fortified at levels of 0.05 and 0.5 mg/kg. The samples were kept in frozen storage (-20 to -25 °C) for 12 months and analysed at 0, 6, 9 and 12 months. Procymidone residues in field-treated samples ranged from 0.30 to 0.45 mg/kg at 0, 0.28 to 0.49 mg/kg at 6, and 0.37 to 0.50 mg/kg at 12 months. Recoveries from homogenised samples fortified at 0.05 mg/kg ranged from 62 to 96% and from those fortified at 0.5 mg/kg from 64 to 112% over the 12-month storage period. The average recoveries from all the samples at levels of 0.02-3 mg/kg ranged from 63 to 102%.

Procymidone was stable in homogenised lettuce fortified at concentrations of 0.1 and 1.0 mg/kg and stored at -20°C for 12 months (Gillis, 1995a). Analyses after 1, 3, 6 and 12 months gave recoveries of 93 to 104% at 0.1 mg/kg and 91 to 99% at 1.0 mg/kg over the 12-month period.

Homogenised haricot beans were fortified with procymidone at concentrations of 0.1 and 1.0 mg/kg and stored at -20°C for 12 months (Gillis, 1995b). After 0, 1, 3, 6 and 12 months of storage recoveries were 83 to 105% at 0.1 mg/kg and 87 to 99% at 1.0 mg/kg. No degradation of procymidone was detected.

USE PATTERN

Procymidone, *N*-(3,5-dichlorophenyl)-1,2-dimethylcyclopropane-1,2-dicarboximide, is a fungicide used for the prevention and control of *Monilinia*, *Sclerotinia* and *Botrytis* species in fruits and

vegetables. It is marketed as a 25% suspension concentrate (25 SC), 500g/l suspension concentrate (500 SC), 50% wettable powder (50 WP), 50% water-dispersible granule (50 WG) and 75% water-dispersible granule (75 WG).

Information on registered use patterns in EU member countries was provided by The Netherlands government and on uses in various countries by the manufacturer. The use patterns for pears, peaches, plums, kiwifruit, peas and cabbages are shown in Table 2. Information on GAP for cabbages in Greece and peas in Germany was tabulated but registered product labels were not provided.

Table 2. Use patterns of procymidone

Crop	Country	Form	Application				PHI, days
			Method	Rate, kg ai/ha	Spray conc., kg ai/hl	No.	
Almond	France	500 g/l Liq, SC, 50 WP	High volume	0.75 0.75	0.075 0.075	– –	8 15
Almond	Italy	50 WP, 50 WG, 75 WG	High volume	1.13-1.80 1.5-2.0	0.075-0.10 0.075-0.10	–	
Almond	Lebanon	50 WP	Foliar		0.025-0.05		14
Apple	Lebanon	50 WP	Foliar		0.025-0.05		14
Apricot	France	500 g/l Liq., SC, 50 WP	High volume	0.75	0.075	–	8
Apricot	Italy	50 WP, 50 WG, 75 WG	High volume	1.13-1.80 0.75-1.35 1.5-2.0 1.0-1.5	0.075-0.1 0.05-0.075 0.075-0.1 0.05-0.075	2-3 2 2-3 2	14
Apricot	Jordan	50 WP	Foliar		0.025-0.05		14
Apricot	Lebanon	50 WP	Foliar		0.025-0.05		14
Asparagus	Italy	50 WP, 50 WG, 75 WG	Foliar	0.5-0.9	0.05-0.075		[1]
Aubergine	France	500 g/l Liq., SC, 50 WP	Foliar	0.75 0.75			7 3
Aubergine	Italy	50 WP, 50 WG, 75 WG	Foliar	0.04-0.05	0.24-0.42	3	14
Aubergine	Jordan	50 WP	Foliar		0.025-0.05		3
Aubergine	Netherlands	EC, 50 WP	Foliar	0.125-0.375	0.025	5	3
Aubergine	Poland	SC	Foliar	0.5-0.75	0.05	2-3	3
Beans[2]	Australia	500 g/l Liq.	Foliar	0.75	0.075	2	–
			Post-harvest dip	50 g ai/100 l solution			–
Beans	France	500 g/l Liq, SC, 50 WP	Foliar spray	0.75		1-2	14-15
Beans	Germany	500 g/kg WG	Foliar[3]	0.38	0.063	3	7
Beans	Italy	50 WP, 50 WG, 75 WG	Foliar	0.3-0.6	0.05-0.075		14
Beans	Jordan	50 WP	Foliar		0.025-0.05		21
Beans	Lebanon	50 WP	Foliar		0.025-0.05		3
Beans	New Zealand	25 FL	Foliar	0.5	0.05	2	3
Beans	Poland	SC	Foliar	0.51	0.083	2	3
Beans	Romania	50 WP	Foliar	0.5	0.05		14
Beans	South Africa	250 g/l SC	Foliar	0.375	0.075	2-3	14
Blackberry	Switzerland	50 WG	Foliar	0.75-1.0			14
Broad beans	Netherlands	EC, 50 WP	Foliar	0.5		2	14

[1] Treatment of vegetation post-harvest.
[2] Same use pattern for green beans and navy beans.
[3] At beginning, middle and end of flowering.

Crop	Country	Form	Application				PHI, days
			Method	Rate, kg ai/ha	Spray conc., kg ai/hl	No.	
Cabbages	France	500 g/l Liq, SC, 50 WP	Foliar spray	0.75		–	21
Cabbage	Jordan	50 WP	Foliar		0.025-0.05		14
Celery	Jordan	50 WP	Foliar		0.025-0.05		14
Cherry	Italy	50 WP, 50 WG, 75 WG	High volume	1.125-1.80 1.5-2.0	0.075-0.10 0.075-0.10	2-3[4]	21
Cherry	Jordan	50 WP	Foliar		0.025-0.05		14
Cherry	Lebanon	50 WP	Foliar		0.025-0.05		14
Colza	Italy	50 WG, 75 WG	Foliar	0.50-0.75		1	
Colza	France	500 g/l Liq.	Foliar	0.75			
Courgette	France	500 g/l Liq., SC, 50 WP	Foliar	0.75			7 3
Courgette	Netherlands	EC, 50 WP	Foliar	0.125-0.375	0.025	5	3
Cucumber	Italy	50 WP, 50 WG, 75 WG	Foliar	0.3 –0.6	0.05-0.075		14
Cucumber	Netherlands	EC, 50 WP	Foliar	0.125-0.375	0.025	5	3
Cucumber	Jordan	50 WP	Foliar		0.025-0.05		3
Cucumber	Poland	SC	Foliar	0.5-0.75	0.05	2-3	3
Cucumber	Romania	50 WP	Foliar	0.5	0.05		14
Currants	Poland	SC	High volume	0.75	0.038-0.075	2-3	14
Faba beans	Australia	500 g/l Liq.	Foliar	0.25			
Garlic	Australia	500 g/l Liq.	Pre-plant treatment	5 g ai/kg cloves			
Garlic	France	500 g/l Liq., SC, 50 WP	Bulb Foliar	150 g ai/100 kg of bulbs[5] 0.75			 21
Garlic	Italy	50 WP, 50 WG, 75 WG	Bulb Foliar	15 g ai/100 kg 0.3-0.8	0.05-0.1[6]		
Garlic	Uruguay	50 WP	Bulb	500 g ai/100 kg cloves			
Gherkin	France	500 g/l Liq., SC, 50 WP	Foliar	0.75			7 3
Gherkin	Netherlands	EC, 50 WP	Foliar	0.125-0.375	0.025	5	3
Grapes	Australia	500 g/l	Foliar	0.5	0.038	4	5
Grapes (vines)	France	500 g/l Liq. SC, 50 WP	High volume	0.75 0.75	0.075	 1[7]	14
Grapes (vines)	Italy	25 SC, 50 WP, 50 WG, 75 WG	Foliar	 0.4-0.75	0.050-0.075 0.04-0.075 0.038-0.075	3-4 2-4 2-4	21
Grapes	New Zealand	25 FL	High volume	0.75	0.05	2	
Grapes	Romania	50 WP	Foliar	0.5-0.75			14
Grapes (table)	South Africa	250 g/l SC	Foliar		0.05	4	28
(wine)					0.05	3	7
Grapes	Switzerland	50 WG	Foliar	1.0	0.05	4	[8]
Grapes	Uruguay	50 WP	Foliar	0.5-0.75	0.0375-0.05		28
Green beet	Italy	50 WP, 50 WG, 75 WG	Foliar	0.3-0.4	0.05 0.0525		2
Green peppers	France	SC, 50 WP	Foliar	0.75			3
Green peppers	Italy	50 WP, 50 WG, 50 WG	Foliar	0.24-0.40 0.225-0.42	0.04 –0.05 0.038-0.053	1	14
Green peppers	Netherlands	EC, 50 WP	Foliar	0.125-0.375	0.025	5	3
Green peppers	Poland	SC	Foliar	0.5-0.75	0.05	1-2	3
Hazel nut	France	500 g/l Liq., SC, 50 WP	High volume	0.75	0.075	–	8

