MYCLOBUTANIL (181)

EXPLANATION

Myclobutanil first evaluated at the 1992 JMPR and maximum residue levels were estimated for fruits and animal commodities. Draft MRLs for apricots, cherries, peaches and plums are at Step 6.

At the 28th (1996) CCPR (ALINORM 97/24), the EU was in disagreement with residue evaluation on stone fruits.

The manufacturer proposed the reconsideration of MRLs for stone fruits in the light of new GAP in the USA. Updated information on new GAP for myclobutanil in the USA and the EU was available to the Meeting.

The manufacturer submitted new residue data on apricots, bananas, citrus fruit, blackcurrants, strawberries, tomatoes, and hops for evaluation.Myclobutanil is used as a post-harvest treatment on citrus and there is as proposed use on bananas to prevent losses during shipment.

METHODS OF RESIDUE ANALYSIS

Analytical methods

Analytical methods were developed to determine the parent compound and its main metabolites, α-(3-oxobutyl)-α-(4-chlorophenyl)-1*H*–1,2,4-triazole-1-propranenitrile (RH-9089, the keto derivative), α-(3-hydroxybutyl)-α-(4-chlorophenyl)-1*H*–1,2,4-triazole-1-propanenitrile (RH-9090) the hydroxy derivative, and the conjugate of RH-9090 (Stavinski *et al.*,1988a).

Residues are soxhlet-extracted overnight with 0.5 N HCl in methanol; this converts the RH-9090 conjugate to RH-9090. RH-9089 is reduced to RH9090 with sodium borohydride ($NaBH_4$). The extract is partially purified by partitioning successively with petroleum ether and methylene chloride, and further cleaned up by chromatography on columns of Chelex 100-Fe^{+++} and Florisil or silica gel. Myclobutanil and RH-9090 fractions are eluted separately by adjusting the polarity of the eluent. The two fractions are separately analysed by GLC with NP or EC detection. The recoveries of myclobutanil and RH-9090 were 92±17% and 83±20% respectively.

This method was also used to determine the parent compound and the same metabolites in bananas with an LOD of 0.01 mg/kg and recoveries of 90% for myclobutanil and 85% for RH-9090.

A simplified analytical method (Brackett, 1984), methanol extraction, partitioning first with hexane and then between hexane and methylene chloride, and clean-up on a Florisil column (silica gel or LC 18 Cartridge) and detection by GLC ECD or NPD, was used in many trials and reported in 1992 (Brackett,1984).

Another analytical method was reported for the analysis of hops. Samples are extracted with acetone/water and partitioned with hexane saturated with sodium chloride. The aqueous layer is extracted twice with dichloromethane. After evaporation of the solvent the reisude is dissolved in cyclohexane/ethyl acetate and cleaned up by gel permeation. The residues are determined by GC-MS,

with an LOD of 0.2 mg/kg for both myclobutanil and RH-9090. The reported recoveries were 72% for myclobutanil and 81% for RH-9090 (Nat. Hop Assoc.1995).

It was reported that myclobutanil could be determined by the multi-residue method in The Netherlands "Analytical Methods for Pesticide Residues in Foodstuffs" 6th. edition (1996). The reported LOD in various types of samples ranged from 0.01 to 0.05 mg/kg, with a recovery of 107%.

Stability of pesticide residues in stored analytical samples

The stability of myclobutanil was studied in stored samples of soils, apples, grapes and tomatoes.

Soil samples fortified at 1 mg/kg with myclobutanil and stored at -15°C were analysed after 0, 7, 14, 42, 83, 183, 365 days and one and two years. There was no significant decrease with time. After two years recoveries were about 82% (Brackett *et al.,* 1985).

Apples. Untreated apple samples were homogenized, fortified at 0.1 mg/kg with [^{14}C]-myclobutanil, and stored at -15°C for two years. The average recovery was 95% ± 8% (Deakyne *et al.,* 1986a).

Grapes fortified at 0.1 mg/kg and stored at -15°C showed an average recovery of 98% over a two-year period (Deakyne *et al.,* 1986b).

Cucurbits. In a study to determine the effect of long-term frozen storage on myclobutanil and RH-9090 in cucurbits samples were fortified at 0.5 mg/kg and stored at -10°C for three years. There was no effect on the total residue during this period (Bartra, 1995a).

Tomatoes. Samples of tomatoes were spiked with 1 mg/kg each of myclobutanil and RH-9090 and stored frozen in the dark at approximately -10°C. At specified intervals from 0 to 36 months, samples of stored and freshly fortified tomatoes were analysed. After all intervals, the average recoveries of both myclobutanil and RH-9090 from the fresh fortifications were similar to those from the stored samples. Recoveries ranged from 77.8% to 100% for myclobutanil and from 63.1% to 109% for RH-9090 (Bartra, 1997a).

Almond kernels and hulls. Samples of almond kernels and hulls were spiked with 1 mg/kg of myclobutanil and RH-9090. After two years of storage at -10°C there was no decrease of either compound (Bartra,1997b).

Definition of the residue

The results of supervised trials indicated that the parent compound is the major component of the residue. Where residues of the parent compound are significant those of the main metabolites are much lower. The previous definition of the residue as the parent compound is therefore considered appropriate for monitoring compliance with MRLs and for the estimation of dietary intake.

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

USE PATTERN

Information on GAP for the use of myclobutanil was given in the 1992 monograph. New information on GAP for stone fruit in the USA and the EU is shown in Table 1.

Myclobutanil formulated as an emulsifiable liquid concentrate or a wettable powder can be used to protect against crown rot complex in bananas at a concentration of 200 to 400 mg ai/l in

water. It may be applied to banana hands by spraying, and in some locations by dipping or passing the fruit through a recirculating cascade system.

Myclobutanil formulated as an EC or wax emulsion in water can be used on citrus fruit as a post-harvest treatment to control Penicillium spp.

Table 1. Registered uses of myclobutanil.

Crops	Country	Form.	Application				PHI, days
			Method	kg ai/ha	kg ai/hl	No.	
Apricot	France	EC 125g/l	F		0.00625	3-6	7
	France	60 WP	F		0.006	3-6	7
	Greece	EC 125g/l	F	0.055-0.125	0.0037-0.005	3	15
	Hungary	EC	F	0.025-0.0375	0.0025	>2	24
	Romania	EC	F	0.062	0.0062	>2	10
	Spain	EC 75 g/l	F	0.09	0.006	1-2	21
		WP 8 g/kg	F	<0.084	0.0056	1-4	21
	Switzerland	WP 35 g/kg	F	0.05-0.078	0.005	>4	21
	USA	40 WP	F	0.07-0.165 max.total 1.22	0.0038-0.006	7-17	0
Blackcurrants	France	EC	F	0.075		5-6	14
		WP	F	0.075		5-6	14
	Eire	SC	F	0.09		4-6	14
	Switzerland	EC	F	0.084-0.165	0.007-0.011	>4	28
	Switzerland	WP	F	0.06-0.135	0.005-0.009	>4	28
	UK	SC	F	0.09		4-6	14
Cherries	France	EC	F		0.0075	2-4[1]	
	Germany	WP	F	0.135	0.009	>3	21
	Hungary	EC	F	0.025-0.0375	0.0025	>2	14-24
	Romania	EC	F	0.062	0.0062	>2	10
	Switzerland	WP	F	0.05-0.078		>4	21
	USA	WP	F	0.07-0.165 max. 1.45	0.0038-0.006	<9	0
Citrus fruit	Spain	SC	post-harvest drench or spray		0.05	1	0
	Spain	WWE 3g/l	post-harvest spray	0.01 kg ai /t of fruit	0.003	1	0
Hops	UK	SC	F	0.045-0.135	0.0045	6	10
Nectarines	Greece	EC	F	0.055-0.125	0.0037-0.005	3	15
	Hungary	EC	F	0.025-0.0375	0.0025	>2	24
	Romania	EC	F	0.062	0.0062	>2	10
	Spain	EC	F	0.1125	0.075	1-4	15
	Switzerland	WP	F	0.05-0.078	0.005	>4	21
	Tunisia	EC	F	0.1125	0.075	1-3	10
	USA	WP	F	0.07-0.165 max.1.45	0.0038-0.006	>9	0
	Yugoslavia	EC	F	0.0336-0.072	0.0048-0.006	4	35
Peaches	France	EC	F	0.075	0.00625-0.0075	3-6	10
	France	WP	F		0.0045	3-6	[1]
	Greece	EC	F	0.0555-0.125	0.0037-0.005	3	15
	Hungary	EC	F	0.025-0.0375	0.0025	>2	14
	Italy	SC	F	0.075-0.093	0.005-0.0062	3-4	15
	Italy	WP	F	0.042-0.073	0.0035-0.0052	3	15
	Israel	EC	F	0.09	0.006	1-2	14
	Portugal	EC	F	0.0375	0.00375	1-2	21

Crops	Country	Form.	Application				PHI, days
			Method	kg ai/ha	kg ai/hl	No.	
	Spain	EC	F	0.09-0.1125	0.006-0.0075	1-4	15
	Spain	WP	F	0.084	0.0056	1-4	15
	Switzerland	WP	F	0.05-0.078	0.005	>4	21
	Tunisia	EC	F	0.1125	0.0075	1-3	10
	USA	WP	F	0.07-0.165 max. 1.45/season	0.0038-0.006	<9	0
	Yugoslavia	SC	F	0.0336-0.0576	0.0048	4	35
Plums	France	WP	F		0.0045-0.0075	2-6	[1]
	France	EC	F		0.0075	2-4	[1]
	Greece	EC	F	0.055-0.1125	0.0037-0.005	3	15
	Hungary	EC	F	0.025	0.0025	up to 2	14
	Israel	EC	F	<0.12	0.006-0.012	2-3	14 (b)
	Romania	EC	F	0.062	0.0062	up to 2	10
	Switzerland	WP	F	0.05-0.078	0.005	up to 4	21
	Tunisia	EC	F	<0.1125	0.0075	1-3	10
Plums /Prunes	USA	40WP	F	0.07-0.165 max. 1.22	0.0038-0.006	7	0
Strawberries	Belgium	12EC	F	0.0625		3-6	1
	Eire	6SC	F	0.09		4- 6	3
	France	12EC	F	0.0625		4-6	3
		60WP	F	0.06		4-6	3
		7.5 EC	F	0.0375		2	3
	Germany	60WP	F	0.045-0.12	0.0045-0.006	up to 6	7
	Italy	12EC	F	0.05	0.005	3-4	7
	Spain	12EC	F	0.075	0.0075	1-4	5
	Spain	8WP	F	0.048	0.0048	1-4	5
	Spain	7.5 EC	F	0.06	0.006	1-2	7
	Switzerland	35WP	F	0.06-0.135	0.005-0.009	up to 4	
		EC	F	0.084-0.165	0.007-0.011	up to 4	28
	UK	6SC		0.09		4-6	3
Tomatoes	Belgium	60 WP	fg	<0.075	0.0075	3-6	3
	Belgium	125 g/l EC	fg/F	<0.075	0.0075	3-6	3
	Canada	40 WP	fg/F	0.136	0.0136	1-2	14
	Italy	12EC	fg/F	0.05-0.075	0.005-0.0075	3-4	7
	Israel	12EC	F	0.120		2-3	3
	Morocco	12EC	fg/F	0.62	0.006	1-3	7
	Spain	12EC	fg/F	<0.112	0.0075	1-6	3
		8WP	fg/F	<0.072	0.0048	1-6	5
	USA	40WP	f/F	0.07 max. 0.4 /season			0 or 5[3]

F: foliar
fg: field or glasshouse
[1] No PHI on label
[2] Also post-harvest
[3] For tomatoes for processing

RESIDUES RESULTING FROM SUPERVISED TRIALS

Residues of both myclobutanil and its main metabilites were determined most of the trials. In the Tables residues of "RH-9090" are total residues of RH-9089, RH-9090 and its conjugates, determined and expressed as RH-9090.

