PROFENOFOS (171)

EXPLANATION

Profenofos was reviewed by the 1990 JMPR, which recommended TMRLs for a number of commodities pending receipt of relevant information on registered national uses. The 1992 Meeting reviewed substantial information on GAP, confirmed or revised several recommendations and withdrew others for which GAP or residue data were inadequate. Additional GAP and/or supervised trials data were considered desirable for bulb onions and soya beans, and clarification of GAP was required for tea.

Clarification of GAP for tea, additional GAP information and/or additional data on other commodities for which data had previously been submitted, and supervised trials data on chilli peppers were submitted. Owing to the work-load, the FAO evaluation of profenofos and some other compounds was postponed to an *ad hoc* meeting in April 1994, by which time additional data for several commodities, analytical methods not previously provided, and comments on a number of proposed MRLs had been supplied. The Meeting reviewed the new information in the context of that previously reviewed.

USE PATTERN

In response to the 1992 requirement the Meeting was informed that the 1 kg ai/ha applications in the supervised tea trials reviewed by the 1990 JMPR were at a concentration of 50 g ai/hl while current GAP is 800 g ai/ha at 40 g ai/hl. The trials were therefore conducted at 1.25 times GAP application rates.

Additional information on GAP (Table 1) was also provided for several commodities on which residue data had previously been submitted as well as for chilli peppers.

Table 1. Nationally approved uses of profenofos, additional to those listed in 1992. All EC formulations.

Crop/Country	Application		PHI, days	Comments
	Rate, kg/ha (g ai/hl)	No.		
Beans, green				
Italy	(40-70)	≥1*	21	*pest-dependent; high vol.
Brussels sprouts				
South Africa	0.4-0.5	2-3*	10	*7-10-day intervals; 300-500 l/ha, high vol.
Cabbage/Cauliflower				
Italy	(40-70)	≥1*	21	*pest-dependent; high vol.
South Africa	0.4-0.5	2-3*	10	*7-10-day intervals; 300-500 l/ha, high vol.

Crop/Country	Application		PHI, days	Comments
	Rate, kg/ha (g ai/hl)	No.		
Citrus fruits				
South Africa	(25-50)*	1	60	*high vol.
	(25)*	1	60	*25-50% petal drop; 6-7 l spray/m tree height
Grapefruit	(37.5)*	1	60	*<pea size; 6-7 l spray/m tree height; citrus psylla
	(50)*	1	60	*<pea size; 10-12 l/m tree height; citrus mealy bug
Lemon	(37.5)*	1	60	*<golf-ball size; 6-7 l spray/m tree height
Italy	(50)*	1	70	*high vol., spring
Maize				
Italy	0.5-0.75 (40-70)	>1*	19	*high vol., pest-dependent
Spain	0.5-1.25 (50-125)	>1*	20	*high vol., pest-dependent
Onion, Bulb				
South Africa	0.5 (50-125)	3-4*	14	*7-10-day intervals
Peaches				
Italy	(40-70)*	>1**	60	*high vol., spring; **pest-dependent
Peppers, Chilli				
Indonesia	(75-100)*	5-15**	14	*high vol., spring; **pest-dependent
Malaysia	(85-110*)**	5-10	14	*exaggerated use; **high vol.
Sri Lanka	(100-150*)**	5-15	14	*exaggerated use; **high vol.
Thailand	(38-75)*	5-15	21	*high vol.
Peppers, green				
Italy	(40-70)*	>1**	28	*high vol.; **pest-dependent

RESIDUES RESULTING FROM SUPERVISED TRIALS

The Meeting received new supervised trials data on cotton and chilli peppers and details of previous summary data on artichokes. After the Meeting additional data were provided on beans, cauliflowers, tangerines and maize. The Meeting evaluated these and re-examined 1990 data on other commodities in the light of additional GAP information.

Artichokes. The 1992 summaries of Spanish and Italian trials (one each) and information on GAP in Spain submitted in 1992 were insufficient to recommend an MRL. In the Spanish trial residues were not detected (<0.002 mg/kg) in artichokes harvested 20 days after spray application (GAP PHI 21 days), while maximum residues were 0.2 mg/kg at 21 days in the Italian trial. Details of the previously summarized Spanish supervised trials (defining the limit of detection previously not defined) were provided to the Meeting, although the detailed report was not in English.