[4] No more than 3 sprays per season.
[5] Bulb treatment before planting.
[6] Bulb treatment against *Botrytis* and *Sclerotinia*; not indicated as pre-planting, so presumably storage.
[7] At veraison.
[8] Last spray end of August.

Crop	Country	Form	Application				PHI, days
			Method	Rate, kg ai/ha	Spray conc., kg ai/hl	No.	
Hazelnut	Italy	50 WG, 75 WG			0.038-0.053		
Kiwifruit	France	500 g/l Liq, SC, 50 WP	High volume	0.75	0.075	–	8[9]
Kiwifruit	Italy[10]	25 SC	Foliar	–	0.075-0.100	5	14
		50 WP, 75 WG		0.56-0.95	0.038-0.053	2-3	
		50 WG		0.75-1.0	0.038-0.050	2-3	
		50 WP, 50 WG	Post-harvest dip	6 g ai/100 l solution		1	60[11]
Lentils	France	500 g/l Liq, SC, 50 WP	Foliar	0.75		1-2	14-15
Lettuce	Australia	500 g/l Liq.	Foliar	0.28-0.6	0.038-0.05		
			Drench	2.5 g ai/L/800 seedlings in a tray			2
			Soil surface spray	1.0	0.1		2
Lettuce[12]	France	500 g/l Liq. SC, 50 WP	Soil, storage	30 g ai/hl[13] 1.5 g ai/m^2 [14]			21
			Foliar	0.75			
Lettuce	Italy	50 WP, 50 WG, 75 WG	Foliar	0.75-1.0 0.5-0.75		2	14
Lettuce	Jordan	50 WP	Foliar		0.025-0.05		–
Lettuce	Lebanon	50 WP	Foliar		0.025-0.05		3
Lettuce[12]	Netherlands	EC, 50 WP	Foliar[15]	0.75 2.0		3 1	
Lettuce	Uruguay	50 WP		0.05			7
Melon	France	500 g/l Liq., SC, 50 WP	Foliar	0.75			7 3
Melon	Netherlands	EC, 50 WP	Foliar	0.125-0.375	0.025	5	3
Melon	Poland	SC	Foliar	0.5-0.75	0.05	2-3	3
Minneola	South Africa	250 g/l SC	Foliar		0.05		120
Onions	Australia	500 g/l Liq.	Seed treatment	10 g ai/kg seed			28
			In-furrow	2 kg ai/ha			28
			Soil spray	1 kg ai/ha		2	28
			Transplant dip	0.5 kg ai/100 l solution			28
Onions, shallots	France	500 g/l Liq., SC, 50 WP	Bulb Foliar, soil	150 g ai/100 kg of bulb[16](shallots) 0.75 (Botrytis, Sclerotinia)			21
Onions	Italy	50 WP, 50 WG, 75 WG	Seed treatment,	0.5 g ai/kg onion seed			
			Foliar	0.3-0.6	0.05-0.075		28
					0.053-0.075		14
Onions	Jordan	50 WP	Foliar		0.025-0.05		1
Onions Shallots	Netherlands	EC, 50 WP	Soil pre-planting	2-3		1	28
			Foliar (shallots)	0.25		1-2	28
Onions	Uruguay	50 WP	Transplanting	100 g ai/100 l solution			3
			Foliar	0.75	0.075		3
Peaches	Australia	500 g/l Liq.	Foliar		0.025 0.0375	4-6	8

[9] Reduction in PHI to 3 days has been proposed in EU submission.
[10] 3 foliar sprays plus a post-harvest dip treatment or 5 consecutive sprays.
[11] 60 days after harvest or post-harvest treatment.
[12] Lettuce includes chicory, witloof, endive and cos lettuce.
[13] Foliar spray and root treatment after planting and after harvest for storage or transport.
[14] Root treatment and soil/bed treatment at planting or transplanting.
[15] Lower rate for 3 sprays, 1st 7 days after planting and 2nd 14 days after planting; higher rate 7 days after planting only.
[16] Bulb treatment before planting.

