PENCONAZOLE (182)

EXPLANATION

Penconazole was first evaluated in 1992. At the 1994 CCPR the delegation of Germany informed the Committee that German GAP for grapes and pome fruits had changed, requiring a different interpretation of the figures presented in the 1992 JMPR evaluation. New residue data supported a maximum residue level in pome fruits of 0.5 mg/kg instead of the proposed MRL of 0.2 mg/kg. The delegation of France requested clarification of GAP for cucumbers, strawberries and tomatoes with respect to glasshouse and field applications.

The 1992 JMPR requested processing studies on apples and tomatoes, and the determination of residues of penconazole and its metabolites containing the 2,4-dichlorophenyl moiety in field-grown apples and grapes.

The Meeting received updated information on GAP, reports of 33 additional residue trials on pome fruits (apples and pears), 46 trials on grapes, a new analytical method, a freezer storage stability study, and an overall assessment of the residue situation with respect to pome fruits and grapes by the manufacturer (Altenburger, 1995a). Summarized information on GAP for pome fruits, residue data and detailed comments were provided by Germany (Anon., 1994a), information on GAP by Australia, New Zealand and the UK (Anon., 1994c; 1995a,b) and on GAP, analytical methods, residue trials and national MRLs by The Netherlands (Anon., 1994b). Data on supervised trials on leeks, strawberries, gooseberries, black and red currants received from The Netherlands had already been included in the 1992 evaluation and were not re-evaluated by the present Meeting.

This monograph reviews the recent residue data and information on GAP for pome fruits and grapes which were not available to the 1992 JMPR.

METHODS OF RESIDUE ANALYSIS

In addition to the analytical methods described in the 1992 evaluation a method for total residues has been used for analysis in some of the supplied residue studies (Bussmann, 1986). The method determines the residues containing the 2,4-dichlorophenyl group as 2,4-dichlorobenzoic acid.

Samples are extracted by refluxing with 20% concentrated ammonium hydroxide/methanol. The organic solvent is evaporated and the residue dissolved in NaOH. Penconazole and its metabolites are converted to 2,4-dichlorobenzoic acid (DCBA) by refluxing this solution with potassium permanganate. After the addition of water DCBA is partitioned into dichloromethane/hexane on a ClinElut column. The eluted organic phase containing DCBA is evaporated and the residue analyzed by HPLC with UV detection using a 3-column switch system. A factor of 1.49 is used to convert DCBA to penconazole. The LOD for plant material except straw was 0.02 mg/kg as DCBA corresponding to 0.03 mg/kg as penconazole, and for straw 0.04 mg/kg as DCBA corresponding to 0.06 mg/kg as penconazole. The overall mean recovery at 0.06 and 0.3 mg/kg fortification levels was 67%.

In a freezer storage stability study by Buettler (1982), untreated samples of apples and grapes were fortified with 5 mg/kg penconazole and kept at -20°C for 16 months. Reasonable stability of the compound was demonstrated by analyses of samples after 1, 3, 6, and 16 months.

USE PATTERN

The manufacturer clarified GAP for indoor and outdoor applications to cucumbers, tomatoes and strawberries. The open field treatment of all crops is authorized, with the exception of the indoor use on cucumbers in Switzerland (Altenburger, 1995b).

World-wide GAP for the use of

penconazole was reported by the 1992 JMPR. The present Meeting received new and updated information on GAP for pome fruits and grapes from New Zealand and Germany. The information on GAP provided by Australia, France, Greece, Italy and the UK is basically the same as in 1992, but more detailed (see Table 1). GAP for pome fruits and grapes in other countries as well as GAP for other crops is given in the 1992 evaluation.

Penconazole is applied to pome fruits and grapes by foliar spray in EC, WP or tablet (TP) formulations alone or in a mixture with other fungicides, especially captan, dithianon, mancozeb and ziram. The PHI depends on local conditions and varies for pome fruits over a range of 14 days in Italy, Germany and the UK to 42 days in Sweden, and for grapes from 6 or 7 days in Taiwan, Portugal and Uruguay to 35 days in Germany after the last application. Up to 10 or even more treatments are possible. The critical GAP is as follows.

Pome fruits: 0.075 kg ai/ha per application for apples and 0.057 for pears with a PHI of 14 days (Italy, Table 1); 0.09 kg ai/ha per application with a PHI of 14 days (South Africa, 1992 JMPR).

Grapes: 0.15 kg ai/ha per application, PHI 30 days (Morocco, 1992 JMPR); 0.045 kg ai/ha per application, PHI 14 days (Italy, Table 1); 0.05 kg ai/ha per application, PHI 14 days (South Africa, 1992 JMPR); 0.03 kg ai/ha per application, PHI 6 days (Taiwan, 1992 JMPR); 0.05 kg ai/ha per application, PHI 35 days (Germany, Table 1).