Stone fruits

Supervised field trials carried out on stone fruits in France, Italy, Spain and the USA were reported in the 1992 monograph. Residues were measured in the edible portions of the fruits and the proportional weights of the edible portions were not given. The 1992 Meeting estimated maximum residue levels in accordance with the Codex commodity descriptions by taking into account the average percentage weights of the stones of the individual commodities.

Apricots. The 1992 monograph reported 10 trials in France and one in Italy; the metabolites were determined only in the Italian trial. Residues following treatments at 0.075 to 0.36 kg ai/ha were 0.04 to 0.17 mg/kg in samples taken 7-10 days after the last treatment.

US GAP reported to the present Meeting allows a maximum application of 1.22 kg ai/ha per season with a PHI of 0 days. Five trials were conducted at five locations in the USA according to GAP (7 applications at 0.167 kg ai/ha, 0 day PHI), with different crop varieties (Bartra *et al.*,1993). The plot size ranged from 4 to 15 trees. Ground applications were made with an air-blast sprayer or hand-gun. Apricot samples were analysed for myclobutanil and the metabolites by GLC with an LOD of 0.01 mg/kg. The sampling-to-analysis interval (SAI) ranged from 173 to 207 days. Myclobutanil residues in the edible portions ranged from 0.11 to 0.62 mg/kg and total residues from 0.13 to 0.7 mg/kg.

The results are shown in Table 2.

Table 2. Myclobutanil residues in apricots from supervised trials. The underlined residues are from treatments according to Gap and were used to estimate maximum residue levels.

Country, State, year	Form.	Application			PHI days	Residues mg/kg			Ref.
		No.	kg ai/ha	Total kg ai/ha		Myclo-butanil	RH-9090	Total	
France, 1987	SC	6	0.06	0.36	8	0.04			F60-03-87
France, 1987	SC	6	0.06	0.36	7	0.08			F60-03-87
France, 1987	12EC	6	0.062	0.372	7	0.06			F60-01-87
France, 1987	12EC	6	0.075	0.45	7	0.01			F60-01-87
France, 1987	12EC	6	0.0625	0.375	8	0.04			F60-03-87
France, 1987	12EC	6	0.075	0.45	8	0.04			F60-03-87
France, 1986	12EC	1	0.075	0.075	0	0.4			F33-01-86
					5	0.4			
					10	0.17			
					14	0.1			
					21	0.05			
					28	0.02			
France	SC	7	0.06	0.42	14	0.04			F60-02-87
Italy	12EC	5	0.05, 0.075, 0.1, 0.15	0.3	18	0.02	<0.01	0.02	4148808
Italy	12EC	5	0.05, 0.075.1, 0.15	0.6	18	0.04	<0.01	0.04	
USA, CA 1992	40WP	7	0.167	1.17	0	0.17	0.08	0.25	Bartra *et al.*, 1993
USA, CA 1992	40WP	7	0.167	1.17	0	0.23	0.06	0.29	

Country, State, year	Form.	Application			PHI days	Residues mg/kg			Ref.
		No.	kg ai/ha	Total kg ai/ha		Myclo-butanil	RH-9090	Total	
USA, CA 1992	40WP	7	0.167	1.17	0	0.11	0.02	0.13	
USA, CA 1992	40WP	7	0.167	1.17	0	0.12	0.02	0.14	
USA, WA 1992	40WP	7	0.167	1.17	0	0.62	0.08	0.7	

Cherries. Data from residue decline trials in Germany were evaluated in 1992. Since four of these trials were according to German GAP reported to the present Meeting they were re-evaluated, with the results shown Table 3.

The 1992 monograph reported several trials on five varieties of fruit carried out on seven US States, where the total amounts applied were below the maximum permitted (1.45 kg ai/ha per season). The results were evaluated according to the 1992 GAP PHI of 7 days (Spina 1991a). The results of those trials which can be evaluated against the current US GAP PHI of 0 days are shown in Table 3.

In five other trials at four locations in the USA in 1987 (Spina, 1991b), five or six ground applications were made with an air-blast sprayer or a hand-gun, the total amounts applied being below the maximum permitted. The SAIs in these trials were 1501-1590 days. The total residues in the edible portions ranged from 0.22 to 2.05 mg/kg.

Table 3. Myclobutanil residues in cherries from supervised trials. The underlined residues are from treatments according to GAP and were used to estimate maximum residue levels.

Country, State, year	Application				PHI, days	Residues mg/kg			Ref.
	Form	No.	kg ai/ha	Total kg ai/ha		Myclo-butanil	RH-9090	Total	
Germany, 1987	6WP	3	0.09 0.135	0.315	0	0.94	0.02	0.96	DEU 87F20021
					7	0.17	0.03	0.2	
					14	0.06	0.02	0.08	
					21	0.02	<0.01	0.02	
					21	0.006	<0.01	0.006	juice
Germany, 1987	6WP	3	0.09- 0.135	0.315	0	0.36	0.01	0.37	(DEU 87F20041)
					7	0.12	0.02	0.14	
					14	0.05	0.01	0.06	
					21	0.02	<0.01	0.02	
					21	0.02	<0.01	0.02	juice
Germany 1987	6WP	3	0.09 0.135	0.315	0	0.46	<0.01	0.46	(DEU 87F20111)
					14	0.01	<0.01	0.01	
					21	<0.01	<0.01	<0.01	
Germany 1987	6WP	3	0.09 0.09 0.135	0.315	0	0.19	0.02	0.21	DEU 87F20131
					7	0.02	<0.01	0.02	
					14	0.02	<0.01	0.02	
					21	0.02	<0.01	0.02	
USA, CA 1987	60DF	5	0.21	1.05	0	0.68	0.11	0.79	Spina 1991a
					7	0.44	0.23	0.67	
					15	0.27	0.2	0.47	
					21	0.16	0.46	0.62	

Country, State, year	Application				PHI, days	Residues mg/kg			Ref.
	Form	No.	kg ai/ha	Total kg ai/ha		Myclo-butanil	RH-9090	Total	
USA, CA 1987	60DF	5	0.21	1.05	7	0.41	0.19	0.6	Spina 1991a
					15	0.22	0.27	0.49	
					21	0.23	0.39	0.62	
USA, CA, 1987	60DF	5	0.21	1.05	0	0.92	0.13	1.05	Spina 1991a
					7	0.45	0.06	0.51	
					15	0.39	0.11	0.50	
					21	0.02	0.01	0.03	
USA, MI,1984	40W	5	0.425	2.13	0	2.64	0.44	3.08	
USA, WI, 1984	40W	6	0.421	2.53	9	0.56	0.39	0.95	
USA WI, 1984	40W	7	0.421	2.95	1	1.0	0.48	1.48	
USA OR, 1987	60DF	5	0.21	1.05	0	0.28	0.04	0.32	Spina 1991a
					7	0.19	0.04	0.23	
					14	0.10	0.05	0.15	
					21	0.03	0.03	0.06	
USA MI, 1987	60DF	6	0.21	1.26	7	0.92	0.60	1.52	
					14	0.61	0.73	1.34	
USA MI, 1987	60DF	6	0.21	1.26	7	0.84	0.58	1.42	
					14	0.35	0.60	0.95	
USA WI, 1987	60DF	6	0.21	1.26	8	0.38	0.43	0.81	
					14	0.19	0.50	0.69	
USA CA, 1987	60DF	5	0.211	1.06	0	0.85	0.22	1.07	Spina, 1991b
USA OR, 1987	60DF	5	0.211	1.06	0	0.20	0.02	0.22	
USA MI, 1987	60DF	6	0.211	1.39	0	1.44	0.61	2.05	
USA MI, 1987	60DF	6	0.211	1.39	0	1.04	0.57	1.61	
USA WI, 1987	60DF	6	0.211	1.39	0	1.12	0.4	1.52	

Peaches. Several field trials carried out in the USA, France and Spain were evaluated in 1992. Details of some of them that can be re-evaluated according to current GAP are given in Table 4.

The Meeting also received data from field trials in 1987 on seven varieties at seven locations in the USA, where samples were taken at a 0-day PHI. Total applications up to 1.5 kg ai/ha approximated GAP (maximum application per season 1.45 kg ai/ha). Residues were determined in the edible portions of the fruit. The SAIs were 1486-1492 days (Ding,1991a). The results are shown in Table 4.

Table 4. Myclobutanil residues in peaches from supervised trials. The underlined residues are from treatments according to GAP and were used to estimate maximum residue levels.

Country, Location, Year	Application				PHI, days	Residues, mg/kg			Ref.
	Form.	No.	kg ai/ha	Total kg ai/ha		Myclobut	Rh-9090	Total	
France 1986	EC	1	0.075	0.075	0	0.01			F31-02-86
					5	0.05			
					10	0.03			
					14	0.03			
					21	0.02			
					28	0.02			
Spain 1985	6WP	5	0.081	0.41	20	0.02			491-85-18
Spain 1987	12EC	3	0.10	0.30	20	0.03			491-87-14
USA, AR 1987	60DF	9	0.211	1.90	0	0.33	0.02	0.35	Ding,
USA, CA 1987	60DF	7	0.211	1.48	0	0.66	0.11	0.76	1991a
USA, NC 1987	60DF	10	0.211	2.11	0	0.84	0.28	1.12	

Country, Location, Year	Application				PHI, days	Residues, mg/kg			Ref.
	Form.	No.	kg ai/ha	Total kg ai/ha		Myclobut	Rh-9090	Total	
USA, PA 1987	60DF	8	0.22	1.78	0	1.22	0.31	1.53	
USA, VA 1987	60DF	9*	0.209	1.81	0	0.85	0.21	1.06	
USA, CA 1987	60DF	9	0.211	1.90	0	0.38	0.17	0.55	
USA, MO 1987	60DF	11	0.211	2.32	0	0.62	0.19	0.81	
USA, CA 1987	60DF	7	0.21	1.47	0	0.74	0.17	0.91	
					7	0.36	0.24	0.6	
					14	0.24	0.22	0.46	
					20	0.11	0.11	0.22	
USA, CA 1987	60DF	7	0.21	1.49	0	0.75	0.07	0.82	Stavinski *et al.*,
					7	0.28	0.06	0.34	1987b
					14	0.23	0.06	0.29	
					20	0.11	0.07	0.18	
USA, AR 1987	60DF	9	0.21	1.89	0	0.34	0.03	0.37	Stavinski *et al.*,
					7	0.18	0.04	0.22	1987a
					14	0.1	0.04	0.14	
USA, CA 1987	60DF	7	0.21	1.44	0	0.75	0.07	0.82	Stavinski *et al.*,
					7	0.28	0.06	0.34	1987a
					14	0.23	0.06	0.29	

Plums and prunes. The 1992 JMPR evaluated field trials on plums in three US States. In five trials the parent ane metabolites were determined in both fresh and dried fruit. Data from supervised trials in Italy reported to the 1992 JMPR were re-evalutated against other current southern European GAP.