Beans (dry). The 1990 JMPR recommended a 0.05 mg/kg limit-of-determination TMRL, pending the submission of relevant country-specific GAP information by 1992. In the absence of the required information the 1992 JMPR recommended withdrawal of the proposal. The Meeting re-examined the 1990 data (included in Table 2 below) in the context of new information on Italian GAP. In the

Brazilian and Swiss dry bean trials 2 or 3 applications were made at 0.3 to 0.6 kg ai/ha compared with Italian GAP rates of 40-70 g ai/hl. Residues were 0.02 mg/kg in each of the 4 trials after 20 to 29 days. The Italian PHI is 21 days.

Beans, green. No limit has previously been recommended for green beans. Although some green bean trials data were available to the 1990 JMPR (Italy, Switzerland), country-specific GAP was not provided. Information on GAP for beans in El Salvador, the Philippines and Thailand provided to the 1992 JMPR could not be related to the 1990 data, but Italian GAP reported to the present Meeting could be related to Italian and Swiss trials reviewed by the 1990 JMPR. The 40-70 g ai/hl and 21-day PHI Italian GAP can be compared with supervised trial rates of 50 g ai/hl (0.6 and 0.75 kg ai/ha) in the Italian trials and 40 g ai/hl in the Swiss trials.

Data from two 1992 Malaysian supervised trials were provided after the Meeting. Applications were made by backpack sprayer to 48 m^2 plots. Samples were handled and stored in an acceptable manner and analyses were by method REM 119.01 which was provided (see "Methods of residue analysis"). Reported recoveries were 75% at 0.04 mg/kg. No information on GAP was provided for Malaysia, although the 75 and 150 g ai/hl field trial application rates are comparable to the 50-75 and 94-156 g ai/hl reported by the 1990 JMPR for Thailand and the Philippines respectively. For convenience the 1990 data are included below with the new data from Malaysia in Table 2.

Table 2. Residues of profenofos in beans resulting from supervised trials. Underlined residues are from treatments according to GAP.

Commodity, Country, Year	Application			Residues (mg/kg) at interval (days) after last application						Ref.
	Form.	Rate kg ai/ha (g ai/hl)	No.							
Dry Beans						20	29	30		
Brazil/1981	-	0.4	2			0.02				1
		0.6	2			0.02				
Switzerland/1978	-	0.3	3				0.02			
		0.3	3					0.02		
Green beans					0	6/7	14	21	28	
Italy/1985	-	0.75(50)	1		2.7	0.08	0.06	0.02		1
		0.6(50)	1		4.1	0.02*	0.3		1.4*	
				* mislabelled samples?						
				0	3	4	6	8/9	11	
Switzerland/1975	-	(40)	1	1.8	0.35		0.12	0.05		1
/1977		(40)	1	0.75		0.07		0.04	0.02	
Malaysia/1992				0	3	7	14	21		
Common long beans	500EC	0.36-0.54 (75)	4	2.4	0.3	0.02	<0.02	<0.02		2
		0.7-1.1 (150)	4	4	0.72	0.05	<0.02	<0.02		3
				Malaysian results corrected for control of 0.02 mg/kg.						

Brussels sprouts. The 1990 JMPR recommended a 0.5 mg/kg temporary limit based on 6 supervised

trials in three countries (one in The Netherlands, one in South Africa, and four in Switzerland). Information on nationally approved uses was required. Because the requirement was not met, the 1992 JMPR recommended withdrawal of the proposal (the 1992 Meeting had been informed that uses of profenofos on Brussels sprouts had been withdrawn in The Netherlands). South African GAP information provided to the present Meeting was reviewed in the context of the 1990 data. Maximum residues from treatments closest to South African GAP (0.4-0.5 kg ai/ha and 10-day GAP PHI) were:

	Rate kg ai/ha	mg/kg	PHI (days)	No. of trials per country
Netherlands	0.75	0.25	12	1
South Africa	0.5	0.45	4	1
		0.4	9	1
Switzerland	0.5	0.3	7	4
	0.5	0.2	14	
	0.04%	1.1*	7	
	0.04%	0.41*	14	

* The 0.04% application rate could not be directly compared to the 0.5 kg ai/ha South African GAP rate, because the 1990 JMPR summary of Swiss supervised trials data did not include the volume of spray/ha. South African GAP recommends 300 to 500 l/ha.