Table 1. Registered uses of penconazole.

Crop	Country	Form.	Application			PHI, days
			Rate, kg ai/ha	Spray conc. kg ai/hl	No.	
Apple	Australia	100 EC	0.03-0.087	0.002-0.0025	5	14
	France	25 WP	0.025	0.0025	10-15	15
		100 EC	0.025	0.0025	10	15
		75 TB	0.025	0.0025	10	15
	Germany	25 WP[1]	0.038	0.0025	10	28[1]
		100 WP	0.038	0.0025	12	14
	Italy	32 WP	0.025-0.072	0.0032-0.0048	seve-	15
		100 EC	0.025-0.072	0.0032-0.0048	ral	14
		83 TB	0.025-0.057	0.0025-0.0038	2-3	14
		41.7 TB	0.025-0.057	0.0025-0.0038	2-3	14

Crop	Country	Form.	Application			PHI, days
			Rate, kg ai/ha	Spray conc. kg ai/hl	No.	
		15 WP	0.03-0.068	0.0030-0.0045	3-4	14
		25 WP[2]	0.025-0.075	0.0025-0.005	2-3	14
		25 WP	0.032-0.057	0.0032-0.0038	seve-	14
		50 WP	0.032-0.057	0.0032-0.0038	ral	14
		100 WP	0.032-0.057	0.0032-0.0038		14
	Netherlands	12.5 WP	0.013-0.038	0.0013-0.0025	10-14	21
	New Zealand	10 WP	0.05-0.075	0.0025	4-635	
	UK	25 WP[3]	0.03-0.05		10	14
		100 EC	0.03-0.05		10	14
		25 SC[4]	0.03-0.05		10	28
Pear	France	25 WP	0.025	0.0025	10-15	15
	Italy	32 WP	0.025-0.057	0.0025-0.0038	seve-	15
		100 EC	0.025-0.057	0.0025-0.0038	ral	14
		83 TB	0.025-0.057	0.0025-0.0038		14
		41.7 TB	0.025-0.057	0.0025-0.0038		14
		25 WP[2]	0.025-0.048	0.0025-0.0038		14
		25 WP	0.025-0.048	0.0025-0.0032		14
		50 WP	0.025-0.048	0.0025-0.0032		14
		100 WP	0.025-0.048	0.0025-0.0032		14
	Netherlands	12.5 WP	0.013-0.038	0.0013-0.0025	10-14	21
	New Zealand	10 WP	0.05-0.075	0.0025	4-635	
Pome fruits	Germany	25 WP[1]	0.038	0.0025	12	28[1]
Grapes	France	62.3 EC	0.019		3	30
		5 SC	0.017		seve-	30
		4.4 WP[5]	0.017		ral	30
		4.4 WP[5]		1.54	2	30
		100 EC	0.025		10	30
		75 TB	0.025		10	30
	Germany	100 EC	0.025-0.05	0.0025	6	35
	Greece	100 EC	0.025-0.04	0.0025-0.005		30
	Italy	83 TB	0.02-0.025	0.0025	seve-	14
		41.7 TB	0.02-0.025	0.0025	ral	14
		15 WP	0.018-0.03	0.0023-0.003		14
		25 WP	0.02-0.03	0.0025-0.003		14
		100 EC	0.015-0.045	0.0015-0.003		14
	New Zealand	100 EC	0.05	0.0015-0.0025	4 28	

[1] 25 g/kg penconazole, 600 g/kg mancozeb, PHI determined by ETU residues
[2] 25 g/kg penconazole, 675 g/kg ziram
[3] 25 g/kg penconazole, 475 g/kg captan
[4] 25 g/kg penconazole, 250 g/kg dithianon
[5] 4.4 g/kg penconazole, 700 g/kg mancozeb

RESIDUES RESULTING FROM SUPERVISED TRIALS

Pome fruits. In addition to more than 70 trials reported in the 1992 submission, 25 studies on apples and 9 on pears carried out in Germany, Switzerland and the UK were provided by the manufacturer. Penconazole was applied alone or in a mixture with captan, mancozeb, or dithianon. Up to fifteen sprays were applied, mostly at weekly intervals, at rates of 0.02-0.05 kg ai/ha or 0.06 g ai/tree.

The three trials on apples provided by The Netherlands (report nos. 2118/84, 2119/84 and 2366/84) and several of those from Germany (report nos. 2105/81 and 2304/81) were reviewed by the 1992 Meeting but were reported again, in detail with corrections, to the present Meeting.