The Meeting also received summarized data from field trials in 1987 on four varieties of fruit at five locations in the USA, where samples were taken at a 0-day PHI. In three of these trials the total application was much higher than permitted per season according to US labels (1.22 kg ai/ha). The application season for these trials was from the end of February to July, with PHIs of 8 to 30 days. The SAIs ranged from 1474 to 1573 days (Ding, 1991b). The residues of the parent compound ranged from 0.09 to 1.12 mg/kg and the total residues from 0.1 to 1.44 mg/kg. The results of all the evaluated trials are shown in Table 5.

Table 5. Myclobutanil residues in plums from supervised trials. The underlined residues are from treatments according to GAP and were used to estimate maximum residue levels.

Location, Year	Application				PHI, days	Residues, mg/kg			Ref.
	Form.	No.	kg ai/ha	Total, kg ai/ha		Myclobut	RH-9090	Total	
Italy, 1988	12EC	4	0.05-0.075	0.25	14	0.01	0.03	0.04	41 48808
Italy, 1988	12EC	4	0.1-0.15	0.5	14	0.07	0.03	0.1	
USA, CA 1987	60DF	9	0.21	1.92	0	0.11	0.04	0.15	Stavinski *et al.*, 1988b
					6	0.07	0.03	0.1	
					14	0.06	0.03	0.09	
USA, CA 1987	60DF	7	0.211	1.48	0	0.09	0.01	0.1	Ding, 1991b
USA, CA 1987	60DF	9[2]	0.211	1.90	0	0.25	0.11	0.36	
USA, WA 1987	60DF	8[3]	0.211	1.69	0	0.28	0.12	0.4	
USA, MI 1987	60DF	6[4]	0.211	1.39	0	0.59	0.14	0.73	
USA, PA 1987	60DF	12[5]	0.200	2.67	0	1.12	0.32	1.44	
USA, CA 1987	40W	6	0.21	1.28	14 (Ff)	0.41	0.07	0.48	Stavinski *et al.*, 1990
					14 (Df)	0.49	0.22	0.71	
USA, CA 1989	40W	6	0.21	1.28	14 (Ff)	0.12	0.01	0.13	
					14 (Df)	0.53	0.10	0.63	

Location, Year	Application				PHI, days	Residues, mg/kg			Ref.
	Form.	No.	kg ai/ha	Total, kg ai/ha		Myclobut	RH-9090	Total	
USA, CA 1989	40W	6	0.21	1.28	14 (Ff)	0.14	<0.01	0.14	
					14 (Df)	0.74	0.22	0.96	
USA, ID 1989	40W	6	0.21	1.28	14 (Ff)	0.05	<0.01	0.05	
					14 (Df)	0.22	0.02	0.24	
USA, OR	40W	6	0.21	1.28	14 (Ff)	0.09	0.04	0.13	
					14 (Df)	0.35	0.34	0.69	

Ff: fresh fruit. Df: dried fruit
[1]Application intervals 8 to 36 days from February to June, the two last applications at 8 and 14 day intervals
[2]Applications from April to August at 13-16 day intervals
[3]Applications from April to August at 7-42 day intervals, the two last applications at 31-42 day intervals
[4]Applications from April to September at 7-14 day intervals, the two last applications at 14 and 6 day intervals

Bananas. Four trials in the USA (California) were according to the proposed use in the banana packing stations in Central America. They were designed to simulate the normal treatment procedures used by commercial growers before shipment and distribution. All treatments consisted of one application at 200, 400 or 800 mg ai/l with a back-pack or hand-gun sprayer. Washed green banana hands were dipped or sprayed and allowed to air-dry for one hour before packing and storage in a cold room at 13°C.

Samples of bananas were taken at 0, 7, 14 and 21 days after application were removed from cold storage, gasified for 24 hours with ethylene and stored for 3 days to simulate supermarket shelf storage. A minimum of 16 random individual whole fruit samples from 4 hands per trial were then sampled, separated into peel and pulp, chopped and stored frozen (-10°C) until analysis. The SAIs were 8-14 days (Zogorski and Ding, 1992). The results are shown in Table 6. Because the highest rate consistent with the proposed GAP is 400 mg ai/l, the data from trials carried out at 800 mg ai/l were omitted from the Table.

Four other trials were conducted in Hawaii, where myclobutanil (CE or WP) was used at 200, 400 or 800 mg ai/l. Whole fruit were weighed before separation into pulp and peel, the weights of which were also recorded (Bartra and Zogorski, 1993). At day 0 residues in the pulp were between 0.01 and 0.05 mg/kg, but increased slightly with storage. The hands lost weight during storage, by an average of 7.26%, mainly from the peel. Residues in the whole fruit were 0.49-0.61 mg/kg from 200 mg ai/l and 0.6-1.36 mg/kg from 400 mg ai/l. The results are shown in Table 6.

In three trials at three different sites in Costa Rica bananas were treated with myclobutanil 2EC at 0, 100, 200 and 400 mg ai/l. Samples of pulp and peel taken 7, 14 and 21 days after treatment were analysed and the residues in the whole fruit calculated (Bartra,1994). The residue in the peel were 0.46-0.65 mg/kg from 100 mg ai/l, 1.0-1.6 mg/kg from 200 mg ai/l and 2.7-3.9 mg/kg from 400 mg ai/l. The residues in the whole fruit were 0.5-0.69 mg/kg from 200 mg ai/l and 1.3-1.7 mg/kg from 400 mg ai/l. Because the lowest rate consistent with the proposed GAP is 200 mg ai/l the data from the trial at 100 mg ai/l are not shown in Table6.

Table 6. Myclobutanil residues in bananas from supervised trials with treatments according to proposed GAP. Singly underlined residues would be used to estimate maxium residue levels, and doubly underlined to estimate STMRs if the GAP is confirmed.

Country, State, Year	Application			Storage period, days	Sample	Residue, mg/kg			Ref.
	Form	mg ai/l	Method			Myclob.	HD-9090	Total	
USA, CA 1991	2EC	200	spray	0	peel	0.36	0.01	0.37	Zogorski 1992

Country, State, Year	Application			Storage period, days	Sample	Residue, mg/kg			Ref.
	Form	mg ai/l	Method			Myclob.	HD-9090	Total	
					pulp	nd	nd	nd	
Trial 1				7	peel pulp	0.29 <0.01	<0.01 nd	0.3 <0.01	
				14	peel pulp	0.33 0.02	<0.01 nd	0.34 0.02	
				21	peel pulp	* 0.02	0.02 nd	* 0.02	
		400	spray	0	peel pulp	0.36 <0.01	nd nd	0.36 <0.01	
				7	peel pulp	0.51 0.02	0.01 nd	0.52 0.02	
				14	peel pulp	0.34 0.02	0.02 <0.01	0.36 0.03	
				21	peel pulp	0.82 0.03	0.02 <0.01	0.84 0.03	
USA, CA, 1991	2EC	200	hand dip	0	peel pulp	1.08 nd	<0.01 nd	1.09 nd	
Trial 2				7	peel pulp	1.14 0.03	0.08 0.01	1.22 0.04	
				14	peel pulp	1.1 0.03	0.05 <0.01	1.15 0.03	
				21	peel pulp	1.58 0.07	0.03 <0.01	1.6 0.08	
	2EC	400	dip	0	peel pulp	1.64 nd	<0.01 nd	1.64 nd	
				7	peel pulp	2.06 0.03	0.07 0.01	2.13 0.04	
				14	peel pulp	2.34 0.05	0.07 0.01	2.4 0.06	
				21	peel pulp	2.54 *	0.05 <0.01	2.6 *	
USA CA, 1991	2EC	200	spray	0	peel pulp	0.13 nd	nd nd	0.13 nd	
Trial 3				7	peel pulp	0.2 0.02	0.01 nd	0.21 0.02	
				14	peel pulp	0.41 *	0.01 nd	0.42 *	
				21	peel pulp	0.36 nd	0.01 nd	0.37 nd	
		400	spray	0	peel pulp	0.28 nd	<0.01 nd	0.28 nd	
				7	peel pulp	0.56 0.02	0.02 <0.01	0.58 0.02	
				14	peel pulp	0.59 0.03	0.03 0.01	0.6 0.04	
				21	peel pulp	0.72 0.02	<0.01 nd	0.72 0.02	
USA, CA 1991	2EC	200	spray	0	peel pulp	0.03 nd	<0.01 nd	0.03 nd	
Trial 4				7	peel pulp	0.02 nd	nd nd	0.02 nd	
				14	peel pulp	0.03 *	nd nd	0.03 *	
				21	peel pulp	0.02 nd	nd nd	0.02 nd	
		200	dip	0	peel pulp	0.67 nd	<0.01 nd	0.67 nd	

Country, State, Year	Application			Storage period, days	Sample	Residue, mg/kg			Ref.
	Form	mg ai/l	Method			Myclob.	HD-9090	Total	
				7	peel pulp	0.93 0.03	0.01 <0.01	0.94 0.03	
				14	peel pulp	1.12 0.03	0.02 nd	1.14 0.03	
				21	peel pulp	0.99 0.03	0.03 nd	1.02 0.3	
	2EC	400	spray	0	peel pulp	nd nd	nd nd	nd nd	
				7	peel pulp	<0.01 0.02	nd nd	<0.01 0.02	
				14	peel pulp	0.06 0.01	nd nd	0.06 0.01	
				21	peel pulp	0.13 <0.01	nd nd	0.13 <0.01	
	2EC	400	dip	0	peel pulp	1.32 0.01	0.06 nd	1.38 0.01	
				7	peel pulp	1.71 0.01	0.03 0.01	1.74 0.02	
				14	peel pulp	1.6 0.04	0.03 0.01	1.63 0.05	
				21	peel pulp	1.43 0.05	0.04 <0.01	1.47 0.05	
Hawaii, Kurtis town, 1992	2EC	200	spray	0	peel pulp whole	1.02 0.01	nd nd	1.02 0.01 0.48	Bartra and Zogomski 1993
				7	peel pulp whole	1.14 0.09	0.03 nd	1.17 0.09 0.54	
				14	peel pulp whole	1.14 0.1	0.04 nd	1.18 0.1 0.55	
				21	peel pulp whole	1.28 0.09	0.04 0.05	1.32 0.14 0.55	
				28	peel pulp whole	1.16 0.07	0.04 0.04	1.2 0.11 0.49	
	2EC	400	spray	0	peel pulp whole	1.93 0.03	0.01 nd	1.94 0.03 0.89	
				7	peel pulp whole	2.21 0.19	0.06 0.01	2.27 0.2 1.07	
				14	peel pulp whole	1.76 0.19	0.06 0.02	1.82 0.21 0.85	
				21	peel pulp whole	2.25 0.22	0.08 0.06	2.33 0.28 1.06	
				28	peel pulp whole	1.99 0.16	0.08 0.07	2.07 0.23 0.86	
Hawaii, Hilo 1992	2EC	200	dip	0	peel pulp whole	1.34 0.02	nd nd	1.34 0.02 0.61	
				14	peel pulp	1.14 0.11	0.04 nd	1.18 0.11	