Cabbages. The 1990 JMPR recommended a 0.5 mg/kg temporary limit based on trials in Australia, Canada, Germany, South Africa and Switzerland. Maximum residues were 0.5 mg/kg after 14 days, but no country-specific information on GAP was provided. Information on Asian and South American GAP was provided to the 1992 JMPR. While this was not completely relevant to the diverse 1990 data base, the 1992 Meeting concluded that sufficient information was available to recommend replacement of the temporary MRL by a full MRL of 1 mg/kg in order to accommodate the shorter PHIs (7 days) of South Korea and the Philippines.

New information on GAP for cabbages and cauliflowers in Italy (40-70 g ai/hl, 21-day PHI) and South Africa (2 or 3 applications of 0.4 to 0.5 kg ai/ha, 10-day PHI) was provided to the Meeting. This was compared with the 1990 cabbage data, although only the South African data could be related strictly to GAP. Maximum residues from the trials reviewed in 1990 most relevant to the new information on GAP are summarized below.

Country	kg ai or % ai	Maximum residue (mg/kg) at interval (days) 5	7	8	9	10	11	14	15
Trials approximating new information on GAP									
South Africa	0.5			0.13					
Switzerland	0.04%					0.06			
Canada	0.06%		0.52						
Other trials									
Australia	0.5	1.1, 1.7	0.38,	0.5		0.34		0.06,	0.12
Switzerland	0.4-0.75	1.4	0.5		0.23, 0.25			0.07, <0.02	
Germany	0.4-0.75	0.3					0.5,	0.7	

Residues after 20 days were <0.02 (2 trials), 0.02, 0.03, 0.1 and 0.3 mg/kg.

Cauliflower. The 1990 JMPR recommended a 0.2 mg/kg temporary limit based on data from Germany (5 trials), South Africa (1 trial) and Switzerland (three trials) and a 14-day PHI, pending the submission of information on GAP. In the absence of the required information the 1992 JMPR recommended withdrawal of the proposed limit. The information on GAP for cabbages in Italy and South Africa provided to the present Meeting also applied to cauliflowers. Data from an additional South African trial on cauliflowers at a twofold application rate were submitted after the Meeting (Ciba-Geigy Residue Report 101-78).

In the three Swiss trials reported in the 1990 monograph single applications were made at 40 g ai/hl. This is the lowest Italian GAP rate and resulted in the following residues.

PHI (days)	Residue (mg/kg)
6	0.3, 0.33
9	0.28, 0.33
11	<0.02
12	0.03, 0.03
20	0.16, 0.18
26	<0.03, <0,03

The 1977 South African trials data submitted to the 1990 and 1993 Meetings showed the following residues (mg/kg).

PHI, days	1990 JMPR GAP rate 6* applics.	1993 JMPR Double rate 1 applic.
0	5.6, 6.1	6, 10.7
2	1.7, 1.9	2.6, 2.9
5	1.3, 1.3	1.9, 1.6
8	0.25, 0.57	0.06, 0.82 (0.82/2 = 0.42)
16	0.05, <0.02	<0.02, <0.02

* GAP = pest-dependent

Additional German trials reviewed in 1990 included the following.

Rate kg ai/ha	Residue, mg/kg at interval, days 7	10	21
3 X 0.4	0.75	0.36	
1 X 0.75 + 2 X 0.4			<0.02, 0.2

Chilli peppers. Detailed reports were available from nine supervised trials in three countries (Table 3, which also shows trials on sweet peppers reported in 1990), four of which were from Spain for which no relevant information on GAP was provided. Three trials (refs. 2, 5 and 7) were recorded in the 1990 monograph. The highest residue from the Spanish trials was 2.6 mg/kg 7 days after a single application (compared with the 5-10 applications allowed by GAP in other countries) at a spray concentration comparable to GAP concentrations in the other two countries, with residues up to 1.8 mg/kg after 21 days. The highest residues from the trials approximating GAP (14-day PHI) in Malaysia and Indonesia were 4.1 and 6 mg/kg respectively, the latter at a 1.2-fold rate which would correspond to 5 mg/kg

adjusted to the GAP rate. The results in Table 3 indicate a slow decrease in the residues over two weeks.

Method REM 15/82 (methanol extraction, hexane partition clean-up and GLC with NP detection) was used in the Spanish and Indonesian trials, with control values of ≤0.07 mg/kg and recoveries of 75-122% at fortification levels ranging from 0.02 to 0.2 mg/kg. The limit of determination was reported to be 0.02 mg/kg. Method REM 119.01 (modified) was used in the Malaysian trial, with recoveries of 73-95% at 0.2 mg/kg fortification levels. See "Methods of residue analysis" for a description of both methods.