The application rates of two trials on pears in France and one in Switzerland were reported incorrectly in the 1992 evaluation (report nos. RR 25/87, RR 26/87 and 2247/81) and have been corrected now. The first two trials on applies (report no. 83/1/943) listed in Table 2 on page 721 of the 1992 evaluation were carried out in New Zealand, not Australia. Details of the new residue trials, the corrected versions of those previously reviewed and all German trials according to GAP are given in Tables 2 (apples) and 3 (pears). The underlined residues of the parent compound are from treatments according to GAP.

Table 2. Residues of penconazole in apples, determined as penconazole or as total residues calculated as penconazole.

Country, Year	Application				PHI, days	Residues, mg/kg		Report
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
Germany	WP	14	0.025 (2)	0.0025	0	0.11		2007/80
1980			0.05 (12)		7	0.10		(JMPR 1992)
					10	0.05		
					21	0.03		
1980	WP	14	0.038	0.0025	0	0.16		2008/80
					7	0.10		(JMPR 1992)
					10	0.07		
					14	<u>0.06</u>		
					21	0.06		
1980	WP	14	0.038	0.0075	0	0.05		2105/81
					6	0.02		(JMPR 1992)
					9	0.02		
					13	<u>0.03</u>		
					20	0.02		
1981	WP	14	0.05	0.0025	17	0.11		2027/81 (JMPR 1992)
1981	WP	14	0.037	0.0075	0	0.06		2304/81
					7	0.07		(JMPR 1992)
					10	0.12		
					14	<u>0.08</u>		
					21	0.09		
1981	WP	14	0.05	0.0025	0	0.06		2028/81
					7	0.03		(JMPR 1992)
					10	0.04		

Country, Year	Application				PHI, days	Residues, mg/kg		Report
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
					14	0.03		
					21	0.03		
1981	WP	14	0.037	0.0075	0	0.11		2029/81
					7	0.11		(JMPR 1992)
					10	0.11		
1982	WP	14	0.037	0.0075	0	0.11		2044/82
					6	0.04		(JMPR 1992)
					10	0.04		
					14	0.03		
					21	0.03		
1986	WP	12	0.037	0.007	0		0.13	2170/86
					7		0.19	
					10		0.11	
					14		0.17	
					21		0.08	
1986	WP	12	0.025	0.003	0		0.11	2171/86
					7		0.08	
					10		0.08	
					14		0.06	
					21		0.05	
1986	WP	12	0.037	0.004	0		0.21	2172/86
					7		0.22	
					10		0.19	
					14		0.35	
					21		0.21	
1986	WP	12	0.037	0.007	0		0.25	2173/86
					7		0.33	
					10		0.32	
					14		0.30	
					21		0.16	
1986	WP	12	0.025	0.003	0		0.11	2174/86
					7		0.06	
					10		0.06	
					14		0.05	
					21		0.06	
1986	WP	11	0.037	0.003	0		0.21	2175/86
					7		0.14	
					10		0.14	
					14		0.16	
					21		0.14	
1986	SC	12	0.037	0.007	0		0.07	2184/86
					7		0.05	

Country, Year	Application				PHI, days	Residues, mg/kg		Report
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
					10		<0.05	
					14		0.05	
					21		0.05	
1986	SC	12	0.025	0.003	0		0.05	2185/86
					7		0.05	
					10		0.05	
					14		0.05	
					21		<0.05	
1986	SC	12	0.037	0.004	0		0.13	2186/86
					7		0.17	
					10		0.08	
					14		0.10	
					21		0.08	
1986	SC	11	0.037	0.003	0		0.06	2188/86
					7		0.11	
					10		0.06	
					14		0.09	
					21		<0.05	
1986	WP	12	0.037	0.007	0		0.19	2179/86
					7		0.17	
					10		0.14	
					14		0.08	
					21		0.13	
1986	WP	12	0.025	0.003	0		0.05	2180/86
					7		0.05	
					10		0.05	
					14		0.05	
					21		0.05	
1986	WP	12	0.037	0.004	0		0.27	2181/86
					7		0.13	
					10		0.13	
					14		0.13	
					21		0.10	
1987	WP	12	0.037	0.003	0		0.11	2163/87
					7		0.08	
					10		0.07	
					14		0.06	
					21		0.10	
1987	WP	12	0.037	0.003	0		0.05	2164/87
					7		0.05	
					10		<0.05	
					14		0.05	