Country, State, Year	Application			Storage period, days	Sample	Residue, mg/kg			Ref.
	Form	mg ai/l	Method			Myclob.	HD-9090	Total	
					whole			0.54	
				28	peel	0.98	0.08	1.06	
					pulp	0.17	0.02	0.19	
					whole			0.49	
	2EC	400	dip	0	peel	2.04	0.01	2.05	
					pulp	0.03	nd	0.03	
					whole			0.9	
				14	peel	1.94	0.06	2.0	
					pulp	0.21	0.01	0.22	
					whole			0.93	
				28	peel	1.53	0.09	1.62	
					pulp	0.19	0.08	0.27	
					whole			0.69	
	2EC	400	spray	0	peel	2.56	0.01	2.57	
					pulp	0.05	nd	0.05	
					whole			1.13	
				14	peel	2.27	0.07	2.34	
					pulp	0.25	0.01	0.26	
					whole			1.06	
				28	peel	3.65	0.12	3.77	
					pulp	0.27	0.05	0.32	
					whole			1.36	
	40WP	400	spray	0	peel	1.32	nd	1.32	
					pulp	0.02	nd	0.02	
					whole			0.62	
				14	peel	1.38	0.06	1.44	
					pulp	0.2	0.01	0.21	
					whole			0.69	
				28	peel	1.48	0.07	1.56	
					pulp	0.18	0.04	0.22	
					whole			0.69	
	40WP	400	dip	0	peel	1.58	0.01	1.59	
					pulp	0.03	nd	0.03	
					whole			0.71	
				14	peel	1.27	0.05	1.32	
					pulp	0.17	0.03	0.2	
					whole			0.6	
				28	peel	1.6	0.07	1.67	
					pulp	0.12	0.02	0.14	
					whole			0.64	
Hawaii Hilo, 1992	2EC	400	spray	0	peel	2.26	nd	2.26	
					pulp	0.02	nd	0.02	
					whole			1.03	
				7	peel	2.72	0.03	2.75	
					pulp	0.1	nd	0.1	
					whole			1.24	
				14	peel	2.08	0.05	2.13	
					pulp	0.12	0.01	0.13	
					whole			0.97	
				21	peel	2.84	0.06	2.9	
					pulp	0.17	0.01	0.18	
					whole			1.24	
				28	peel	2.58	0.07	2.65	
					pulp	0.15	0.02	0.17	
					whole			1.07	
	40WP	400	spray	0	peel	1.56	nd	1.56	
					pulp	0.02	nd	0.02	
					whole			0.73	

Country, State, Year	Application			Storage period, days	Sample	Residue, mg/kg			Ref.
	Form	mg ai/l	Method			Myclob.	HD-9090	Total	
				14	peel pulp whole	1.45 0.19	0.05 0.01	1.5 0.2 0.75	
				28	peel pulp whole	1.67 0.1	0.05 0.02	1.72 0.12 0.68	
Hawaii Hilo 1992	2EC	400	spray	0	peel pulp whole	2.72 0.04	0.01 nd	2.73 0.04 1.25	
				14	peel pulp whole	2.26 0.22	0.07 0.02	2.32 0.24 1.03	
				28	peel pulp whole	3.24 0.28	0.11 0.03	3.35 0.31 1.31	
	40WP	400	spray	0	peel pulp whole	1.8 0.03	nd nd	1.8 0.03 0.82	
				14	peel pulp whole	2.33 0.21	0.06 0.03	2.39 0.24 1.02	
				28	peel pulp whole	2.67 0.41	0.08 0.04	2.75 0.45 1.14	
Costa Rica 1993 2	2EC	200	spray	7	peel pulp whole	1.11 0.1	0.02 nd	1.13 0.1 0.22	Bartra 1994
				14	peel pulp whole	1.2 0.1	0.03 nd	1.23 0.1 0.3	
				21	peel pulp whole	1.32 0.14	0.05 0.01	1.37 0.15 0.25	
	2EC	400	spray	7	peel pulp whole	3.26 0.23	0.04 nd	3.3 0.23 1.52	
				14	peel pulp whole	3.62 0.31	0.06 0.02	3.7 0.33 1.64	
				21	peel pulp whole	3.77 0.35	0.08 0.02	3.85 0.37 1.64	
	2EC	200	spray	7	peel pulp whole	1.17 0.09	0.02 <0.01	1.19 0.09 0.56	
				14	peel pulp whole	1.07 0.11	0.01 nd	1.08 0.11 0.49	
				21	peel pulp whole	1.57 0.15	0.03 0.01	1.6 0.16 0.69	
		400	spray	7	peel pulp whole	2.95 0.17	0.03 nd	2.98 0.17 1.35	
				14	peel pulp whole	2.81 0.29	0.06 0.01	2.87 0.3 1.3	
				21	peel	2.91	0.06	2.97	

Country, State, Year	Application			Storage period, days	Sample	Residue, mg/kg			Ref.
	Form	mg ai/l	Method			Myclob.	HD-9090	Total	
					pulp whole	0.26	0.02	0.28 1.26	
Costa Rica St.1 1993	2EC	200	spray	7	peel pulp whole	0.99 0.12	0.02 nd	1.01 0.12 0.5	
				14	peel pulp whole	1.33 0.12	0.03 nd	1.36 0.12 0.61	
				21	peel pulp whole	1.22 0.13	0.06 nd	1.28 0.13 0.55	
	2EC	400	spray	7	peel pulp whole	2.7 0.31	0.04 nd	2.74 0.31 1.33	
				14	peel pulp whole	2.86 0.29	0.05 0.02	2.91 0.31 1.33	
				21	peel pulp whole	3.83 0.39	0.09 0.02	3.92 0.41 1.68	

*lack of residue data

Citrus fruit

GAP exists in Spain for post-harvest spraying with a water wax emulsion or spraying or drenching with an emulsifiable concentrate, to control Penicillium. Summary reports of trials in Spain on mandarins and oranges were submitted to the Meeting, but lacked critical analytical data such as LODs, recoveries and chromatograms.

Mandarins. Twelve trials were conducted using 3 g/l water wax emulsion or 120 g/l emulsifiable concentrate formulations as drenches. Only myclobutanil was determined.

Five trials were with a water wax emulsion.Residues of myclobutanil in the whole fruit were 2.6-2.9 mg/kg at day 0 (Elf. Atochem, 1996c).

Seven trials were carried out with the EC formulation applied at 0.05 kg ai/hl. In two of them whole fruit were separated into peel, pulp and juice fractions. Residues of myclobutanil in whole fruit at day 0 ranged from 0.94 to 2 mg/kg (Elf Atochem, 1996b).

Table 7. Myclobutanil residues in mandarins from supervised trials in Spain after one post-harvest treatment. Underlined residues are from treatments according to GAP. All drench applications (Elf Atochem, 1996b,c).

Trial no./Year	Application			Sample	Days after treatment	Myclobutanil, mg/kg
	Form.	kg ai/t fruit	kg ai/hl			
5/95	EC		0.05	whole[1]	0	1.15
					30	1.40
					45	1.0
				peel	0	2.75
					30	3.40
					45	2.0
				pulp	0	nd

Trial no./Year	Application			Sample	Days after treatment	Myclobutanil, mg/kg
	Form.	kg ai/t fruit	kg ai/hl			
					30	nd
					45	nd
				juice	0	0.1
					30	nd
					45	nd
6/1995	EC		0.05	whole	0	0.94
					30	1.5
					45	1.1
				peel	0	3.35
					30	3.8
					45	3.1
				pulp	0	nd
					30	nd
					45	nd
				juice	0	0.09
					30	nd
					45	nd
5/1994	EC		0.05	whole fruit	0	2.0
					7	1.7
					14	1.1
7/1994	EC		0.05	whole fruit	0	1.56
10/1994	EC		0.05	whole fruit	0	1.33
					7	1.1
					14	0.57
11/1994	EC		0.05	whole	0	1.5
					7	1.2
					14	1.1
12/1994	EC		0.05	whole	0	1.7
					7	1.2
					14	1.0
1994	WWE	0.003		whole	0	2.6
					7	2.35
					14	2.26
1994	WWE	0.003		whole	0	2.8
					7	2.54
					14	2.36
1994	WWE	0.003		whole	0	2.75
					7	2.18
					14	2.4
1994	WWE	0.003		whole	0	2.72
					7	2.53
					14	2.51
1994	WWE	0.003		whole	0	2.9

Oranges. Fifteen trials were carried out in 1994 and 1995. Five were on Valencia late oranges with a water wax emulsion at 0.003 kg ai/tonne of fruit. Whole fruits were separated into peel, pulp and juice fractions which were analysed for myclobutanil only. Residues were found only in the peel (Elf. Atochem, 1996a).

Other trials in 1994 on different varieties of orange were with the water wax emulsion or EC formulation according to Spanish GAP. Fruit treated with the wax emulsion were analysed only at

day 0, but those treated with the EC were analysed at intervals. Only whole fruit were analysed and metabolites were not determined (Elf Atochem, 1996c).

The residues of myclobutanil in all the trials ranged from 0.87 to 2.66 mg/kg. The results are shown in Table 8.

Table 8. Myclobutanil residues in oranges from supervised trials in Spain after one post-harvest treatment. The underlined residues are from treatments according to GAP. All spray applications (Elf Atochem, 1996a,c).

Year, Trial no.	Form.	Application		Sample	PHI, days	Myclobutanil, mg/kg
		kg ai/t fruit	kg ai/hl			
1995 9/95	WWE	0.003		whole fruit	0	2.3
					30	1.99
					60	2.6
					90	1.88
				peel	0	7.1
					30	5.03
					60	7.1
					90	6.0
				pulp	0	nd
					30	nd
					60	nd
					90	nd
				juice	0	nd
					30	nd
					60	nd
					90	nd
1995 10/95	WWE	0.003		whole fruit	0	0.87
					30	1.04
					60	1.66
					90	0.74
				peel	0	1.77
					30	3.2
					60	4.6
					90	0.74
				pulp	0	nd
					30	nd
					60	nd
					90	nd
				juice	0	nd
					30	nd
					60	nd
					90	nd
1995 11/95	WWE	0.003		whole fruit	0	1.47
					30	1.44
					60	0.8
					90	1.24
				peel	0	3.8
					30	5.5
					60	3.0
					90	3.8
				pulp	0	nd
					30	nd

Year, Trial no.	Form.	Application		Sample	PHI, days	Myclobutanil, mg/kg
		kg ai/t fruit	kg ai/hl			
					60	nd
					90	nd
				juice	0	nd
					30	nd
					60	nd
					90	nd
1995	WWE	0.003		Whole fruit	0	2.6
12/95					30	2.6
					60	2.0
					90	1.8
				peel	0	6.6
					30	6.5
					60	6.1
					90	2.18
				pulp	0	nd
					30	nd
					60	nd
					90	nd
				juice	0	nd
					30	nd
					60	nd
					90	nd
1995	WWE	0.003		whole fruit	0	1.23
13/95					30	1.6
					60	1.98
					90	1.9
				peel	0	3.22
					30	5.0
					60	7.8
					90	4.8
				pulp	0	nd
					30	nd
					60	nd
					90	nd
				juice	0	nd
					30	nd
					60	nd
					90	nd
14/94	WWE	0.003		whole fruit	0	2.63
15/94	WWE	0.003		Whole fruit	0	2.36
20/94	WWE	0.003		whole fruit	0	2.43
22/94	WWE	0.003		whole fruit	0	2.66
1995 7/95	EC		0.05	whole fruit	0	1.3
					30	1.6
					45	1.0
				peel	0	4.22
					30	3.0
					45	3.4
				pulp	0	nd
					30	nd
					45	nd
				juice	0	0.1
					30	nd
					45	nd
1995	EC		0.05	whole fruit	0	1.06

Year, Trial no.	Form.	Application		Sample	PHI, days	Myclobutanil, mg/kg
		kg ai/t fruit	kg ai/hl			
					30	1.16
					45	1.1
				peel	0	3.5
					30	3.4
					45	3.3
				pulp	0	nd
					30	nd
					45	nd
				juice	0	0.7
					30	nd
					45	nd
1994 6/94	EC		0.05	whole fruit	0	1.8
					7	1.7
					14	0.7
1994 8/94	EC		0.05	whole fruit	0	1.36
1994	EC		0.05	whole fruit	0	1.49
9/94					7	1.37
					14	0.69
1994	EC		0.05	whole fruit	0	1.53
13/94					7	1.2
					14	1.1

Berries

Residue trials on blackcurrants and strawberries were carried out in France, Italy, Spain and the UK.