Crop	Country	Form	Application				PHI, days
			Method	Rate, kg ai/ha	Spray conc., kg ai/hl	No.	
			Post-harvest dip	50 g ai/100 l solution			
Peaches	France	500 g/l Liq, SC, 50 WP	High volume	0.75	0.075		8
Peaches	Italy	25 SC	Foliar spray	–	0.075-0.100	3	
				–	0.05-0.075	2[17]	
		50 WP, 75 WG	High volume	1.125-1.80	0.075-0.100	2-3	
		50 WG		1.50-2.0	0.075-0.100	2-3	14
Peaches	Jordan	50 WP	Foliar		0.025-0.05		30
Peaches	Lebanon	50 WP	Foliar		0.025-0.05		14
Peaches	Morocco	50 WP	Foliar		0.25		
Peaches	New Zealand	25 FL	High volume	0.75-1.0	0.038-0.05	3	1
Peaches	Romania	50 WP	Foliar	0.5-0.75	0.05-0.075		14
Peaches	South Africa	250 g/l SC	Foliar		0.0375	2	7
Peaches	Switzerland	50 WG	Foliar	1.0			
Peaches	Uruguay	50 WP	Foliar	0.5-0.75	0.025-0.0375		7
Pears	Italy	25 SC, 75 WP	High volume	0.75-1.35	0.050-0.075		14
		50 WG		1.0-1.5	0.050-0.075		14
Pears	Lebanon	50 WP	Foliar		0.025-0.05		3
Pears	South Africa	250 g/l SC	Foliar		0.05		
Pears	Switzerland	50 WG	Foliar	1.0	0.05		
Peas	France	500 g/l Liq, SC, 50 WP	Foliar spray	0.75		1-2	14-15
Peas (field)	Germany	500 g/kg WG	Foliar	0.5	0.125	1	14
Peas	South Africa	250 g/l SC	Foliar	0.5			21
Peppers	Jordan	50 WP	Foliar		0.025-0.05		7
Peppers	Lebanon	50 WP	Foliar		0.025-0.05		21
Pimento	France	500 g/l Liq.	Foliar	0.75			7
Plums	Italy	50 WP, 75 WG	High volume	1.125-1.80	0.075-0.100	3	21
		50 WG		1.50-2.00	0.075-0.100		
Plums	France	500 g/l Liq, SC, 50 WP		0.75	0.075	–	8
Plums	Lebanon	50 WP	Foliar		0.025-0.05		14
Potato	Australia	500 g/l Liq.	Foliar	0.25 0.5			7
Potato	Jordan	50 WP	Foliar		0.025-0.05		
Potato	Lebanon	50 WP	Foliar		0.025-0.05		45
Potato	South Africa	250 g/l SC	Foliar	0.625-0.937	0.125		35
Rape seed	France	SC					8
Rape seed	Germany	500 g/kg WG	Foliar	0.5	0.125	1[18]	56
Rape seed	Italy	50 WP	Foliar	0.5-0.75		1[19]	7
Rape seed	Poland	SC	High volume	0.75	0.19-0.38	1-2	56
Raspberry	France	500 g/l Liq., SC, 50 WP	Foliar	0.75	0.075	–	14
Raspberry	Switzerland	50 WG	Foliar	0.75-1.0			14
Strawberry	France	500 g/l Liq., SC, 50 WP	Foliar	0.75		3-4[20]	–
Strawberry	Germany	500 g/kg WG	Foliar	0.75	0.038	3[21]	7
Strawberry	Italy	25 SC, 50 WP, 50 WG, 75 WG	Foliar	0.23-0.42	0.0375-0.050 0.038-0.053	3 3	14
Strawberry	Jordan	50 WP	Foliar		0.025-0.05		
Strawberry	Netherlands	EC, 50 WP	Foliar	0.19-0.45	0.0375-0.05 0.25-0.60	3-5	14

[17] Apply 4 or 5 weeks and 2 or 3 weeks before harvest.
[18] At beginning of infection or when 50 to 60% of buds have opened.
[19] Apply at first flowering.
[20] 3 or 4 sprays from beginning of flowering.
[21] Beginning, middle and end of flowering.

Crop	Country	Form	Application				PHI, days
			Method	Rate, kg ai/ha	Spray conc., kg ai/hl	No.	
Strawberry	New Zealand	25FL	Foliar	0.5	0.05	2	
Strawberry	Poland	SC	Foliar	0.75-1.25	0.05-0.38	1-2	7
Strawberry	Romania	50 WP	Foliar	0.5-0.75	0.05-0.075		14
Strawberry	Switzerland	50 WG	Foliar	0.75-1.0			14
Strawberry	Uruguay	50 WP	Foliar	0.5-0.75	0.0475-0.05		–
Sugar beet	Poland	SC	High volume	5 g ai/ton of root*			
Sunflower	Italy	50 WP, 50 WG, 75 WG	Seed	50-100 g ai/100 kg seed (57.75-97.5)			7
			Foliar	0.3-0.4	0.05		3
				0.315-0.42	0.053	2[22]	21
Sunflower	Romania	50 WP	Seed treatment	0.5 g ai/kg seed			14
			Foliar	0.5			14
Tomato	Australia	500 g/l Liq.	Foliar	0.28-0.60	0.0375-0.05		14
Tomato	France	500 g/l Liq., SC, 50 WP	Foliar	0.75			3
Tomato	Italy	25 SC, 50 WP, 50 WG, 75 WG	Foliar	0.24-0.40 0.225-0.42	0.04-0.05 0.038-0.053	–	7
Tomato	Jordan	50 WP	Foliar		0.025-0.05		3
Tomato	Morocco	50 WP	Foliar		0.3		
Tomato	Netherlands	EC, 50 WP	Foliar	0.125-0.375	0.025	5	
Tomato	Poland	SC	High volume	0.5-0.75	0.05	2-3	3
Tomato	Romania	50 WP	Foliar	0.5	0.05		14
Tomato	South Africa	250 g/l SC	Foliar		0.025		3
Watermelon	Jordan	50 WP	Foliar		0.025-0.05		21
Watermelon	Lebanon	50 WP	Foliar		0.025-0.05		3

RESIDUES RESULTING FROM SUPERVISED TRIALS

Data from numerous supervised trials on pears, peaches, plums, kiwifruit, peas and brassica vegetables were submitted for evaluation and are shown in Tables 3-11. All the trials were in France and Italy.

Table 3 Pears, *Italy.*
Table 4 Peaches, *France and Italy.*
Table 5 Plums, *France and Italy.*
Table 6 Kiwifruit, *France and Italy.*
Table 7 Kiwifruit, *Italy.*
Table 8 Cabbage, *France.*
Table 9 Cauliflower, Brussels sprouts, broccoli, *France.*
Table 10 Peas, *France.*
Table 11 Pea plants; legume animal feeds, *France.*

Trials where residues were found in untreated control samples are indicated by *c* followed by the corresponding residues in the control. Trials unsuitable for evaluation owing to the residues found in untreated samples and/or lack of appropriate information on recoveries are shaded in the Tables. The residues in the peaches and plums were calculated from the ratio of the weight of the stone and flesh to that of the flesh alone.

Residues from trials according to GAP are underlined; those used to estimate STMRs are double underlined. In instances where more than one figure is given, the samples were taken from

[22] 2 sprays before flowering.

different replicate plots. All residues are defined as procymidone. The limit of quantification was 0.02 mg/kg, unless otherwise stated.

Pears. Five applications were made at 1.08 to 1.38 kg ai/ha (0.075 kg ai/hl) which complied with Italian GAP. Although a re-treatment interval of 7 to 10 days is specified on the labels provided, the actual intervals between sprays 4 and 5 were 14 or 15 days. In two trials, finite residues were detected in untreated control samples. The results are shown in Table 3 (Sumitomo, 1997c).

Peaches. The trials in France and Italy complied with GAP. Applications were made at rates from 0.075 to 0.1 kg ai/hl. In one of the 1993 French trials recoveries were not adequately reported since an average over a range of fortification levels was reported without indication of recoveries at individual concentrations. The results are shown in Table 4 (Benet and Massenot, 1994a, 1995a).

Plums. Trials according to GAP in France (north and south regions) and Italy were reported. Residues in prunes were reported in one French trial. Application rates ranged from 0.75 to 1.8 kg ai/ha. The results are shown in Table 5 (Benet and Massenot, 1995b; Massenot and Cohadon, 1996a, 1997a).

Kiwifruit. Trials with foliar and post-harvest treatments were reported, but GAP was reported only for post-harvest treatments. The residues were determined in fruit treated up to 4 weeks before harvest and in cold storage for up to 4 months. On registered product labels 2 to 5 consecutive foliar sprays are indicated, but only single applications were made in the trial. The results are shown in Tables 6 and 7 (Massenot and Cohadon, 1987; Maini and Boni, 1985; Gandolfi and Collina, 1989).

The residues in the whole fruit are shown, although individual figures for pulp and peel were given. After post-harvest treatment (Table 7), residues in the pulp were 0.02 mg/kg to 0.15 mg/kg from dip concentrations of 3.25 to 25 kg ai/100 l. Recoveries were not adequately reported for any of the trials nor any storage details for the 1984 Italian trial.