Country, Year	Application				PHI, days	Residues, mg/kg		Report
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
					21		<0.05	
1987	WP	12	0.037	0.003	0		0.12	2165/87
					7		0.06	
					10		0.07	
					14		0.08	
					21		0.06	
Netherlands	WP	5	0.019	0.0013	9	0.02		2118/84 (JMPR 1992)
1984	WP	5	0.025	0.0013	15	0.08		2119/84 (JMPR 1992)
	WP	5	0.025	0.0013	15	0.06		2366/84 (JMPR 1992)
Switzerland	WP	14	0.05	0.0025	0	0.04		2009/80
1980					7	0.03		
					10	0.03		
					14	0.03		
					21	0.02		
					28	<0.02		
1981	WP	14	0.05	0.0025	0	0.06		2031/81
					7	0.03		
					10	0.03		
					14	0.02		
					21	0.02		
					28	0.02		
UK, 1990[1]	EC	10	0.063 g/tree (corresp. to approx. 0.025 kg ai/ha)	0.025	15		0.01 (2), 0.02 (8), 0.03 (2)	CSTR/016:3

[1] 6 trials, 3 locations

Table 3. Residues of penconazole in pears, determined as penconazole or as total residues calculated as penconazole.

Country, Year	Application				PHI, days	Residues, mg/kg		Report
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
France	WP	11	0.019	0.023	13	<0.02		RR 25/87 JMPR 1992
1984	WP	15	0.019	0.023	12	0.19		RR 26/87 JMPR 1992
Germany	WP	12	0.037	0.007	0		0.32	2176/86
1986					7		0.25	
					10		0.32	
					14		0.29	
					21		0.22	
1986	WP	12	0.033 (5)	0.005	0		0.17	2177/86
			0.04 (7)		7		0.16	
					10		0.13	
					14		0.06	
					21		0.08	
1986	WP	12	0.037	0.007	0		0.40	2182/86
					7		0.27	
					10		0.14	
					14		0.16	
					21		0.22	
1986	SC	12	0.033 (5)	0.005	0		0.22	2187/86
			0.04 (7)		7		0.11	
					10		0.10	
					14		0.06	
					21		0.07	
1986	SC	12	0.037	0.006	0		0.24	2189/86
					7		0.18	
					10		0.11	
					14		0.15	
					21		0.10	
1987	WP	12	0.037	0.007	0		0.08	2167/87
					7		0.08	
					12		0.07	
					14		0.05	
					21		0.05	
					30		0.05	
1987	WP	12	0.037	0.002	0		0.14	2168/87
					7		0.18	
					10		0.11	
					14		0.12	
					21		0.10	
Switzerland	WP	14	0.025	0.0013	0	0.06		2247/81
1981					3	0.05		JMPR 1992

Country, Year	Application				PHI, days	Residues, mg/kg		Report
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
					7	0.03		
					10	0.03		
					14	0.02		
1986	WP	12	0.025	0.003	0		0.14	2178/86
					7		0.10	
					9		0.10	
					14		0.08	
					21		0.08	
					28		0.05	
1986	WP	12	0.025	0.003	0		0.13	2183/86
					7		0.08	
					9		0.08	
					14		0.08	
					21		0.06	
					28		0.05	

Grapes. In addition to more than 100 residue trials listed in the 1992 evaluation, 46 residue trials on grapes carried out in France, Germany and Switzerland were reported by the manufacturer. Penconazole was applied alone or in a mixture with captan, mancozeb or dithianon. Up to ten sprays were applied, mostly at weekly intervals, at rates between 0.001 and 0.086 kg ai/ha. Residues were determined as parent penconazole, as total residues containing the 2,4-dichlorophenyl moiety, or both.

Details of the new residue trials are given in Table 4. The underlined residues of the parent compound are from treatments according to GAP.

Table 4. Residues of penconazole in grapes, determined as penconazole or as total residues calculated as penconazole.

Country, Year	Application				PHI, days	Residues, mg/kg		Report & notes
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
France, 1981	EC	9	0.014-0.034	0.005	28	0.02		43/82
1981	EC	8	0.020-0.040	0.005	48	<0.02		42/82
1981	EC	9	0.013-0.047	0.005	20	<0.02		41/82
1983	EC	6	0.004-0.012	0.002	51	<0.02		07/84
1984	EC	7	0.001-0.005	0.0005	55	<0.02		61/85
1993	EC	8	0.014-0.016	0.0015	30	<0.02 (2)	0.07 (2)	2072/93
1993	EC	8	0.030-0.033	0.0031	30	<0.02	0.09	2072/93B
1993	TB	8	0.015-0.028	0.0016-0.0028	30	<0.02 (2)	<0.07, 0.07	2072/93C
1993	TB	8	0.03-0.06	0.0032-0.0055	30	<0.02	0.09	2072/93D
1993	EC	8	0.015-0.016	0.0015-0.0016	28	<0.02 (4)	0.07 (4)	2073/93
1993	EC	8	0.03-0.032	0.0031	28	<0.02	0.14	2073/93B
1993	EC	8	0.015	0.0015	30	0.04, 0.03	0.24, 0.17	2074/93
1993	EC	8	0.028-0.031	0.0031	30	0.08	0.47	2074/93B
1993	TB	8	0.015-0.016	0.0016	30	0.04, 0.03	0.19, 0.20	2074/93C