Blackcurrants. Eighteen field trials in the UK and one in France between 1990 and 1995 were reported. Four of the trials in 1995 were on commercial crops at a range of sites in the UK. Three formulations were used to determine whether the formulation type or concentration had any bearing on residue levels. Myclobutanil 60 g/l SC, 6 WP or 200 g/l EW was applied at the GAP rate of 0.09 kg ai/ha at 11-14 day intervals, using a Krist Mistblower. Three trials in 1991 were residue decline trials, also at 0.09 kg ai/ha. The plots were 5 m rows and myclobutanil was applied with a motor knapsack sprayer at 6- to 20-day intervals. Samples were stored at -20°C and the SAI was 6-10 months.

In all the UK trials the samples were analysed for the parent compound and metabolites as RH-9090. The LOD for both compounds was 0.01 mg/kg and recoveries were >80%.

Residues of myclobutanil in blackcurrant samples harvested at 13-17 days PHI in approximate accordance with UK GAP ranged from 0.04 to 0.43 mg/kg and those of RH-9090 were between 0.02 and 0.19 mg/kg. Total residues were 0.08-0.47 mg/kg.

In the trial in France blackcurrants were treated with myclobutanil 12 EC at 0.062 kg ai/ha. Samples were taken 7, 21, and 35 days after the last treatment.

The results are given in Table 9.

Table 9. Myclobutanil residues in blackcurrants. Underlined residues are from trials according to GAP and were used to estimate maximum residue levels.

Country, Location, Year	Application				PHI, days	Residues, mg/kg			Ref.
	Form	No	kg ai/hl	kg ai/ha		Myclob.	RH-9090	Total	
England, 1991	6 SC	5	0.0045	0.09	0	0.72	0.67	1.39	Murray, 1993b
					7	0.26	0.66	0.92	
					13	0.07	0.19	0.26	
					20	0.13	0.29	0.42	
			0.009	0.18	20	0.1	0.1	0.2	
England, 1991	6SC	5	0.0045	0.09	0	0.57	0.16	0.73	
					8	0.31	0.64	0.95	
					17	0.08	0.14	0.22	
					21	0.2	0.09	0.29	
			0.009	0.18	21	0.22	0.20	0.42	
England, 1991	6SC	5	0.0045	0.09	0	0.52	<0.01	0.54	
					7	0.11	0.03	0.14	
					13	0.04	0.04	0.08	
					20	0.16	0.05	0.21	
England, 1990	6SC	6	0.006	0.12	12	0.57	0.22	0.79	Murray, 1993a
				Control	12	0.01	0.03	0.04	
England, 1990	6SC	6	0.006	0.12	16	0.46	0.13	0.59	
				Control		0.02	0.06	0.08	
England, 1990	6SC	6	0.006	0.12	16	0.21	0.11	0.32	
				Control		0.03	0.13	0.16	
England, Staffordshire, 1995	6SC	6		0.09	14	0.35	0.04	0.39	Agrisearch, 1996a
England, Worcestshire	6SC	6		0.09	14	0.3	0.05	0.35	
England, Kent 1995	6SC	6		0.09	14	0.19	0.02	0.21	
England, Kent 1995	6SC	6		0.09	14	0.24	0.04	0.28	
England, Staffordshire 1995	6WP	6		0.09	14	0.42	0.04	0.46	Agrisearch, 1996b
England, Worcs. 1995	6WP	6		0.09	14	0.29	0.05	0.34	
England, Kent 1995	6WP	6		0.09	14	0.31	0.03	0.34	
	6WP	6		0.09	14	0.26	0.05	0.31	
England, Staffordshire 1995	20EW	6		0.09	14	0.43	0.04	0.47	Agrisearch 1996c
England, Worcestshire 1995	20EW	6		0.09	14	0.3	0.07	0.37	
England, Kent 1995	20EW	6		0.09	14	0.24	0.04	0.28	
England, Kent 1995	20EW	6		0.09	14	0.26	0.05	0.31	
France 1992	12EC	3		0.0625	7	0.08			Anadiag, 1994a
					21	0.07			
					35	0.04			

Strawberries (Table 10). Several residue trials in the UK between 1990 and 1996 were reported. Two were carried out in Kent in 1990 to determine the rate of decline of myclobutanil and its metabolites determined as RH-9090. Myclobutanil SC was applied at 10- to 23-day intervals. Samples were stored frozen at -18°C for 11 months before analysis (Murray,1993c).

Four other trials were conducted at 4 sites in the UK, two in England and two in Scotland. Myclobutanil was applied five times at 11-14-day intervals (Murray, 1994).

Another four sets of three field trials were on commercial crops at a range sites in England. Each set consisted of an untreated plot and three plots (2 x 10 m rows) treated with different formulations. The treated plots were sprayed six times, with the first spray applied approximately 12 weeks before the expected harvest and the following five application at 9-16 day intervals. The SAI was 154 days (Agrisearch, 1996d-f).

Two other trials were conducted in England in 1996 to determine myclobutanil residues in strawberries, strawberry jam and strawberry preserve (Huntingdon, 1997a).

Myclobutanil residues in strawberries in the UK trials which approximated GAP ranged from 0.08 to 0.69 mg/kg.

Summary data from supervised trials in France, Italy and Spain during 1988 and 1989 were reported to the Meeting.

Other residue decline trials were conducted in 1992 and 1993 in Italy and Spain at 0.07-0.09 kg ai/ha. Samples from the Spanish trials were analysed only for myclobutanil. Residues of RH-9090 in the Italian trial after 7 days were below the LOD.

Table 10. Residues in strawberries from supervised trials. Underlined residues are from trials according to GAP and are used to estimate maximum residue levels.

Country, Year, Trial	Application				PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/hl	kg ai/ha		Myclo-butanil	RH-9090	
England 1990	6SC	6		0.09	0	1.21	0.07	Murray, 1993c
					5	0.36	<0.01	
					8	0.11	<0.01	
					15	0.07	<0.01	
England 1990	6SC	6		0.09	0	0.25	0.08	Murray 1993c
					7	0.23	<0.01	
					14	0.03	0.06	
England 1993	6SC	5		0.09	0	0.36	<0.01	Murray 1994
					3	0.48	<0.01	
					7	0.12	<0.01	
					14	0.02	<0.01	
				0.18	0	1.01	<0.01	
					7	0.2	<0.01	
England 1993	6SC	5		0.09	0	0.48	<0.01	Murray, 1994
					3	0.69	<0.01	
					7	0.28	<0.01	
					14	0.03	<0.01	
Scotland 1993	6SC	5		0.09	0	0.38	<0.01	Murray 1994
					3	0.24	<0.01	
					7	0.09	<0.01	

Country, Year, Trial	Application				PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/hl	kg ai/ha		Myclo-butanil	RH-9090	
					14	0.04	<0.01	
Scotland 1993	6SC	5		0.09	0	0.83	<0.01	Murray 1994
					3	0.5	<0.01	
					7	0.27	<0.01	
					14	0.06	<0.01	
England 1995 RH/1	6SC	6		0.09	3	0.2	<0.01	Agrisearch 1996f
England 1995 RH/2	6SC	6		0.09	3	0.19	<0.01	
England 1995 RH/3	6SC	6		0.09	3	0.22	<0.01	
England 1995 RH/4	6SC	6		0.09	3	0.19	<0.01	
England 1995 RH/1	6WP	6		0.09	3	0.17	<0.01	Agrisearch 1996e
England 1995 RH/2	6WP	6		0.09	3	0.2	<0.01	
England 1995 RH/3	6WP	6		0.09	3	0.15	<0.01	
England 1995 RH/4	6WP	6		0.09	3	0.18	<0.01	
England 1995 RH/1	20EW	6		0.09	3	0.18	<0.01	Agrisearch 1996d
England 1995 RH/2	20EW	6		0.09	3	0.19	<0.01	
England 1995 RH/3	20EW	6		0.09	3	0.1	<0.01	
England 1995 RH/4	20EW	6		0.09	3	0.19	<0.01	
England 1996	20EW	6	0.05	0.076	0	0.12	<0.01	Huntingdon, 1997a
					3	0.08	<0.01	
England 1996	20EW	6	0.05	0.082	0	0.15	<0.01	
					3	0.08	<0.01	
France 1989	EC	8		0.0625	0	0.06		Procida, 1989
					4	0.04		
					7	0.03		
					14	0.02		
					28	<0.01		
Italy 1988	EC	3	0.005	0.0375	7	0.09	<0.01	Pessina, 1990
		3	0.01	0.075	7	0.11	<0.01	
Italy 1993	EC	3	0.0062	0.067	0	0.07	0.01	Pessina 1995
					3	0.07	<0.01	
					7	0.05	<0.01	
Spain 1988	EC	5	0.0062	0.093	3	0.12		Jousseaume 1988
					7	0.07		
					14	0.04		
		5	0.0075	0.112	3	0.15		
					7	0.08		
					14	0.05		
Spain 1992	EC	2	0.011	0.0875	0	0.2		Anadiag. 1993a
					3	0.15		

Country, Year, Trial	Application				PHI, days	Residues, mg/kg		Ref.
	Form	No.	kg ai/hl	kg ai/ha		Myclo-butanil	RH-9090	
					7	0.08		
					13	0.08		
		1	0.011	0.0875	0	0.2		
					3	0.07		
					7	0.12		
					13	0.03		

Tomatoes. In nine trials on greenhouse tomatoes in Belgium in 1995, three formulations of myclobutanil (EC, SC and WP) were applied according to GAP at 0.0075 kg ai/hl to the point of run-off. Residues of myclobutanil and its metabolites were determined by GLC with an ECD. The LOD was 0.01 mg/kg for myclobutanil and 0.02 mg/kg for RH-9090. Samples were taken 3 and 7 days after the last treatment (Phytopharmacie, 1996a-c). Residues of myclobutanil were 0.05-0.15 mg/kg; RH-9090 was not detected.

Only summary data from two field trials carried out in France in 1990 were submitted to the Meeting. Eight application of myclobutanil EC at 0.075 kg ai/ha were made at 10-12 day intervals. The metabolites were not determined (Herisse, 1990,a,b). In four other trials in Southern France in 1996 to determine myclobutanil and its metabolites in whole tomatoes, juice, preserve and purée tomatoes were treated with myclobutanil 240 g/l EC or 200 g/l EW. The first applications were made 11 weeks before harvest and the other five at 10-14 day intervals. The SAIs were 320 to 348 days.