Brassica vegetables. GAP was reported only for head cabbages in France and Jordan, although trials on cauliflower, broccoli and Brussels sprouts were also reported. In all the trials two applications were made at the maximum rate of 0.75 kg ai/ha. The registered labels provided describe specific application to cabbages only; not to other brassica crops. The residues in cabbages are shown in Table 8 and those in cauliflower, Brussels sprouts and broccoli in Table 9 (Benet and Massenot, 1994b,c, 1995c; Massenot and Cohadon, 1996b, 1997b). Recoveries in the two 1993 trials on cabbages were not adequately reported;. an average was given over a range of fortifications.

Peas. Supervised trials in France were reported, where a maximum of 2 sprays may be applied at 0.75 kg ai/ha. The residues were determined in whole plants with pods (early harvest and late harvest), whole pods, peas, and empty pods. The residues in whole plants, which are used as animal feed, are shown in Table 11. Differences were noted between the residues in mechanically and hand-harvested pods. The highest residues were found in whole plants and empty pods.

Table 3. Supervised trials on pears in Italy (Sumitomo, 1997c).

Year, Trial ID.	Application				PHI, days	Residues, mg/kg
	Form	No.	kg ai/ha	kg ai/hl		
1995 IIQ95/IT/01/01	50 WP	5	1.376	0.075	14	0.62
1995 IIQ95/IT/01/02	50 WP	5	1.082	0.075	14	0.16

Year, Trial ID.	Application				PHI, days	Residues, mg/kg
	Form	No.	kg ai/ha	kg ai/hl		
1995 IIQ95/IT/02/A	50 WP	5	1.361	0.075	0 3 7	1.85, 2.12, 2.24, 2.38 1.32, 1.33, 1.57, 1.60 1.10
					14 21	0.58 0.25, 0.27, 0.32, 0.34
1995 IIQ95/IT/02/B	50 WP	5	1.103	0.075	0 3 7 14 21	1.40, 1.43, 1.66, 1.71 *c* 0.25 1.49 *c* 0.16 0.77 *c* 0.11 0.45 *c* 0.05 0.30 *c* 0.09
1996 IIQ96/IT/02/A	50 WP	5	1.361	0.075	0 3 7 14 21	1.45 1.02 0.97 0.43 0.37
1996 IIQ96/IT/02/B	50 WP	5	1.340	0.075	0 3 7 14 21	1.26 1.43 1.20 0.65 *c* 0.11, 0.12 0.40 *c* 0.06
1996 IIQ96/IT/01/01 IIQ96/IT/01/02	50 WP 50 WP	5 5	1.348 1.348	0.075 0.075	14 14	0.43 0.35

c Untreated control samples.

Table 4. Supervised trials on peaches.

Country, Year Trial ID.	Application				PHI, days	Residues, mg/kg Whole fruit	Reference
	Form	No.	kg ai/ha	kg ai/hl			
Italy 1995 IIQ95/IT/03A	50 WP	3	1.1	0.1	0 3 7 14 21	1.67 1.17 0.92 0.72 0.35	BR-0488
IIQ95/IT/03B	50 WP	3	0.917	0.1	0 3 7 14 21	1.63 2.23 3.25 1.33 0.51	BR-0488
France 1993 S 323.93	500 g/l SC	2	0.75	0.075	-0 1 4 8 15	0.22 0.69 0.56 0.39 0.28	BR-31-0445F (Benet and Massenot, 1994a)
S 502.93					-0 1	0.40 1.80	BR-31-0445F
					4 8 14	1.90 1.30 0.87	
France 1995 94FARSA01	500 g/l SC	2	0.73 0.75	0.079 0.084	1 8	0.41 0.19	BR-0477F (Benet and Massenot, 1995a)

Country, Year Trial ID.	Application				PHI, days	Residues, mg/kg Whole fruit	Reference
	Form	No.	kg ai/ha	kg ai/hl			
94FARSA02	SC	2	0.75	0.10	1	0.65	BR-0477F
			0.75	0.11	8	0.44	
					14	0.30	
94FARSA03	SC	2	0.73	0.093	1	1.40	BR-0477F
			0.75	0.094	8	1.40	
					14	0.72	
94FARSA04	SC	2	0.75	0.094	1	0.75	BR-0477F
			0.76	0.093	8	0.68	
					14	0.28	

Table 5. Supervised trials on plums.

Country, Year Trial ID.	Application				PHI, days	Residues, mg/kg	Reference
	Form	No.	kg ai/ha	kg ai/hl			
Italy 1995	50 WDG	3	1.80	0.188	0	1.17	BR-0489
F-R-11-6011/95					7	1.21	
					14	0.83	
					21	0.74	
					28	0.52	
F-R-12-6012/95	50 WDG	3	1.80	0.178	21	1.50 *c* 0.02, 0.03	BR-0489
F-R-13-6013/95	50 WDG	3	1.80	0.191	22	1.38 *c* 0.03, 0.03	BR-0489
France 1994	500 g/l SC	2	0.75	0.188	8	0.61 plum	BR-0478F
1/94/03302					8	0.51 dried fruit *c* 0.03	(Benet and Massenot, 1995b)
					14	0.84 flesh	
1/94/0	500 g/l SC	2	0.75	0.15	7	0.48	BR-0478F
					17	0.66	
France 1995	500 g/l SC	2	0.75	0.138	0	0.22	BR-0482
95 FARSA P 01					1	0.24	(Massenot, 1996a)
					3	0.40	
					7	0.59	
95 FARSA P 02		2	0.75	0.251	0	0.75	BR-0482
				0.240	1	0.65	
					3	0.58	
95 FARSA P 03		2	0.75	0.186	0	0.66	BR-0482
				0.182	1	0.65	
					3	0.67	
					8	0.60	
95 FARSA P 04		2	0.75	0.192	0	1.16	BR-0482
				0.194	1	1.66	
					3	0.78	
					8	1.06	
95 FARSA P 05		2	0.75	0.103	0	0.48	BR-0482
				0.099	1	0.44	
					3	0.31	
					8	0.19	
France 1996	500 g/l SC	2	0.75	0.109	7	0.31	BR-0492
96 FARSA P16				0.098			(Massenot, 1997a)
96 FARSA P17		2	0.75	0.183	7	0.77	BR-0492
				0.204			
96 FARSA P18		2	0.75	0.126	7	1.20	BR-0492
				0.157			
96 FARSA P19		2	0.75	0.219	7	0.90	BR-0492
				0.216			

Country, Year Trial ID.	Application				PHI, days	Residues, mg/kg	Reference
	Form	No.	kg ai/ha	kg ai/hl			
96 FARSA P20		2	0.75	0.239 0.224	0 1 3 7	0.89 0.98 1.02 0.86	BR-0492

Table 6. Supervised trials on kiwifruit, pre-harvest foliar treatment.