penconazole

Country, Year	Application				PHI, days	Residues, mg/kg		Report & notes
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
1993	TB	8	0.030-0.032	0.0016	30	0.07	0.38	2074/93D
1993	EC	8	0.015-0.016	0.0015	30	<0.02 (4)	0.06(2), 0.07, 0.08	2075/93
1993	EC	8	0.030-0.031	0.0031	30	<0.02	0.14	2075/93B
Germany	WG	6	0.009 (1)	0.003-0.004	0		0.06	2186/87
1987			0.012 (1)		14		0.10	
			0.018 (1)		28		0.08	
			0.024 (2)		35		0.07	
			0.03 (1)		42		0.10	
1987	WG	6	0.009, 0.012,	0.002	0		0.12	2187/87
			0.024, 0.028,		14		0.05	
			0.031, 0.036		28		0.05	
					35		0.05	
					42		<0.05	
1987	WG	6	0.015, 0.018,	0.002-0.003	0		0.30	2188/87
			0.022 (2),		14		0.21	
			0.03 (2)		28		0.16	
					35		0.21	
1987	WG	6	0.012	0.005	0		0.05	2189/87
			0.015		14		<0.05	
			0.018		28		0.10	
			0.024		35		0.08	
			0.026 (2)		42		0.05	
1987	WG	6	0.006	0.003-0.007	0		0.61	2190/87
			0.01		7		0.60	
			0.015		14		0.52	
			0.02		21		0.30	
			0.028 (2)		28		0.39	
					35		0.43	
1988	EC	6	0.016 (2)	0.003-0.006	0	0.04		CGD 67/88
			0.024 (2)		14	0.02		
			0.027		28	0.05		
			0.031		35	0.04		
					42	0.02		
1988	EC	6	0.016 (2)	0.003-0.006	0	0.01		CGD 68/88
			0.024 (2)		14	0.02		
			0.027		28	0.04		
			0.031		35	0.02		
					42	0.03		
1988	EC	6	0.009, 0.012,	0.0015	0	<0.02		CGD 69/88
			0.018, 0.021,		14	<0.02		last treatment
			0.024, 0.027		28	<0.02		at stage 33-35
					35	<0.02		
					42	<0.02		
1988	EC	6	0.009	0.0015	0	0.04		CGD 70/88

penconazole

Country, Year	Application				PHI, days	Residues, mg/kg		Report & notes
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
			0.012		14	<0.02		last treatment
			0.018		28	<0.02		at stage 33-35
			0.021		35	<0.02		
			0.024		42	<0.02		
			0.027					
1988	EC	6	0.024 (2)	0.0015-0.0023	0	0.17		CGD 71/88
			0.029 (2)		14	0.02		last treatment
			0.036 (2)		28	0.04		at stage 35
					35	<0.02		
					42	0.08		
1988	EC	6	0.024 (2)	0.0015-	0	0.11		CGD 72/88
			0.029 (2)	0.0023	14	0.04		last treatment
			0.036 (2)		28	0.03		at stage 35
					35	0.04		
					42	0.05		
Italy,	EC	8	0.05	0.003	0	0.34		2314/84
1984					7	0.21		
					15	0.07		
					22	0.12		
1984	EC	6	0.02-	0.003	0	0.08		2315/84
			0.03		8	0.09		
					14	0.06		
					22	0.02		
1992	EC	7	0.023	0.003	9	<0.02		2086/92
					23	0.18		
					36	<0.02		
					43	<0.02		
					50	<0.02		
1992	EC	5	0.032	0.003	0	0.05		2087/92
					14	<0.02		
					28	<0.02		
					37	<0.02		
					45	<0.02		
1993	EC	10	0.032-0.033	0.002	14	0.05(2),	0.23, 0.25,	2076/93
						0.06, 0.07	0.28, 0.32	
1993	EC	10	0.064-0.066	0.0041	14	0.10	0.48	2076/93B
1993	EC	10	0.032-0.033	0.002	14	0.02 (2)	0.16, 0.17	2077/93
1993	EC	10	0.063-0.066	0.0041	14	0.06	0.33	2077/93B
1993	TB	10	0.020 (9), 0.042	0.0013-0.0026	14	<0.02 (2)	0.10, 0.11	2077/93C
1993	TB	10	0.042 (9), 0.084	0.0026-0.0052	14	0.02	0.16	2077/93D
1993	EC	10	0.032-0.033	0.002	14	0.03, 0.04	0.15, 0.21	2078/93
1993	EC	10	0.065-0.067	0.0041	14	0.06	0.27	2078/93B
1993	TB	10	0.021 (9), 0.042 (1)	0.0013-0.0026	14	<0.02, 0.02	0.08, 0.09	2078/93C