In a field trial in Italy (1993) to determine residue decline on industrial tomatoes, myclobutanil EC was sprayed three times to run-off at 0.00625 kg ai/hl at 7-day intervals and samples were collected at 0, 7 and 14 days after the last treatment. No RH-9090 was found in any of the analysed samples (LOD 0.01 mg/kg). The SAI was 16 months. Other trials in Italy in 1996 on two varieties were with 6 applications of myclobutanil 240 g/l EC or 200 g/l SC: only 2-4 applications are approved according to Italian GAP. The first application was made 11 weeks before harvest and the other five at 10-14 day intervals. The SAIs were 320 to 348 days.

Two trials were carried out in Morocco in 1992 and six (three field and three glasshouse) in 1993. In 1993 1, 3 or 4 applications of myclobutanil EC were made at 0.00625 kg ai/hl. The SAI ranged from 57 to 104 days. RH-9090 was determined in 1993 but not found above the LOD.

Fourteen residue trials were conducted in Spain between 1984 and 1993, five of them to measure residue decline.The trials in 1984-1986 were outdoor and only myclobutanil was determined. The trials in 1993 were indoors and RH-9090 was also determined. Residues of myclobutanil in samples of whole fruit from trials complying with GAP ranged from 0.03 to 0.24 mg/kg.

Reported US GAP indicates that myclobutanil 40 WP can be applied by ground or aerial spray to unripe fruit at an application rate of 0.07 kg ai/ha with a maximum of 0.4 kg ai/ha per season and an application interval of 11-21 days. Application may be made up to the day of harvest for the fresh market and with a 5-day PHI for varieties used in processing. A total of 21 trials was reported from California, Indiana, Ohio, Michigan, South Carolina, New Jersey and Florida, where myclobutanil was applied to different varieties of tomato. The fruit were harvested at day 0, and in some cases also at 5, 10 and 15 days after the last treatment, and analysed for the parent compound and total metabolites. Residues of the parent compound ranged from 0.01 to 0.22 mg/kg at day 0. Residues of metabolite were detected in only two trials which complied with GAP as a low proportion of the parent compound.

The results are shown in Table 11.

Table 11. Myclobutanil residues in tomatoes (whole fruit) from supervised trials. The underlined residues are from treatments according to GAP and were used to estimate maximum residue levels.

Country, Year, Trial no.	Application				PHI, days	Residues, mg/kg		Ref.
	Form.	No	kg ai/hl	kg ai/ha		Myclobutanil	RH-9090	
Belgium 1995 9131/1	WP	4 g	0.0075		3 7	<u>0.09</u> 0.1	nd nd	Phyto-pharmacie, 1996c
Belgium 1995 9131/2	WP	4 g	0.0075		3 7	<u>0.16</u> 0.11	nd nd	
Belgium 1995 9131/3	WP	4 g	0.0075		3 7	<u>0.06</u> 0.14	nd nd	
Belgium 1995 9131/1	EC	4 g	0.0075		3 7	<u>0.08</u> 0.09	nd nd	Phyto-pharmacie, 1996a
Belgium 1995 9131/2	EC	4 g	0.0075		3 7	<u>0.15</u> 0.08	nd nd	
Belgium 1995 9131/3	EC	4 g	0.0075		3 7	<u>0.05</u> 0.08	nd nd	
Belgium 1995 9131/1	EW	4 g	0.0075		3 7	<u>0.11</u> 0.12	nd nd	Phyto-pharmacie, 1996 b
Belgium 1995 9131/2	EW	4 g	0.0075		3 7	<u>0.15</u> 0.1	nd nd	
Belgium 1995 9131/3	EW	4 g	0.0075		3 7	<u>0.08</u> 0.12	nd nd	
France 1990	EC	8	0.015	0.075	0	0.13		Herisse, 1990a
					2	0.12		
					4	0.02		
					7	0.02		
France 1990	EC	8	0.015	0.075	0	0.06		Herisse, 1990b.
					2	0.09		
					4	0.09		
					7	0.03		
France, Aucamville 1996	SC	6	0.0075	<0.107	0	0.07	nd	Huntingdon, 1997d
					3	<u>0.04</u>	nd	
					7	0.02	nd	
France, Bressoles 1996	SC	6	0.0075	<0.12	0	0.11	<0.01	
					3	<u>0.05</u>	nd	
					7	0.01	nd	
France, Aucamville 1996	EC	6	0.0075	<0.107	0	0.05	nd	Huntingdon, 1997c
					3	<u>0.02</u>	nd	
					7	0.03	nd	
France, Bressols 1996	EC	6	0.0075	<0.12	0	0.05	nd	
					3	<u>0.03</u>	nd	
					7	0.03	nd	
Italy 1993	EC	3	0.00625	0.0641	0	0.08	<0.01	Pessina, 1996
					7	<u>0.02</u>	<0.01	
					14	0.03	<0.01	
Italy 1996	EC	6	0.0075	<0.114	0	0.24	<0.01	Huntingdon, 1996c
					3	0.18	<0.01	
					7	0.05	<0.01	
Italy 1996	EC	6	0.0075	<0.113	0	0.24	<0.01	
					3	0.18	<0.01	

Country, Year, Trial no.	Application				PHI, days	Residues, mg/kg		Ref.
	Form.	No	kg ai/hl	kg ai/ha		Myclobutanil	RH-9090	
					7	0.06	<0.01	
Italy 1996	SC	6	0.0075	<0.112	0	0.22	<0.01	Huntingdon, 1997d
					3	0.18	<0.01	
					7	0.08	<0.01	
Italy 1996	SC	6	0.0075	<0.112	0	0.24	<0.01	
					3	0.18	<0.01	
					7	0.06	<0.01	
Morocco 1992	EC	4 f	0.00625	0.0625	0	0.1		Anadiag, 1993b
					3	0.04		
					5	0.05		
					7	0.04		
Morocco 1992	EC	4	0.00625		0	0.04		Anadiag, 1993c
					3	0.06		
					5	<0.02		
					7	<0.02		
Morocco 1993	EC	1 f	0.00625	0.094	0	0.06	<0.01	Anadiag, 1994d
	EC	3 f	0.00625	0.094	7	0.09	<0.01	
	EC	4 f	0.00625	0.094	0	0.04	<0.01	
					3	0.02	<0.01	
					7	0.02	<0.01	
					14	0.01	<0.01	
Morocco 1993	EC	1 g	0.00625	0.094	0	0.03	<0.01	Anadiag, 1994e
	EC	3 g	0.00625	0.094	7	0.06	<0.01	
	EC	4 g	0.00625	0.094	0	0.11	<0.01	
					3	0.05	<0.01	
					7	0.04	<0.01	
					14	0.03	<0.01	
Spain 1984	EC	6	0.009	0.08	6	0.04		Jousseaume, 1986c
Spain Barcelona 1985	EC	8 f	0.008	0.240	0	0.06		Jousseaume, 1995
					3	0.04		
					5	0.03		
					8	0.02		
					15	0.02		
					22	0.02		
	EC	5	0.008	0.240	8	0.06		
		3	0.008	0.240	8	0.03		
		2	0.008	0.240	15	0.03		
Spain Barcelona 1986	EC	5 f	0.008	0.02	0	0.1		Jousseaume, 1986a
					2	0.15		
					4	0.07		
					8	0.1		
					16	0.05		
	EC	4 f	0.16	0.04	0	0.25		
					2	0.3		
					4	0.4		
					8	0.1		

Country, Year, Trial no.	Application				PHI, days	Residues, mg/kg		Ref.
	Form.	No	kg ai/hl	kg ai/ha		Myclobutanil	RH-9090	
Spain Barcelona 1986	EC	1 f	0.012	0.08	3	<0.01		Jousseaume, 1986b
					5	0.01		
					7	<0.01		
					9	<0.01		
					12	<0.01		
	EC	1	0.024	0.16	5	0.03		
					9	0.01		
					12	<0.01		
Spain 1993	EC	1 g	0.012	0.131	0	0.03	<0.01	Anadiag, 1994c
					7	0.02	0.02	
		2 g	0.012	0.131	7	0.02	<0.01	
		3 g	0.012	0.131	0	0.02	<0.01	
					4	0.03	<0.01	
					7	0.03	<0.01	
					14	0.04	0.02	
Spain 1993	EC	3 g	0.0083	0.131	0	0.16	0.01	Anadiag, 1994b
					3	0.24	0.02	
					7	0.16	0.03	
					14	0.04	0.02	
		2	0.0083	0.131	8	0.23	<0.01	
USA, CA 1989	WP	4 f		0.067	0	0.05	<0.01	Stavinski and Filchner, 1991
					5	0.03	<0.01	
USA, CA 1989	WP	4 f		0.07	0	0.07	<0.01	
					5	0.07	<0.01	
USA, CA 1989	WP	4 f		0.07	0	0.05	<0.01	
USA, IN 1989	WP	5 f		0.067	0	0.05	<0.01	
					5	0.04	<0.01	
USA, OH 1989	WP	5 f		0.067	0	0.05	<0.01	
					5	0.05	<0.01	
USA, MI 1989	WP	4 f		0.067	0	0.08	<0.01	
					5	0.03	<0.01	
USA, SC 1989	WP	4 f		0.067	0	0.08	<0.01	
					5	0.04	<0.01	
USA, NJ 1989	WP	5 f		0.07	0	0.03	<0.01	
					5	0.03	<0.01	
USA, FL 1990	WP	4 f		0.093	0	0.22	0.03	Ding & Zogorski, 1992
USA, CA 1993	WP	4 f		0.07	0	0.01	<0.01	Bartra 1995b
					5	0.01	<0.01	
					10	0.01	<0.01	
	WP	4		0.14	0	0.02	<0.01	
USA, NJ 1993	WP	4 f		0.07	0	0.05	0.01	

Country, Year, Trial no.	Application				PHI, days	Residues, mg/kg		Ref.
	Form.	No	kg ai/hl	kg ai/ha		Myclobutanil	RH-9090	
	WP	4 f		0.14	0	0.1	0.02	
USA, CA 1993	WP	4 f		0.07	0	0.03	<0.01	
	WP	4 f		0.14	0	0.08	0.02	
USA, OH 1993	WP	5 f		0.07	0	0.02	<0.01	
	WP	5 f		0.14	0	0.07	0.02	
USA, FL 1993	WP	4 f		0.07	0	0.02	<0.01	
					5	0.01	<0.01	
					10	0.01	0.01	
	WP	4 f		0.14	0	0.07	0.02	
USA, FL 1993	WP	5 f		0.07	0	0.02	<0.01	
	WP	5 f		0.14	0	0.04	<0.01	

f: field; g: glasshouse

Hops. In six trials in England reported to the Meeting myclobutanil EW was sprayed six times at 0.0045 kg ai/hl to the point of run-off. Residues of myclobutanil in samples of dried cones from trials complying with GAP, taken at 7-13 days PHI, ranged from 0.3 to 1.2 mg/kg. The residues of RH-9090 were all below the LOD (0.2 mg/kg). The results are shown in Table 12.

Table 12. Myclobutanil residues in hops (dried cones) from supervised trials in England (Nat. Hop Assoc., 1995).