Country, Year Trial ID.	Application				PHI, days	Residues, mg/kg	Reference
	Form	No.	kg ai/ha	kg ai/hl			
France 1986	500 g/l SC	2	1.50		2	1.60 (whole fruit) 0.14 (pulp)	BR-71-0174F (Massenot and Culoto, 1987)
Italy 1984 [1] A	50% WP	2	0.112	0.075	161	0.07	BR-51-0154 (Maini and Boni, 1985)
B [2]		1	0.100	0.050	0 7 14 21 28 28 (5)[3] 28 (35) 28 (66) 28 (107)	1.89, 2.30, 1.53, 1.69 2.16, 1.49, 1.99, 0.97 2.12, 1.29, 0 79, 1.10 1.73, 1.46, 1.49, 0.81 1.01, 0.89, 0.79, 0.73 1.48, 0.95, 1.13, 0.83 *c* 0.03 1.31, 1.18, 1.22, 1.20 *c* 0.01 1.05, 1.19, 0.99, 0.93 *c* 0.02 1.09, 0.59, 1.02, 0.89 *c* 0.10	BR-51-0154
C		1	0.100	0.050	0 7 12 12 (30)[3] 12 (61) 12 (98)	0.96 (2), 1.17, 0.87 0.52, 0.94, 1.04, 1.64 0.88, 0.92, 0.82, 1.29 *c* 0.03 0.57, 1.16, 0.87, 0.80 *c* 0.01 0.96, 0.77, 0.99, 0.83 *c* 0.02 0.78, 0.77, 0.75, 0.66 *c* 0.01	BR-51-0154
D		1	0.100	0.050	0 5 5 (30)[3] 5 (61) 5 (100)	2.23, 1.34, 2.06, 2.54 1.41, 1.93, 1.73, 1.83 *c* 0.03 2.35, 0.68, 0.72, 0.65 *c* 0.01 1.61, 1.29, 2.60, 0.78 *c* 0.02 1.84, 0.78, 1.17, 1.14 *c* 0.01	BR-51-0154

[1] The limit of determination was not stated. [2] Individual figures represent four different trial sites.
[3] Samples were analysed after the periods of storage shown in parentheses.

Table 7. Supervised trials on kiwifruit in Italy, post-harvest dip treatment.

Year Trial ID.	Application			PHI, days	Residues, mg/kg	Reference
	Form	No.	g ai/100 l [1]			
1984[2]			50	0 31 60	2.68 (0.09 pulp) 2.74 4.30	BR-51-0154 (Maini and Boni, 1985)

Year Trial ID.	Application Form	No.	g ai/100 l[1]	PHI, days	Residues, mg/kg	Reference
				101	3.09	
			100	0	4.36 (0.11 pulp)	
				31	5.51	
				60	5.77	
				101	4.92	
1989	50 WP	1	3.25	0	0.45	BR-91-0254 (Gandolfi and Collina, 1989)
				30	0.51	
				57	0.40	
				90	0.48	
				117	0.31	
		1	6.5	0	1.39	
				30	1.25	
				57	0.85	
				90	0.85	
				117	0.76	
		1	12.5	0	2.63	
				30	2.51	
				57	2.16	
				90	2.00	
				117	1.45	
		1	25	0	3.31	
				30	3.58	
				57	1.99	
				90	2.21	
				117	2.33	

[1]. g ai/100 l of dipping solution.
[2] LOD not reported.

Table 8. Supervised trials on cabbages, France.

Year Trial ID	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg[1]	Reference
1993 S 203.93	500 g/l SC	2	0.75	0.25	26	0.04	BR-41-0452F (Benet and Massenot, 1994b)
1993 S 201.94	500 g/l SC	2	0.75	0.25	139	0.03	BR-41-0460F (Benet and Massenot, 1994c)
S 342.94		2	0.75	0.15	93	0.20	
1994 S 201.95	500 g/l SC	2	0.75	0.25	14	0.30	BR-0480 (Benet and Massenot, 1995c)
				0.15	21	0.30	
					28	0.09	
S 101.95		2	0.75	0.25	13	<0.02	BR-0480
					20	<0.02	
					27	<0.02	
S 605.95		2	0.75	0.25	15	0.67	BR-0480
					22	0.12	
					29	0.26	
S 341.95		2	0.75	0.15	14	1.40	BR-0480
					21	1.30	
					28	1.40	
1995 S 207.95	500 g/l SC	2	0.75	0.25	0	1.18	BR-0483 (Massenot and Cohadon, 1996b)
				0.15	9	0.31	
					14	0.03	
					21	0.03	

Year Trial ID	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg[1]	Reference
S 208.95		2	0.75	0.25	0	1.36	BR-0483
				0.15	7	0.02	
					14	0.04	
					21	<0.02	
S 209.95		2	0.75	0.25	0	1.17	BR-0483
				0.15	8	0.08	
					14	0.05	
					20	0.03	
S 606.95		2	0.75	0.25	0	0.45	BR-0483
					7	0.55	
					14	0.05	
					20	0.17	
1995	500 g/l SC	2	0.75	0.25	0	0.97	BR-0491
S 203.96				0.15	7	0.55	(Massenot 1997b)
					14	0.33	
					21	0.44	
S 501.96		2	0.75	0.25	0	4.75	BR-0491
					7	1.72	
					13	1.60	
					21	0.43	
S 340.96		2	0.75	0.15	0	1.01	BR-0491
					7	0.40	
					13	0.23	
					21	0.32	

[1] Outer wrapper leaves removed before analysis.

Table 9. Supervised trials on cauliflower, Brussels sprouts and broccoli in France.

Year Trial ID	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg	Reference
CAULIFLOWER							
1993	500 g/l SC	2	0.85	0.15	21	0.05	BR-41-0452F
S 345.93			0.75	0.15			(B. & M., 1994b)
1993	500 g/l SC	2	0.75	0.25	85	0.05	BR-41-0460F
S 202.94							(B. & M., 1994c)
S 340.93		1	0.75	0.15	30	0.03	
S 321.93		2	0.75	0.15	67	0.06	
1994	500 g/l SC	2	0.75	0.25	14	0.03	BR-0480
S 202.95				0.15	21	<0.02	(B. & M., 1995c)
					28	0.03	
S 401.95		2	0.75	0.25	15	<0.02	
					21	<0.02	
					28	0.04	
S 604.95		2	0.75	0.25	14	0.24	
					21	0.12	
					28	0.17	
S 321.95		2	0.75	0.15	14	0.49	
					21	0.56	
					28	0.65	
1995	500 g/l SC	2	0.75	0.25	0	1.33	BR-0483
S 402.95					6	0.75	(M. & C., 1996b)

Year Trial ID	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg	Reference
					14	0.28	
					19	0.22	
S 608.95		2	0.75	0.25	0	1.93	
					7	1.62	
					14	0.68	
S 641.95		2	0.75	0.25	0	0.26	
					7	0.08	
					14	0.04	
					19	0.05	
S 642.95		2	0.75	0.25	0	0.06	
					7	0.08	
					14	0.06	
					19	0.05	
1995 S 204.96	500 g/l SC	2	0.75	0.25 0.125	0 7	0.03 <0.02	BR-0491 (M. & C., 1997b)
					12	<0.02	
					20	<0.02	
S 205.96		2	0.75	0.25 0.125	0 7	0.04 0.03	
					14	0.02	
					20	<0.02	
BRUSSELS SPROUTS							
1995 S 607.95	500 g/l SC	2	0.75	0.25	0 6	0.29 0.21	BR-0483 (M. & C., 1996b)
					14	0.08	
					21	0.09	
1995 S 642.96	500 g/l SC	2	0.75	0.25	0 7	0.75 0.37	BR-0491 (M. & C., 1997b)
					14	0.22	
					20	0.14	
BROCCOLI							
1995 S 609.95	500 g/l SC	2	0.75	0.25	0 7	2.30 1.65	BR-0483 (M. & C., 1996b)
					14	0.93	
					20	0.39	
1995	500 g/l SC	2	0.75	0.25	0	3.07	BR-0491
S 641.96					7	1.29	(M. & C., 1997b)
					14	0.40	
					19	0.23	

B. & M. = Benet and Massenot M. & C. = Massenot and Cohadon

Table 10. Supervised trials on peas in France.