Country, Year	Application				PHI, days	Residues, mg/kg		Report & notes
	Form.	No.	kg, ai/ha	kg, ai/hl		Parent	DCBA	
1993	TB	10	0.042 (9), 0.084 (1)	0.0026-0.0052	14	0.03	0.20	2078/93D
South Africa	EC	1	0.03	0.003	0		0.16	2330/87
					3		0.14	
1988					7		0.10	
					14		0.08	
					21		0.12	
1988	EC	1	0.045	0.005	0		0.22	2331/87
					3		0.21	
					7		0.14	
					14		0.14	
					21		0.18	
1988	EC	1	0.03	0.003	0		0.28	2332/87
					3		0.22	
					7		0.22	
					14		0.14	
					21		0.12	
Switzer-	EC	6	0.065-	0.005	0	0.09		2023/80
land,			0.11		7	0.03		
1981					14	0.02		
					21	<0.02		
					35	<0.02		
					42	<0.02		
					49	<0.02		
					56	<0.02		

FATE OF RESIDUES IN STORAGE AND PROCESSING

In storage

No data were received.

In processing

Grapes. Grapes from selected residue trials were processed to wine (new), wine (6-month old), juice, must, raisins, raisin waste, and wet and dry pomace (Table 5). The field treatments and application rates are shown in Table 4.

Table 5. Residues of penconazole in processed products of grapes.

Country, Year	Sample	Days after last appl.	Residues, mg/kg		Report
			parent	DCBA	
France	grapes	28	0.02		43/82
1981	wine		<0.01		
1981	grapes	48	<0.02		42/82
	wine		<0.01		
1981	grapes	20	<0.02		41/82
	wine		<0.01		
1983	grapes	51	<0.02		07/84
	wine		<0.01		
1984	grapes	55	<0.02		61/85
	wine		<0.01	1993	
1993	grapes	28	<0.02	0.07	2073/93
	grapes before processing		<0.02	0.07	
	raisins		<0.02	0.14	
	raisin waste		0.03	0.25	
	wet pomace		<0.02	<0.2	
	dry pomace		0.04	0.41	
	juice		<0.02	0.08	
	must		<0.02	<0.06	
	wine, new		<0.02	<0.06	
	wine, 6 month		<0.02	<0.06	
1993	grapes	28	<0.02	0.14	2073/93B
	grapes before processing		<0.02	0.15	
	raisins		0.02	0.38	
	raisin waste		0.05	0.58	
	wet pomace		0.04	0.31	
	dry pomace		0.11	1.2	
	juice		<0.02	0.09	
	must		<0.02	0.06	
	wine, new		<0.02	<0.06	
	wine, 6 month		<0.02	<0.06	
1993	grapes	30	<0.02	0.06, 0.08	2075/93
	raisins		0.02	0.23	
	raisin waste		0.04	0.57	
	wet pomace		0.03	0.20	
	dry pomace		0.05	0.33	
	juice		<0.02	<0.07	
	must		<0.02	<0.07	
	wine, new		<0.02	0.06	
	wine, 6 month		<0.02	<0.06	

Country, Year	Sample	Days after last appl.	Residues, mg/kg		Report
			parent	DCBA	
1993	grapes	30	<0.02	0.13, 0.14	2075/93B
	raisins		0.03	0.77	
	raisin waste		0.04	1.0	
	wet pomace		0.06	0.42	
	dry pomace		0.10	0.58	
	juice		<0.02	0.07	
	must		<0.02	0.07	
	wine, new		<0.02	0.10	
	wine, 6 month		<0.02	0.10	
Germany	grapes	42	0.02		CGD 67/88
1988	must		0.01		
	wine		<0.01		
1988	grapes	42	0.03		CGD 68/88
	must		<0.01		
	wine		<0.01		
1988	grapes	42	<0.02		CGD 69/88
	must		<0.01		
	wine		<0.01		
1988	grapes	42	<0.02		CGD 70/88
	must		<0.01		
	wine		<0.01		
1988	grapes	42	0.08		CGD 71/88
	must		<0.01		
	wine		<0.01		
1988	grapes	42	0.05		CGD 72/88
	must		<0.01		
	wine		<0.01		
Italy	grapes	14	0.05, 0.07	0.23, 0.32	2076/93
1993	grapes before processing		0.05	0.24	
	raisins		0.11	0.87	
	raisin waste		0.21	1.4	
	wet pomace		0.26	0.83	
	dry pomace		1.1	2.5	
	juice		<0.02	0.09	
	must		<0.02	0.07	
	wine, new		<0.02	0.11	
	wine, 6 month		<0.02	0.14	
1993	grapes	14	0.10	0.48	2076/93B
	grapes before processing		0.08	0.34	
	raisins		0.32	2.9	