Table 3. Residues of profenofos in peppers resulting from supervised trials. Underlined residues are from treatments according to GAP.

Country/Year	Application			Residues (mg/kg) at interval (days) after last application					Ref.
	Form.	kg ai/ha (g ai/hl)	No.						
Chilli Peppers					7	21/22			
Spain 1984									
trial 2	EC	1.7 (75)	1		2.1	1.8			1
trial 3		0.83 (75)	1		2.6	0.6			2
trial 4		1.1 (75)	1		2.4	1.8			3
		1.1 (75)	1		1.9	1.4			4
Indonesia									
1983	EC	0.3-0.6 (75)	9		3.4, 3.2				5
	EC	0.6-1.2 (75)	9		4.5, 4.6				6
				0	3	7	14	21	
1985	EC	0.4-0.64 (80)	10	Duplicate analyses		1.1,	0.3, 1.2	0.2	7
1985	EC	0.6-1 (120) (1.2X)	10	Duplicate analyses		4.7,	1.5, 6	1.4	8
Malaysia 1991									
Peppers, Sweet, (red, green)	EC	0.64[1] (75)	5	5.4	5	4.4	4.1	2.1	9
Italy 1985				0	7	14/15	21	29	
	EC	0.5	1	3.3	1.2	0.64	0.25	0.29	10
	EC	0.65	1	2	1.3	0.87	0.8	0.12	11
Switzerland 1978									
1979				0	2	4	7/8	14 21	
	-	0.53	3			1.1	1	0.5	12
France/1978	-	0.4	5	1.2		1.3	0.3	0.27 0.06	13
	-	0.4	4		0.64		0.3	0.05	14

[1] 42.8 mg ai/plant

Citrus fruits. The 1990 JMPR recommended a 1 mg/kg temporary limit for sweet and sour oranges, pending the receipt of information on GAP relevant to the trials data or new data relevant to the available information on GAP. Because neither was provided, the 1992 Meeting recommended withdrawal of the TMRL.

The Meeting received information on GAP for South Africa and Italy, the countries for which

supervised trials data were provided to the 1990 JMPR. For convenience and to convey more detailed information on application rates than was included in the 1990 monograph, Table 4 reproduces data on lemons, grapefruit and oranges which were recorded in 1990 as well as data on mandarins not previously reported. Because most of the data in 1990 were for peel and pulp and not for whole fruit, the Meeting estimated whole fruit residues assuming a 30:70 peel:pulp ratio. The reported ratio of 1.3 was used for mandarins.

Mandarin trial 11185 was on a single tree and 1114/79 on several trees. Samples were handled and stored in a satisfactory manner and analyzed approximately 7 months after harvest by methods REM 28/73 and REM 15/82 respectively. The reported limit of determination for REM 28/73 in citrus fruit was 0.02 mg/kg, although the lowest fortifications were 0.04 mg/kg, with recoveries of ≥87% for both methods. Controls were ≤0.02 mg/kg in whole fruit, peel and pulp for REM 15/82 and 0.07 mg/kg in peel for REM 28/73 (recovery values were corrected for the peel control). No storage stability data were provided.

Table 4. Residues of profenofos in citrus fruit resulting from supervised trials. Underlined residues are from treatments according to GAP.

Crop/ Country/Year	Application			PHI, days	Residue, mg/kg			Ref.
	Form.	kg ai/ha (g ai/hl)	No.					
Lemon					Pulp	Peel	Whole*	
Italy/1984 (1 tree)		1.2 (60)	1	21			1.2	1
Italy/1979		(60)	1	70	0.02	0.5	0.16	2
S. Africa/1981 (4 trees)		1.5 (30)	1	32	0.05 (16 d.)	1.6	0.52	3
Grapefruit		0.6 (50)	7**	164	0.02	1	0.31	4
S. Africa/1982		3 g/tree						
		1.8 (50)	7	167	0.02	1	0.31	5
		9 g/tree						
Orange		1.25 (50)	1	22			0.3	6
Italy/1986 (1 tree)								
Italy/1978		(60)	1	70	0.02	1.9	0.58	7
		1.2 (60)	1	21	0.02	1.5	0.46	8
S. Africa/1977		(50)	1	16	0.02	3.6	1.1	9
		(60) 20g/tree	1	32	0.02	4.5	1.4	10
		1.4 (60) 7.2g/tree	1	47	0.03 (14 d.)	2.6	0.8	11
		2.2 (60) 10.8g/tree	1	25	0.06 (1 d.)	3.5	1.1	12
		1.4 (180) 7.2g/tree	1	47	0.04 (0 d.)	1.6	0.51	13
		2.2 (180) 10.8g/tree	1	17	0.18 (1 d.)	5.6	1.8	14
		1.5 (30)						