Year Trial ID.	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg	Reference
1992 S 322.92	500 g/l SC	2	0.75	0.25	13	0.49 whole pod 0.15 peas 1.20 empty pods	BR-21-0336F (Benet and Massenot, 1992)

Year Trial ID.	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg	Reference
S 341.92		2	0.75	0.25	20	0.25 whole pod 0.07 peas 0.44 empty pods	BR-21-0336F
S 201.92		2	0.75	0.25	21	0.17 whole pod 0.03 peas 0.43 empty pods	BR-21-0336F
S 202.92		2	0.75	0.25	27	0.05 whole pod <0.02 peas 0.13 empty pods	BR-21-0336F
1994 S 203.94	500 g/l SC	2	0.75	0.25	1 7 14 21	1.8 whole pod 0.69 whole pod peas 0.16 <u>0.36</u> whole pod peas 0.07 0.24 whole pod peas 0.07	BR-0476 (Benet and Massenot, 1995d)
S 406.94		2	0.75	0.25	1 7 14 21	1.7 whole pod 1.1 whole pod peas 0.32 0.66 whole pod peas 0.16 <u>2.1</u> whole pod peas 0.48	BR-0476
1994 S 407.94		2	0.75	0.25	1 7 14 21	2.0 whole pod 0.96 whole pod peas 0.21 0.66 whole pod peas 0.16 <u>1.50</u> whole pod peas <u>0.27</u>	BR-0476
S 663.94		2	0.75	0.25	1 7 14 21	2.20 whole pod 1.10 whole pod peas 0.13 <u>0.26</u> whole pod peas 0.07 0.24 whole pod peas 0.09	BR-0476
1995 S 104.95	500 g/l SC	2	0.75	0.25	0 7 10	1.05 whole pod 25.1 whole plant 0.46 whole pod 0.08 peas 0.84 empty pod 0.46 whole pod *c* 0.03	BR-0499 (Provot 1997)
						0.11 peas	
						0.98 empty pod	
					13	<u>0.28</u> whole pod *c* 0.04 0.17 peas *c* 0.03 0.60 empty pod *c* 0.09	
					32 33	0.40 peas 19.6 whole plant	
S 105.95		2	0.75	0.25	0	2.04 whole pod *c* 0.14 23.5 whole plant *c* 0.02	BR-0499
					7	0.77 whole pod	
					 11 14	0.19 peas 1.94 empty pod 0.64 whole pod 0.20 peas 1.90 empty pods <u>0.83</u> whole pod 0.20 peas	
						3.23 empty pod *c* 0.02	

Year Trial ID.	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg	Reference
					26	0.29 peas	
					27	14.1 whole plant	
S 106.95		2	0.75	0.25	0	3.80 whole pod *c* 0.03 16.5 whole plant *c* 0.15	BR-0499
					7	2.19 whole pod 0.70 peas 2.37 empty pod *c* 0.02	
					10	1.13 whole pod 0.11 peas 1.28 empty pod	
					15	0.46 whole pod 0.07 peas 0.57 empty pods	
					22	1.12 whole pod 0.08 peas 1.93 empty pods	
					22	0.20 peas	
					41	0.63 peas	
						10.3 whole plant *c* 0.19	
1995 S 661.95		2	0.75	0.25	0	1.93 whole pod 23.0 whole plant	BR-0499
					7	1.02 whole pod 0.08 peas 2.63 empty pods *c* 0.02	
					10	0.60 whole pod 0.09 peas *c* 0.02	
					14	1.47 empty pods 0.60 whole pod 0.08 peas 2.11 empty pods	
					27	0.19 peas 16.5 whole plant *c* 0.11	

Table 11: Residues in whole pea plants (leguminous animal feed), France, 1995.

Trial ID	Application Form	No.	kg ai/ha	kg ai/hl	PHI, days	Residues, mg/kg	Reference
S 104.95	500 g/l SC	2	0.75	0.25	0	25.1	BR-0499
					33	19.6	(Provot 1997)
S 105.95	500 g/l SC	2	0.75	0.25	0	23.5	BR-0499
					27	14.1	
S 106.95	500 g/l SC	2	0.75	0.25	0	16.5 *c* 0.15	BR-0499
					41	10.3 *c* 0.19	
S 661.95	500 g/l SC	2	0.75	0.25	0	23.0	BR-0499
					27	16.5 *c* 0.11	

FATE OF RESIDUES IN STORAGE AND PROCESSING

In storage

After 117 days storage at 0°C and 90% relative humidity, procymidone residues in the pulp and peel of kiwifruit were 55% to 70% of the levels found immediately after post-harvest dip treatment at rates ranging from 3.25 to 25 g ai/100 l (Gandolfi and Collina, 1989). The residues in the peel ranged

from <0.01 to 21.62 mg/kg and in the pulp <0.01 to 0.15 mg/kg. A linear relation was observed between application rate and residues in peel.

The residues in the pulp and peel of kiwifruit after dip treatment at 6.25 g ai/100 l are shown in Table 12. This rate is close to GAP for post-harvest treatments in Italy. After 117 days of cold storage (0°C, 90% r.h.), the residues in the peel decreased slowly to 50-60% of their initial levels, and those in the pulp to 25%. Ratios of average residues in the peel to those in the pulp ranged from 0.004 to 0.01.

Table 12. Residues in kiwifruit peel and pulp after a post-harvest dip treatment at 6.25 g ai/100 l.

Storage period, days	Residues in peel, mg/kg	Residues in pulp, mg/kg	Mean ratio, pulp:peel
0	7.76, 7.94, 8.13	0.08, 0.08	0.01
30	7.08, 7.17, 7.27	0.06, 0.06	0.008
57	4.29, 4.89, 5.50	0.04, 0.04	0.008
91	4.40, 4.90, 5.40	0.04, 0.04	0.008
117	4.37, 4.47, 4.57	0.02, 0.02	0.004

Residues in kiwifruit treated with a single foliar application ranged from 67% to 78% of the levels found at harvest after cold storage for 98 to 107 days (Maini and Boni, 1985). The interval from treatment to harvest ranged from 5 to 28 days. The maximum decline of 33% of the procymidone residues is comparable to that observed from a post-harvest dip. Additional data from post-harvest dip treatments at rates of 50 and 100 g ai/100 l showed no decrease after 101 days of storage, but details of the storage conditions were not reported.

Residues in the edible portion of food commodities

Residues in the edible portion of the commodity were reported for kiwifruit and peas, where residues were determined in kiwifruit pulp, peas and empty pods.

In two trials in Italy the residues in kiwifruit pulp were approximately 2.5 and 3.3% of the levels found in the whole commodity, after dip treatments at 50 and 100 g ai/100 l solution (Table 7). After dip treatments at 3.25 to 25 g ai/100 l solution and storage up to 117 days, residues in the pulp ranged from 0.02 to 0.15 mg/kg, approximately 4-8% of those found in the whole commodity.