penconazole

Country, Year	Sample	Days after last appl.	Residues, mg/kg		Report
			parent	DCBA	
	raisin waste		0.57	3.1	
	wet pomace		0.60	1.9	
	dry pomace		2.1	5.3	
	juice		<0.02	0.16	
	must		<0.02	0.13	
	wine, new		<0.02	0.30	
	wine, 6 month		<0.02	0.27	

NATIONAL MAXIMUM RESIDUE LIMITS

The manufacturer reported new Belgium MRLs of 0.2 mg/kg for small seed fruit such as pome fruit and for grapes. Australia extended the MRL of 0.1 mg/kg for apples (JMPR 1992) to pome fruit. For the other commodities see the 1992 evaluation.

APPRAISAL

Penconazole is a systemic triazole fungicide first evaluated in 1992.

At the 1994 CCPR the delegation of Germany stated that German GAP for grapes and pome fruits had been changed, and questioned the interpretation by the JMPR of the figures presented in the 1992 evaluation. The delegation of France requested clarification of the GAP for cucumbers, strawberries and tomatoes with respect to glasshouse and field applications.

The 1992 JMPR requested processing studies on apples and tomatoes and a method for the determination of residues of penconazole and its metabolites containing the 2,4-dichlorophenyl moiety in field-grown apples and grapes, because residues of the parent compound were found in metabolism studies on apples and grapes at only 10-15 % of the total residue levels.

The Meeting received updated information on GAP, the results of additional residue trials on pome fruits and grapes, a new analytical method, a study of freezer storage stability and an overall assessment of the residue situation for pome fruits and grapes by the manufacturer. Information on GAP for pome fruits, residue data and detailed comments were provided by Germany, and information on GAP by Australia, The Netherlands, New Zealand and the UK. Analytical methods, residue data and national MRLs were also provided by The Netherlands.

In addition to the analytical methods described in the 1992 evaluation a method for determining total residues of penconazole and all metabolites containing the 2,4-dichlorobenzyl group as 2,4-dichlorobenzoic acid (DCBA) has been used in some of the trials. Determination is by HPLC with UV detection. The LOD for plant material except straw was 0.02 mg/kg as DCBA corresponding to 0.03 mg/kg calculated as penconazole, and for straw 0.04 mg/kg as DCBA corresponding to 0.06 mg/kg as penconazole. The overall mean recovery at 0.06 and 0.3 mg/kg fortification levels was 67%.

Penconazole was stable for at least 16 months in apples and grapes under frozen conditions.

The Meeting was informed that GAP for cucumbers, tomatoes and strawberries refers to field treatments but the indoor use of penconazole on cucumbers is authorized in Switzerland.

GAP for the world-wide use of penconazole on all commodities was reported by the 1992 JMPR. The Meeting received updated information on GAP for pome fruits and grapes from Germany. The information on GAP provided by Australia, France, Greece, Italy and the UK was basically the same as in 1992.

Penconazole is applied to pome fruits and grapes by foliar spray as EC, WP or tablet (TP) formulations, alone or mixed with other fungicides. Up to 10 or more spray treatments with maximum rates of 0.07 kg ai/ha (Italy) or 0.09 and 0.15 kg ai/ha (South Africa, Morocco) are allowed.

The present Meeting reviewed the new residue data on pome fruits and grapes in the context of previous reviews.

Pome fruits. The 1992 JMPR estimated a maximum residue level of 0.2 mg/kg for pome fruits, based on numerous European trials with residues generally below 0.1 mg/kg, but also up to 0.17 mg/kg.

In addition to the trials evaluated in 1992, the present Meeting received reports of twelve German residue trials on apples and seven on pears from 1986-87 which accorded with German GAP (10-12 treatments with 0.038 kg ai/ha, 14-day PHI), but total residues were determined instead of those of the parent compound. Although the PHI for pears is 28 days (because a mixed formulation with mancozeb is used and the PHI is determined by ETU residues from mancozeb) the Meeting considered the 14-day residues on pears because the residue behaviour on apples and pears is comparable. Penconazole was applied 11 or 12 times at 0.037 kg ai/ha. After 14 days the total residues in apples ranged from 0.05 to 0.35 mg/kg and in pears from 0.05 to 0.29 mg/kg. As the residue is defined as penconazole the total residues were not used in estimating a maximum residue level, but were noted as useful additional information. The Meeting agreed to maintain the current recommendation of 0.2 mg/kg for pome fruits.