Crop/ Country/Year	Application			PHI, days	Residue, mg/kg			Ref.
	Form.	kg ai/ha (g ai/hl)	No.					
S. Africa/1982			3	49 (GAP = 60 d.)		0.4		15
				73			0.3	
			3	49			0.5	16
		2.5(30)		73			0.4	
			2	49			0.4	17
		1.4 (60)		73			0.3	
		7.2g/tree	2	33			0.9	18
				69			0.2	
		1.4 (180)						
		7.2g/tree	2	33			1.7	19
				69			0.3	
Mandarins					Pulp	Peel	Whole***	
Italy/1985	EC	1 (50)	1	22			1.03	
				28		<0.02	1.4	0.37
Italy/1979	EC	(60)	7**	18		<0.02	2.3	0.59
				38		<0.02	0.96	0.26
				59		<0.02	0.95	0.25
				80		<0.02	0.84	0.23
				102		<0.02	0.74	0.20
				122		<0.02	0.21	0.07

* Whole fruit residue estimated from peel/pulp residues assuming 30:70 peel:pulp ratio where peel and pulp residues are recorded.
** GAP = 1 application, although the multiple applications were at GAP rates.
*** Whole mandarin residue estimated from peel/pulp residues and the reported 1:3 peel:pulp ratio.

Cotton. On the basis of required information on GAP the 1992 JMPR recommended replacement of the TMRL of 1 mg/kg for cotton seed by an MRL of 3 mg/kg, taking into account that PHIs were commonly 14 days compared with the 21 days used for the 1990 estimate and observing that several individual analyses of replicate samples which had been treated according to GAP exceeded 2 mg/kg.

The Meeting received additional data from Brazil (provided by the government of Spain). Residues were <0.03 mg/kg in untreated samples and in each of 3 replicate field samples 29 days after a single application of an EC formulation at 1 kg ai/ha (720 g ai/hl) in 1973. Samples were Soxhlet-extracted with methylene chloride, cleaned up on silica gel, eluted with 5:95 acetone/hexane and determined by GLC with an AFID. Recoveries were 90% at a 0.2 mg/kg fortification level and the limit of detection was reported as 0.03 mg/kg. Analyses were approximately 2 years after application (Spain, 1991a).

Maize. The 1990 JMPR estimated a temporary maximum residue level of 0.05 mg/kg (limit of determination) for maize based on residues of <0.02 mg/kg in trials on sweet corn in Australia (2) and Canada (4) and on maize in France (2), Mexico (9), Spain (2) and Switzerland (1). Because the required information on GAP relevant to the trials reviewed in 1990 had not been provided, the 1992 JMPR withdrew the estimate.

The 1990 monograph text stated that one or two applications to maize at 0.75 to 1.5 kg/ha at four-week intervals and two to four applications at one-week intervals to sweet corn resulted in residues of <0.02 mg/kg in the grain. The present Meeting was informed that PHIs in the trials were 7-55 days for sweet corn and 60-122 days for maize.

The Meeting was informed that GAP in Italy and Spain involved application rates ranging from

0.5 to 1.25 kg ai/ha and PHIs of 19 or 20 days (Table 1). The rates are comparable to those reported in the 1990 monograph, but 20 days is much shorter than the 60-122 days of the field trials on maize. The Meeting received reports of Spanish supervised field trials on maize and, after the 1993 JMPR, of Canadian trials on sweet corn and Italian trials on maize (Table 5). The Meeting was informed that at least the two Spanish trials 74/1003 and CGF 75/24 were among those provided to the 1990 JMPR (Spain, 1991b). It is not clear whether the Canadian trials were the same as those reviewed in 1990.