The residues in whole pea pods 13 to 15 days after treatment were 0.26 to 0.83 mg/kg and in peas 0.07 to 0.20 mg/kg. Overall, peas contained approximately 13-30% of the residues found in the whole pod.

RESIDUES IN FOOD IN COMMERCE OR AT CONSUMPTION

National monitoring data were reported by The Netherlands (Table 13).

Table 13. Monitoring data for procymidone in The Netherlands (1994-1996).

Commodity	Samples analysed	Samples without residues (LOD = 0.02 mg/kg)	Samples with residues <MRL	Samples with residues >MRL	Mean, mg/kg[1]	MRL, mg/kg
CITRUS FRUIT						0.02*
Grapefruit	327	321		6	<0.02	
Tangerines	632	632			<0.02	

Commodity	Samples analysed	Samples without residues (LOD = 0.02 mg/kg)	Samples with residues <MRL	Samples with residues >MRL	Mean, mg/kg[1]	MRL, mg/kg
Oranges	982	965		17	<0.02	
STONE FRUIT						0.02*
Apricots	91	90		1	<0.02	
Peaches	283	283			<0.02	
Nectarines	247	247			<0.02	
Plums	467	463	2	2	<0.02	
BERRIES AND SMALL FRUIT						
Grapes	765	653	112		0.23	5
Strawberries	2743	2650	93		0.14	5
Raspberries	269	269			<0.02	10
Currants (red, black, white)	481	479	2		<0.02	0.02*
TROPICAL FRUIT						
Kiwi	260	231	23	6	0.40	5
Mangoes	217	217			<0.02	0.02*
Passion fruit	50	49		1	<0.02	0.02*
ROOT AND TUBER VEGETABLES						
Carrots	500	490	1	10	<0.02	0.02*
Scorzonera (black salsify)	23	22		1	<0.02	0.02*
Potatoes	417	415	1	1	<0.02	0.02*
BULB VEGETABLES						
Onions (incl. Pearl, cocktail onions)	112	110	2		<0.02	0.2
Onions (small)	110	109		1	<0.02	0.2
FRUITING VEGETABLES						
Tomatoes	1242	1137	105		0.02	2
Peppers	1655	1556	99		0.02	2
Aubergines	176	174	2		<0.02	2
Cucumbers	1089	1054	35		<0.02	1
Courgettes	257	242	15		<0.02	1
Melons	455	447	8		<0.02	1
BRASSICA VEGETABLES						
Cauliflower	378	378			<0.02	0.02*
Brussels sprouts	197	197			<0.02	0.02*
Chinese cabbage	352	350		2	<0.02	0.02*
LEAFY VEGETABLES AND FRESH HERBS						
Lettuce	3834	3699	130	5	0.03	5
Iceberg lettuce	535	488	46	1	<0.02	5
Endive	1297	1265	31	1	<0.02	5
Spinach	532	531		1	<0.02	0.02*
Witloof	549	548		1	<0.02	0.02*
Other leafy vegetables	230	229		1	<0.02	0.02*
Parsley	390	389		1	<0.02	0.02*
Other herbs	224	223		1	<0.02	0.02*
LEGUME VEGETABLES						
Beans, fresh (with pod)	690	683	7		<0.02	2
Peas, fresh	66	65	1		<0.02	0.02*
STEM VEGETABLES						
Celery	300	299		1	<0.02	0.02*
Leek	459	458		1	<0.02	0.02*

Commodity	Samples analysed	Samples without residues (LOD = 0.02 mg/kg)	Samples with residues <MRL	Samples with residues >MRL	Mean, mg/kg[1]	MRL, mg/kg
Other	375	371		4	<0.02	0.02*
FUNGI Cultivated Mushrooms	460	459		1	<0.02	0.02*
Other ARABLE PRODUCTS	759	752		7	<0.02	0.02*

* Lower limit of determination.
[1] For samples without residues (<LOD), half the LOD is taken for the calculation of the mean.

NATIONAL MAXIMUM RESIDUE LIMITS

The following national MRLs, mainly in EU countries, were reported.

sCountry	MRL, mg/kg	Commodity
Belgium	5	kiwifruit
EU	0.02 5	broccoli, Brussels sprouts, cabbage (head), cauliflower, peas kiwifruit
France	2 5	stone fruit kiwifruit
Germany	0.02 0.05 0.1 0.2 1	other foods of plant origin tree nuts, remaining oilseeds hops, tea, tealike products knoblauch, onions, shallots cucurbits with edible and inedible peel, peas with pods (fresh), sunflower seeds with pods, rape seed, soya beans
Germany	2 5 10	beans with pods (fresh), solanaceae grapes, kiwifruit, lettuce (and similar), strawberries raspberries
Italy	1.5	peaches, pears
Poland	0.02 0.05 0.1 0.2 1 2 5	cereal grains, citrus fruits, potato, root and tuber vegetables (except potato) eggs, meat and meat products, milks, milk products tea onion, bulb cucumber, fruits (except as otherwise listed) legume vegetables, tomato berries and other small fruit, leafy vegetables, stalk and stem vegetables
Spain	0.02 2 5	brassica vegetables, pears, peas without pods, stone fruit peas with pods kiwifruit
The Netherlands	*0.02 *0.05 *0.1 0.2 1 2 5 10	other food commodities eggs, meat, milk, nuts, other oil seeds, hops, tea garlic, onions, shallots, cucurbits with edible peel, cucurbits with inedible peel, rape seed, soya beans, sunflower seeds with cups beans (pods), solanaceae, kiwifruit, lettuce and similar, strawberries (except wild), table and wine grapes raspberries

APPRAISAL

Residue aspects of procymidone were reviewed by the JMPR in 1981, 1989, 1990 and 1993. At the 27th session of the CCPR (1995), draft MRLs for apples, currants (black, red, white), egg plant, kiwifruit, melons (except watermelon), potatoes and rice (polished and husked) were recommended for deletion. The Committee noted that residue data for peaches, plums, kiwifruit, peas and brassica

vegetables would be made available for evaluation in 1998. In addition to these commodities, data on pears were also submitted. Information on analytical methods, stability of residues in stored analytical samples and current GAP in numerous countries was provided.

Validated methods for the determination of procymidone in pears, peaches, plums, cabbage and peas were provided. The limit of determination in all these crops was 0.02 mg/kg and validated recoveries ranged from 70 to 110%. The methods are almost identical to the method reviewed in the 1981 monograph. The Netherlands government provided a multi-residue method for the determination of procymidone in fruits and vegetables. The limits of determination ranged from 0.01 to 0.1 mg/kg, with recoveries above 80%.

The storage stability of procymidone in strawberries, homogenised cherries, lettuce and haricot beans was reported. The Meeting concluded that procymidone residues were stable under frozen storage conditions for the duration of the 12 month studies in strawberries, lettuce and homogenised haricot beans, but some degradation was observed in homogenised cherry samples.

Supervised residue trials

Pears. GAP from Italy was reported, where registered use patterns indicate a maximum rate of 0.075 kg ai/hl using 25 SC, 50 WP or 75 WDG formulations. Procymidone may be applied from the end of flowering with repeated applications at intervals of 7 to 10 days depending on disease indications. A 14-day pre-harvest interval is recommended. In the reported trials 5 sprays were applied with a minimum re-treatment interval of 14 days. In two trials finite procymidone residues were found in untreated control samples; the result found in one of these was included in the estimation of the MRL and STMR as the residue in the control sample was comparable to the limit of quantification in the study.