Year	Application				PHI, days	Residues, mg/kg	
	Form	No	kg ai/hl	kg ai/ha		Myclobutanil	RH-9090
1991	EW	6	0.0045	0.101	7	0.5	<0.2
1991	EW	6	0.0045	0.101	13	0.3	<0.2
1992	EW	6	0.0045	0.103	8	1.2	<0.2
1992	EW	6	0.0045	0.103	9	0.27	<0.2
1991	EW	6	0.0045	0.103	3	1.8	<0.2
1991	EW	6	0.0045	0.09	4	1.6	<0.2

FATE OF RESIDUES IN STORAGE AND PROCESSING

In storage

No information was available.

In processing

Processing studies on tomatoes in France and the USA and on blackcurrants in the UK were reported to the Meeting.

Tomatoes treated at two levels were processed into various products simulating commercial practice as closely as possible in the USA (Stavinski *et al*, 1991). Samples harvested 5 days after the last of 4 applications at 0.067 and 0.14 kg ai/ha were washed and processed into canned whole tomatoes, juice, purée, wet pomace, dry pomace and paste.

Four processing studies were conducted in France in 1996. Tomatoes treated 6 times with myclobutanil 240 g/l EC or 200 g/l EW at 0.107 and 0.12 kg ai/ha and harvested 3 days after the last treatment were processed into juice, preserve and purée (Huntingdon, 1997c,d).

The results are shown in Table 13.

Table 13. Residues of myclobutanil in tomatoes and their processed products in the USA (Stavinski *et al.*, 1991) and France (Huntingdon, 1997c, d).

Application, kg ai/ha	PHI, days	Sample	Residues, mg/kg			Processing factor (total residue)
			Myclobutanil	RH-9090	Total	
USA						
0.282	5	unwashed fruit	0.03	nd	0.03	-
(0.07x4)		washed fruit	0.02	nd	0.02	0.67
		canned fruit	0.01	0.01	0.02	0.67
		wet pomace	0.25	nd	0.25	8.3
		dry pomace	0.43	nd	0.43	14.3
		juice	0.02	nd	0.02	0.67
		purée	0.02	0.02	0.04	1.3
		paste	0.08	0.03	0.11	3.7
0.56	5	unwashed fruit	0.04	0.02	0.06	-
(0.14 x 4)		washed fruit	0.06	0.02	0.08	1.3
		canned fruit	0.02	0.03	0.05	0.83
		wet pomace	0.026	0.006	0.03	0.5
		dry pomace	1.03	0.01	1.04	17.3
		juice	0.04	0.02	0.06	1.0
		purée	0.05	0.02	0.07	1.17
		paste	0.17	0.08	0.25	4.2
France						
0.107 x 6	3	whole fruit	0.02	nd	0.02	-
		juice	0.02	nd	0.02	1.0
		preserve	<0.01	nd	<0.01	<0.5
		purée	0.06	nd	0.06	3.0
0.12 x 6	3	whole fruit	0.03	nd	0.03	-
		juice	0.01	nd	0.01	0.33
		preserve	<0.01	nd	<0.01	<0.33
		purée	0.06	nd	0.06	2.0
0.107 x 6	3	whole fruit	0.04	nd	0.04	-
		juice	0.01	nd	0.01	0.25
		preserve	0.01	nd	0.01	0.25
		purée	0.04	nd	0.04	1.0
0.12 x 6	3	whole fruit	0.05	nd	0.05	-
		juice	0.01	nd	0.01	0.2
		preserve	<0.01	nd	<0.01	<0.2
		purée	0.05	nd	0.05	1.0

There was no concentration in the juice, preserve or canned tomatoes. Tomato purée showed a mean concentration factor of about 1.6. Only the paste and dry pomace consistently showed high concentration factors, largely due to the dehydration. In the US trials washing produced a slight reduction of the residue from the lower treatment rate and a slight increase at the higher rate, but the residues were too low for this to be significant.

Blackcurrant samples from three trials in England were processed into juice, and in one of the trials into canned fruit. Residues in the juice were lower than in the whole fruit, as were residues of the parent compound in the canned fruit. Residues of RH-9090 were higher than those of myclobutanil in both the juice and canned fruit owing to degradation of the parent compound during processing. The results are given in Table 14.

Table 14. Residues of myclobutanil in fresh and processed blackcurrants in England (Murray, 1993a).

Application			PHI, days	Sample	Residues, mg/kg		
Form.	kg ai/hl	No.			Myclobutanil	RH-9090	Total
6SC	0.006	6	12	whole fruit	0.57	0.22	0.79
				juice	<0.01	0.15	0.15
6SC	0.006	6	16	whole fruit	0.46	0.13	0.59
				juice	0.04	0.2	0.24
				canned fruit	0.09	0.5	0.59
6SC	0.006	6	16	whole fruit	0.21	0.11	0.32
				juice	0.07	0.14	0.21

Strawberries. Two trials were carried out in the UK in 1996 to determine the effect on residues of myclobutanil of processing strawberries treated with myclobutanil 20EW during field trials to preserve and jam. Samples for processing were taken at a 3-day PHI. The results are shown in Table15.

Table 15. Residues of myclobutanil in fresh and processed strawberries in England (Huntingdon, 1997a).

Application			PHI, days	Sample	Residues, mg/kg		Processing factor
Form.	kg ai/hl	No.			Mycobutanil	RH-9090	
20EW	0.05	6	3	whole fruit	0.08	<0.01	-
				jam	0.04	<0.01	0.5
				preserve	0.06	<0.01	0.75
20EW	0.05	6	3	whole fruit	0.08	<0.01	-
				jam	0.04	<0.01	0.5
				preserve	0.07	<0.01	0.88

RESIDUES IN FOOD COMMERCE OR AT CONSUMPTION

No information was provided.

NATIONAL MAXIMUM RESIDUE LIMITS

The following national MRLs were reported.

Country	Commodity	MRL, mg/kg
Belgium	Strawberry	0.5
	Tomato	0.5
France	Apricot	0.3
	Cherry	0.3
	Peach	0.3
	Plums	0.3
	Blackcurrants	1

Country	Commodity	MRL, mg/kg
	Strawberry	0.3
Germany	Strawberry	0.2
	Tomato	0.2
Italy	Peach	0.2
	Strawberry	0.2
Spain	Mandarin	5
	Orange	5
	Stone fruit	0.5
	Strawberry	2
	Tomato	1
Switzerland	Stone fruit	0.2
	Strawberry	0.2
USA	Stone fruit (except cherry)	2
	Cherry	5
	Prune (dried)	8
	Tomato	0.3[1]
	Tomato (paste)	1.2[1]
	Tomato purée	0.6[1]
Yugoslavia	Peaches	0.2

[1] Temporary

APPRAISAL

Myclobutanil is a systemic, foliar-applied fungicide. It was first reviewed by the 1992 JMPR. The MRLs recommended for stone fruits are now adopted as CXLs. At the 28th Session of the CCPR the EC delegation questioned the residue evaluation for stone fruits. The manufacturer provided information on GAP and data on residues for a review of use patterns and a reconsideration of maximum residue levels.

The Meeting received updated information on GAP in EC countries and the USA. The manufacturer provided reports of five supervised trials carried out in the USA on apricots in 1991, and data on residues at a 0-day PHI in cherries, peaches and plums.

The manufacturer also requested the evaluation of data on residues in bananas, blackcurrants, citrus, hops, strawberries and tomatoes. The manufacturer provided data on residues in sweet peppers, but this information was received too late for evaluation.

The analytical methods for determining the residues of myclobutanil and its metabolites in fruits were as described in the 1992 JMPR evaluation.

Studies of the stability of residues in stored analytical samples of soil, apples, grapes, tomatoes, cucurbits and almond meat and hulls were reported to the Meeting. Residues of myclobutanil and its metabolite hydroxy-myclobutanil (RH-9090) were found to be stable in frozen conditions (-15°C) in soil, apples and grapes for at least two years, in cucurbits and tomatoes (at -10°C) for three years and in almond meat and hulls at -10°C for at least two years. It can be concluded that residues of myclobutanil in stored samples are stable in frozen conditions.

Myclobutanil is available as 125 and 240 g/l emulsifiable concentrate, 60 g/l suspension concentrate, 200 g/l emulsion oil in water and 40% wettable powder.

Supervised trials

In all the trials on stone fruits reported to the Meeting the residues were determined in the edible portion of the fruits and the proportional weights of the stones were not given. The average percentage weights of the stones in each of the fruits were reported by the manufacturer and these averages were used to estimate maximum residue levels in the whole fruits.

Apricots. The results of field trials in France, Italy and the USA were provided. The trials from Italy were not considered for the estimation of a maximum residue level as no relevant GAP was reported. Residues from six trials according to GAP in France ranged from 0.01 to 0.08 mg/kg; the residues of the metabolite were not determined. In five trials according to US GAP (7-17 applications at 0.07 to 0.165 kg ai/ha, 0-day PHI), the total residues found were between 0.13 and 0.7 mg/kg in the edible fruit. Residues of the metabolite were between 13 and 26%, and in one trial 46%, of the parent compound. In summary the myclobutanil residues in apricots from trials complying with GAP were 0.01, 0.04, 0.04, 0.04, 0.06 and 0.08 mg/kg in France and 0.11, 0.12, 0.17, 0.23 and 0.62 mg/kg in the USA.

Cherries. Supervised trials on cherries carried out in Germany and the USA which were evaluated by the 1992 JMPR were re-evaluated at the light of new GAP. Total residues (myclobutanil + metabolites) were determined. Myclobutanil residues from four residue decline trials in Germany according to GAP (3 applications at 0.135 kg ai/ha, 21 days PHI) were <0.01 and 0.02 (3) mg/kg. Three of the US trials reported in 1992 which included a 0-day PHI were reviewed. Five other trials reported to the present Meeting complied with US GAP (<9 applications at 0.07-0.16 kg ai/ha, with a maximum of 1.45 kg ai/ha per season, 0-day PHI). The residues of myclobutanil *per se* in the US trials in rank order were 0.2, 0.28, 0.68, 0.85, 0.92, 1.04, 1.12 and 1.44 mg/kg. In two of the trials metabolite residues reached more than 40% of those of the parent compound.

Peaches. Several trials carried out in France, Spain and the USA were reported in 1992. A trial in France was not conducted according to GAP but it could be evaluated against the Spanish use pattern. Residues from two Spanish trials according to GAP (1-4 applications at 0.08-0.1125 kg ai/ha, 15 days PHI) were 0.02 and 0.03 mg/kg; metabolites were not determined. Three US trials reported in 1992 were re-evaluated together with six new trials, all according to new US GAP (<9 applications at 0.07-0.165 kg ai/ha, with a maximum of 1.45 kg ai/ha per season, 0-day PHI). Residues of RH-9090, its conjugate, and the ketone RH-9089 were determined as RH-9090 in all the trials. The total residue in the edible portion in the US trials ranged from 0.35 to 1.53 mg/kg, with residues of myclobutanil from 0.33 to 1.22 mg/kg.

Plums and prunes. Two trials reported to the Meeting complied with US GAP (7 applications at 0.06-0.165 kg ai/ha with a maximum of 1.2 kg ai/ha per season, 0-day PHI). The total residues were 0.1 and 0.73 mg/kg with myclobutanil residues of 0.09 and 0.59 mg/kg. One trial in Italy (4 applications at 0.1-0.15 kg ai/ha, 14-day PHI) was evaluated against Greek GAP (3 applications at 0.055-0.125, 15 days PHI); the total residue was 0.1 mg/kg. There were too few results to estimate a maximum residue level. The existing CXL is 0.2 mg/kg.