Grapes. The 1992 JMPR estimated a maximum residue level of 0.2 mg/kg for penconazole in grapes, based on a large number of trials with residues generally below 0.2 mg/kg four weeks after the last treatment.

The present Meeting received data from numerous new trials according to GAP. In French trials in 1993 penconazole was applied eight times a season at rates from 0.014 to 0.028 kg ai/ha. Residues at PHIs of 28-30 days ranged from <0.02 to 0.04 mg/kg for the parent, and from <0.07 to 0.24 mg/kg for total residues. In three trials in South Africa (1 treatment, 0.03-0.045 kg ai/ha) total residues 14 days after the last treatment were from 0.08 to 0.14 mg/kg. Eleven German trials (6 treatments with 0.006-0.036 kg ai/ha) showed maximum total residues of 0.43 mg/kg and parent residues of 0.04 mg/kg (35-day PHI) and ten Italian trials (5-10 treatments with 0.002-0.003 kg ai/hl, 0.02-0.08 kg ai/ha) gave total residues from 0.1 to 0.32 mg/kg and parent residues from <0.02 to 0.07 mg/kg at a 14-day PHI.

Because the parent penconazole is the relevant residue with regard to consumer safety, the total residues determined as DCBA were not used for the estimation of a maximum residue level. The Meeting agreed to maintain the current recommendation of 0.2 mg/kg for grapes.

Raisins and grape pomace. Processing studies were carried out on grapes. Although parent residues were not detectable in wine and juice, they were found in raisins and wet pomace. Residues of the parent compound in 2 Italian trials were concentrated in raisins and dry pomace by factors of 2-3 and 22 respectively. Total residues as DCBA in 6 trials showed concentration factors ranging from 2 to 6 for raisins and from 4.5 to 11 for dry pomace. The Meeting estimated a maximum residue level of 0.5 mg/kg for dried grapes (raisins).

RECOMMENDATIONS

The Meeting estimated the maximum residue level shown below for dried grapes (i.e. currants, raisins and sultanas) which is recommended for use as an MRL.

Definition of the residue: penconazole

Commodity		Recommended limit, mg/kg		PHI on which based, days
CCN	Name	New	Previous	

DF 0269	Dried grapes (currants, raisins and sultanas)	0.5	-	30[1]

[1] PHI for fresh grapes

FURTHER WORK OR INFORMATION

Desirable

Processing studies on apples and tomatoes (from 1992).

REFERENCES

Altenburger, E. 1995a. Penconazole - Second Working Paper prepared by Ciba-Geigy Ltd., Basel, Switzerland, March 1995. Unpublished.

Altenburger, E. 1995b. Penconazole (CGA 71818) - JMPR 1995. Letter from Ciba-Geigy Ltd., Basle, 08. June 1995. Unpublished.

Anon. 1994a. Information on GAP, residue data and explanatory notes on Penconazole for the 1995 JMPR. Federal Biological Research Centre for Agriculture and Forestry, Federal Republic of Germany, May, 1994. Unpublished.

Anon. 1994b. Information from The Netherlands on pesticides to be considered by the JMPR 1995 - penconazole. Ministrie van Volksgezondheid, Welzijn en Sport, Netherlands, August, 1994. Unpublished.

Anon. 1994c. Information on GAP for penconazole for the 1995 JMPR by Pesticides Safety Directorate, UK. Unpublished.

Anon. 1995a. Information on GAP and national MRLs for penconazole for the 1995 JMPR by Agricultural and Veterinary Chemicals Policy Section of Department of Primary Industries and Energy, Australia, April 12, 1995. Unpublished.

Anon. 1995b. Information on GAP for penconazole for the 1995 JMPR. Ministry of Agriculture and Fisheries, New Zealand, May 25, 1995. Unpublished.

Buettler, B. 1982. CGA 71818, Deep freeze stability of residues in apples and grapes; Ciba-Geigy Ltd., Basel, Switzerland, Rep.-No. SPR 17/82, 05.05.1982. Unpublished.

Bussmann, W. 1986. Analytical method REM 11/86: Penconazole (CGA-71818) determination of total residues as 2,4-dichlorobenzoic acid by liquid chromatography - plant material. Ciba-Geigy Ltd., Basel, Switzerland, 02.09.1986. Unpublished.

JMPR, 1992. Pesticides residues in food. Evaluations 1992, Part I - Residues. FAO Plant Production and Protection Paper 118, FAO, Rome, 1993.