The residues reflecting GAP ranged from 0.16 to 0.62 mg/kg 14 days after the fifth application. The residues used in the estimation of the STMR were in rank order 0.16, 0.35, 0.43, 0.43, 0.45, 0.58 and 0.62 mg/kg.

The Meeting estimated a maximum residue level of 1 mg/kg and an STMR of 0.43 mg/kg for procymidone in pears on the basis of GAP in Italy.

Peaches. Data from supervised trials in France and Italy were reported. Application rates were 0.075-0.11 kg ai/hl, with a maximum of 3 applications in the Italian trials. Registered labels in Italy allow a maximum of five applications. at appearance of flowering buds, when 25% of flowers have opened, at full flowering and at a lower rate at 4-5 and 2-3 weeks before harvest. In the French trials, two applications were made at the maximum rate of 0.75 kg ai/ha.

The residues resulting from treatments according to GAP in France and Italy ranged from 0.19 to 1.40 mg/kg 8–14 days after treatment. The residues in rank order were 0.19, 0.39, 0.44, 0.68, 0.72, 1.30, 1.33 and 1.40 mg/kg.

The Meeting estimated a maximum residue level of 2 mg/kg and an STMR of 0.70 mg/kg on the basis of GAP in France and Italy.

Plums. In France GAP allows a maximum rate of 0.75 kg ai/ha, with no indication of application timing or maximum number of sprays; a pre-harvest interval of 8 days is recommended. In Italy, 2–3 applications from the appearance of flowering buds to full flowering are recommended at rates from 1.1 to 1.8 or 1.5 to 2 kg ai/ha. A pre-harvest interval of 21 days is indicated.

Trials according to GAP were carried out in France and Italy. The residues in the French trials ranged from 0.19 to 1.20 mg/kg 7 or 8 days after 2 foliar applications at 0.75 kg ai/ha and in the 3 Italian trials were 0.74, 1.38 and 1.50 mg/kg 21 days after 3 sprays at 1.8 kg ai/ha.

The residues in rank order were 0.19, 0.31, 0.48, 0.52, 0.59, 0.60, 0.61, 0.74, 0.77, 0.86, 0.90, 1.06, 1.20, 1.38 and 1.50 mg/kg. The Meeting estimated a maximum residue level of 2 mg/kg and an STMR of 0.74 mg/kg for plums.

Kiwifruit. GAP was reported for Italy and France. The maximum label rate in France is 0.75 kg ai/ha; the labels did not indicate application timings or a maximum number of sprays. Italian labels for the 25 SC formulation indicate a maximum of 5 consecutive foliar applications at a maximum rate of 0.1 kg ai/hl, including a spray 14 days before harvest as a storage protection measure. For the 50 WP and 50 WDG formulations, 2–3 sprays are recommended followed by a post-harvest dip. A pre-harvest interval of 14 days and post-harvest storage period of 60 days are recommended.

Pre-harvest trials were reported from France and Italy, and post-harvest from Italy. The pre-harvest trials did not reflect GAP for foliar application in Italy or France. In some of them, single applications were made at various intervals before harvest and the residues were monitored for prolonged storage periods. Details of the storage conditions were not given, and analytical recoveries were not adequately reported. The post-harvest trials were in accordance with GAP and details of storage conditions were provided, but no analytical recoveries were reported. The data from post-harvest treatment and storage trials indicate that residues can decrease by as much as 50% of their initial levels, but without details of the storage conditions the results could not be evaluated.

On the basis of the minimal data provided, the Meeting could not estimate a maximum residue level in kiwifruit. Further information such as details of post-harvest storage conditions and analytical recoveries would be needed.

Cabbages. Trials on cabbages, cauliflowers, broccoli and Brussels sprouts were carried out in France, but GAP was reported only for cabbages. The application rate for cabbages in France is 0.75 kg ai/ha with a pre-harvest interval of 21 days; the maximum number of applications is not indicated on any product labels.

Procymidone residues in cabbages after two sprays at varying intervals ranged from <0.02 to 1.30 mg/kg 20 or 21 days after treatment. The results reflecting GAP were <0.02 (2), 0.03 (2), 0.17, 0.26, 0.30, 0.32, 0.43, 0.44 and 1.40 mg/kg.

The Meeting estimated a maximum residue level of 2 mg/kg and an STMR of 0.26 mg/kg for head cabbages.

The trials on Brussels sprouts, broccoli and cauliflower could not be evaluated in the absence of appropriate registered labels.

Peas. Data were reported from supervised trials reflecting GAP in France, where a maximum of 2 sprays are permitted at 0.75 kg ai/ha, with a re-treatment interval of 20–21 days and a pre-harvest interval of 14 days. Residues were determined in whole plants with pods, whole pods, peas and empty pods. Re-treatment intervals were typically 14 to 19 days. The highest levels of procymidone were found in whole plants with pods, with residues of 16.5–25.1 and 10.3–19.6 mg/kg at early and late harvests respectively. Residues in empty pods were 0.6 to 3.23 mg/kg 13 to 15 days after treatment. The residues in peas ranged from 0.03 to 0.48 mg/kg. It was noted that higher residues were found in peas harvested mechanically than in those which were hand-picked.

The residues in whole pods 13 to 15 days after treatment were in the range 0.26–0.83 mg/kg. In trials where the residue was higher after 21 days than after the GAP PHI the higher value was used in the estimation of the STMR. The residues at 13-21 days ranged from 0.26 to 2.1 mg/kg in whole pods and from 0.03 to 0.48 mg/kg in peas.

The residues reflecting GAP in the whole pods in rank order were 0.26, 0.28, 0.36, 0.49, 0.60, 0.83, 1.12, 1.50 and 2.1 mg/kg, and those in the shelled peas were 0.03, 0.07 (4), 0.08, 0.15, 0.17, 0.20, 0.27 and 0.48 mg/kg. The Meeting estimated a maximum residue level of 3 mg/kg and an STMR of 0.60 mg/kg for garden pea (young pods) and a maximum residue level of 1 mg/kg and an STMR of 0.08 mg/kg for garden pea (shelled).

The Meeting did not consider that the data on whole pea plants were adequate for estimating a maximum residue level for a leguminous animal feed commodity as appropriate GAP had not been reported.

RECOMMENDATIONS

On the basis of the data from supervised trials the Meeting estimated the maximum levels and STMR levels 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: procymidone.

Commodity		MRL, mg/kg		STMR
CCN	Name	new	current	mg/kg
VB 0041	Cabbages, Head	2	–	0.26
VP 0529	Garden pea, shelled (succulent seeds)	1	–	0.08
VP 0528	Garden pea (young pods)	3	–	0.60
FS 0247	Peach	2	–	0.70
FP 0230	Pear	1	–	0.43
FS 0014	Plums (including Prunes)	2	–	0.74

FURTHER WORK OR INFORMATION

Desirable

Details of post-harvest storage conditions and analytical recoveries in relation to the reported supervised residue trials on kiwifruit.

DIETARY RISK ASSESSMENT

STMRs have been estimated for procymidone in six commodities. These have been used in estimating the dietary intake together with MRLs for 12 commodities. The International Estimated Daily Intakes for the five GEMS/Food regional diets were in the range 1 to 12% of the ADI. The Meeting concluded that the intake of residues of procymidone resulting from its uses that have been considered by the JMPR is unlikely to present a public health concern.

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