In view of the similar use patterns for the individual fruits, the Meeting agreed to evaluate the combined US data as applying to stone fruit, except plums. The myclobutanil residues in stone fruit (edible portion) in rank order (median underlined) were 0.09, 0.11, 0.12, 0.17, 0.2, 0.23, 0.28, 0.33, 0.34, 0.38, 0.59, 0.62, 0.66, 0.68, 0.74, 0.75 (2), 0.85, 0.92, 1.04, 1.12, 1.22 and 1.44 mg/kg. The Meeting estimated a maximum residue level of 2 mg/kg and an STMR of 0.62 mg/kg for stone fruit except plums, and recommended the withdrawal of the individual CXLs for apricot, cherries and peach.

Bananas. Several studies were conducted in the USA and Costa Rica according to the proposed use of myclobutanil in banana packing stations in grower countries. All treatments consisted of one application of myclobutanil, and banana hands were sprayed or dipped at various concentrations.

Those trials in which myclobutanil was used at 200 or 400 mg ai/l and residues were calculated on the whole banana were evaluated to estimate a maximum residue level.

Banana samples taken at intervals of 0 to 28 days after treatment showed that the residues in the pulp increase with time. There was also a loss in weight of the banana hands with storage time, mainly from the peel. Storage periods from 7 to 21 or 28 days represent the shipping periods needed to reach different markets.

Residues in samples with 0-7 days storage are most appropriate for estimating maximum residue levels because they are the highest in the whole fruit, but residues after longer storage times are appropriate for assessing dietary exposure because the residues in the pulp increase with time. Residues of the parent compound were predominant in the total residue; those of the sum of the free and conjugated forms of the hydroxy metabolite (RH-9090) were less than 10% of the total in most of the trials.

The highest residues in whole bananas from each trial at the highest proposed GAP concentration, 400 mg ai/l, from 7 to 28 days ranged from 0.64 to 1.7 mg/kg. Since these results were from trials according only to proposed GAP, the Meeting was unable to estimate a maximum residue level.

Residues of myclobutanil in the edible pulp of the bananas in rank order (median underlined) were 0.1, 0.17, 0.17, 0.19, 0.2, 0.21, 0.22, 0.27, 0.28, 0.35, 0.39 and 0.41 mg/kg.

Citrus fruit. The results of twelve trials in Spain on the post-harvest treatment of mandarins with myclobutanil were reported to the Meeting. The reports lacked critical analytical data such as LOD, recoveries, and chromatograms. The residues of myclobutanil (applied as a water/wax emulsion or emulsifiable concentrate) in samples of whole fruit from trials complying with GAP (0.05 kg ai/hl or 0.01 kg ai/t fruit, 0-day PHI), ranged from 0.94 to 2.9 mg/kg. The residues from treatments with the EC formulation at 0.05 kg ai/hl, 0-day PHI, in rank order were 0.94, 1.15, 1.33, 1.5, 1.56, 1.7 and 2.0 mg/kg. Fruit samples were also analysed at 7 and 14 days after treatment. No decrease in the residue was observed in most of the trials.

Several trials on the post-harvest treatment of various varieties of orange which complied with Spanish GAP were reported to the Meeting. Myclobutanil was used as a water/wax emulsion and an EC formulation. The residues of myclobutanil ranged from 0.87 to 2.66 mg/kg. The myclobutanil residues in the whole fruit from treatment with the EC formulation according to GAP (0.05 kg ai/hl) were 1.06, 1.3, 1.36, 1.49, 1.53 and 1.8 mg/kg.

Since the citrus trials lacked the critical analytical data mentioned above the Meeting could not recommend an MRL.

Whole-fruit samples of the oranges and mandarins in these trials were separated into peel, pulp and juice. Analysis showed that the myclobutanil residue was almost all in the peel and not found in the pulp. The residue in the juice was approximately 10% of that in the whole fruit (0-day PHI). The residues of the metabolite were not determined.

Berries. Several field trials were conducted on blackcurrants in the UK with various myclobutanil formulations. In all the trials blackcurrant samples were analysed for the parent compound and RH-9090. The residues of myclobutanil from trials according to UK GAP (4-6 applications at 0.09 kg ai/ha, 14 days PHI) ranged from 0.04 to 0.43 mg/kg, with total residues (myclobutanil + RH-9090)

from 0.08 to 0.47 mg/kg. In three of fifteen trials reflecting GAP, residues of the metabolite were equal to or higher than those of the parent compound.

The residues of myclobutanil in blackcurrants in rank order (median underlined) were 0.04, 0.07, 0.08, 0.19, 0.24, 0.24, 0.26, 0.26, 0.29, 0.3, 0.3, 0.31, 0.35, 0.42, 0.43 mg/kg.

The Meeting estimated a maximum residue level of 0.5 mg/kg and an STMR of 0.26 mg/kg for blackcurrants.

Numerous field trials on strawberries have been conducted in the UK, France, Italy and Spain. The residues in seventeen trials in the UK in accordance with GAP (4-6 applications at 0.09 kg ai/ha, 3-day PHI) ranged from 0.1 to 0.5 mg/kg; residues of the metabolite were below the LOD. In one trial in France with more applications than are allowed by GAP, the residue of myclobutanil at 4 days was 0.04 mg/kg. In two trials in Italy which complied with GAP (3 or 4 applications, 0.005 kg ai/hl, 7-day PHI) the residues were 0.05 and 0.09 mg/kg. The residues in strawberries from trials in Spain ranged from 0.02 to 0.15 mg/kg.

The myclobutanil residues in strawberries in rank order (median underlined) were 0.04, 0.05, 0.08, 0.08, 0.09, 0.1, 0.12, 0.15, 0.15, 0.15, 0.17, 0.18, 0.18, 0.19, 0.19, 0.19, 0.19, 0.2, 0.2, 0.22, 0.24, 0.36, 0.48, 0.5 and 0.69 mg/kg.

The Meeting estimated a maximum residue level of 1 mg/kg and an STMR of 0.18 mg/kg for strawberries.

Tomatoes. The results of a large number of indoor and outdoor trials from several countries were reported to the Meeting. The residues found in Belgian trials (indoors) reflecting GAP (3-6 applications at 0.0075 kg ai/hl, 3 days PHI) ranged from 0.05 to 0.16 mg/kg; metabolites were not detected. Four trials in France (6 applications at <0.12 kg ai/ha, 3 days PHI) were evaluated against Spanish GAP (1-6 applications, <0.112 kg ai/ha, 3 days PHI). The residues were 0.02, 0.03, 0.04 and 0.05 mg/kg. The residues from trials in Spain according to GAP ranged from 0.03 to 0.24 mg/kg; the residues of metabolites determined in two trials were below 20% of those of the parent compound. In one trial in Italy according to GAP the residue was 0.02 mg/kg, with metabolites expressed as RH-9090 below the LOD. Four other trials were carried out in Italy in 1996, but as the Meeting doubted whether the data had been recorded properly the residues from them were not included in the evaluation. In trials according to GAP in Morocco (1-3 applications, 0.00625 kg ai/hl, 7-day PHI), the residues were between 0.02 and 0.06 mg/kg. The residues of the metabolite determined in two trials were below the LOD.

The residues in fifteen US field trials according to GAP on several varieties of tomato (0.07 kg ai/ha/application, with a maximum of 0.4 kg ai/season, 0-day PHI), ranged from 0.01 to 0.22 mg/kg.

The myclobutanil residues in tomatoes in rank order (median underlined) were 0.01, 0.02 (7), 0.03 (3), 0.04 (3), 0.05 (7), 0.06 (2), 0.07, 0.08 (4), 0.09 (2), 0.11, 0.15 (3), 0.16, 0.22 and 0.24 mg/kg.

The Meeting estimated a maximum residue level of 0.3 mg/kg and an STMR of 0.05 mg/kg for tomatoes.

Hops. Four of six trials conducted in the UK were according to GAP (6 applications, 0.0045 kg ai/hl, 10 days PHI). The residues of myclobutanil in the dried cones ranged from 0.2 to 1.2 mg/kg. The Meeting considered the database insufficient to estimate a maximum residue level.

The Meeting was informed that a further four trials are in progress in Germany and that they included processing studies.

Processing

Two supervised trials on tomatoes were conducted in the USA, with 4 applications at rates of 0.067 and 0.14 kg ai/ha. Samples harvested 5 days after the last treatment were processed to canned whole tomatoes, juice, purée, pomace and paste. In four processing studies in France, tomatoes treated with 6 applications of myclobutanil (0.107-0.12 kg ai/ha) were harvested 3 days after the last treatment and processed into juice, preserve and purée.

There was no concentration of the residue in tomato juice, canned tomatoes or preserve. The residues in tomato purée were concentrated by factors of 1.0 to 3, with an average of 1.6. The concentration factors for dry pomace were 14 and 17, with an average of 15.5, and for paste 3.7 and 4.2, mean 3.9. In some processed products, residues of the metabolite reached 50% or more of the total residue. On the basis of an STMR of 0.05 mg/kg, the Meeting estimated STMR-Ps of 0.08 mg/kg for tomato purée, 0.78 mg/kg for dry pomace, and 0.2 mg/kg for paste.

Data from three processing trials on blackcurrants in the UK indicated that residues in the juice decreased about 1.5-5 times, with a mean processing factor of 0.35. Canned fruit, in a single trial, showed a decrease in the residue of myclobutanil but a higher concentration of the metabolite, with the same total residue. The Meeting estimated an STMR-P of 0.09 mg/kg for blackcurrant juice from the STMR of 0.26 mg/kg for blackcurrants (whole fruit).

Two processing trials on strawberries in the UK showed that residues do not concentrate in strawberry jam or preserve. The average processing factors were 0.5 for jam and 0.81 for preserve.

The Meeting estimated STMR-Ps of 0.09 mg/kg for jam and 0.15 mg/kg for preserve on the basis of an STMR of 0.18 mg/kg for whole strawberries.

RECOMMENDATIONS

On the basis of the data from supervised trials the Meeting concluded that the residue level listed below are suitable for establishing maximum residue limits and the supervised trials median residue are suitable for use in dietary intake estimations.

Definition of residue for compliance with MRL and for estimation of dietary intake: myclobutanil

Commodity		MRL, mg/kg		PHI, days	STMR or STMR-P, mg/kg
CCN	Name	New	Pevious		
FS 0240	Apricot	w	0.2		
FB 0278	Blackcurrant	0.5	-	14	0.26
	Blackcurrant juice				0.09 (P)
FS 0013	Cherries	w	1		
FS 0247	Peach	w	0.5		
FS 0012	Stone fruits, except plums	2	-	0	0.62
FB 0275	Strawberry	1	-	3	0.19
	Strawberry jam				0.09(P)
	Strawberry preserve				0.15(P)
VO 0448	Tomato	0.3	-	0	0.05
	Tomato, canned				0.05 (P)
	Tomato juice				0.05 (P)

Commodity		MRL, mg/kg		PHI, days	STMR or STMR-P, mg/kg
CCN	Name	New	Pevious		
	Tomato, dry pomace				0.78 (P)
	Tomato paste				0.2 (P)
	Tomato puree				0.08(P)

(P): STMR-P

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