In the Spanish maize trials, grain residues from granular formulations applied at Spanish GAP rates for EC formulations were <0.02-0.03 mg/kg after 7-100 days (the Spanish PHI is 20 days for EC), using Method REM 28/73 for which the limit of determination was reported as 0.02 mg/kg with recoveries ≥80%. Samples were stored in an acceptable manner for 3 to 8 months after harvest before analysis, although no storage stability data were provided. While information on Spanish GAP for EC formulations was provided, none of the reported Spanish trials was with an EC and the Meeting was informed that the granular formulations referred to are no longer in use.

In Canadian trials on sweet corn residues were <0.02 mg/kg after 6 or 13 days from application rates comparable to those of Italian and Spanish GAP. In the Italian trials on maize residues in the whole plant were <0.02 mg/kg 122 days after applications at approximately half the maximum permitted rate. The Italian PHI is 19 days.

Table 5. Residues of profenofos in maize and sweet corn resulting from supervised trials.

Country Crop/Year/ Report No.	Application			Residues (mg/kg) at interval (days) after last application
	Form.	kg ai/ha (g ai/hl)	No.	
Canada				Days 6/7 13/14
Sweet corn	EC	1.5 (300)	2	grain leaves* grain leaves*
1979				profenofos <0.02 4.2 <0.02 2.4
Report 1082-79				total** <0.02 5.4 <0.02 3.4
				control <0.02 <0.02
Report 1150-79		1.5(330)	2	
				profenofos <0.02 0.8 <0.02 0.4
				total <0.02 1.2 <0.02 0.9
				control <0.02 <0.02
Italy				122 days
Maize 1981	EC	0.2 (40)	1	profenofos <0.02 (whole plant)
Report 1118-79				control <0.02
Spain				100 days
Maize 1977	GR	1	1	grain 0.03 (corr. for control)
Report 199/77				control 0.03
		0.75	1	grain 0.02 (corr. for control)
				control 0.03
				Days 23 40
Maussane		1.25	2	grain (harvest) <0.02
Maize 1974	GR			leaves, ears or
Report 74/1003				stalks milk stage <0.02
				controls <0.02
	GR	0.25	1	7 days
Spain				
Maize 1975				grain (51 days) <0.02 (4)
Report CGF 75/24				ears <0.02 (4)
				stalk 0.15 (3), 0.12
				leaves 1.1, 1.3, 1.4, 0.6

Country Crop/Year/ Report No.	Application			Residues (mg/kg) at interval (days) after last application
	Form.	kg ai/ha (g ai/hl)	No.	
				control <0.02

* Cobs were sampled and separated into grain and leaves (shucks) for analysis.
** Total means the total residue containing the 4-bromo-2-chlorophenyl moiety expressed as profenofos.

Onions. The 1990 JMPR recommended a temporary limit of 0.2 mg/kg for bulb onions pending the availability of information on GAP relevant to the data from Indonesia and South Africa. Information on GAP provided to the 1992 JMPR did not relate closely to the field trials (no GAP for South Africa where most of the trials were conducted). Because the data were limited and the trials did not match GAP closely, and because residue decline rates and levels at shorter intervals suggested that residues could approach 0.2 mg/kg, the 1992 Meeting concluded that the TMRL of 0.2 mg/kg could not be lowered and recommended its conversion to an MRL. It considered that additional data were desirable. Information was provided to the present Meeting on GAP in South Africa (Table 1).

In the South African trials reviewed in 1990 two applications were made at rates of 0.3 or 0.6 kg ai/ha, the current GAP being 3-4 applications at 0.5 kg ai/ha or 50-125 g ai/hl with a PHI of 14 days. In the trials where conditions were closest to GAP residues were $\leq$0.05 mg/kg after 16 days from 2 applications up to 0.6 kg ai/ha. Residues in Indonesian trials were 0.17 and 0.34 mg/kg 7 days after 6 applications at 0.4 and 0.8 kg ai/ha respectively.

Peaches. The 1992 JMPR withdrew the 1990 temporary estimate of 0.5 mg/kg for peaches (based on a 28-day PHI), because the Italian data were limited and the required information on relevant GAP had not been provided. Information on Italian GAP was provided to the present Meeting (multiple applications at 40-70 g ai/hl, 60-day PHI). Supervised trials with profenofos applied at 0.9-1.25 kg ai/ha resulted in a maximum residue after 28 days of 0.4 mg/kg (1990 JMPR), but could not be evaluated against Italian GAP specified in terms of spray concentration. Since the 1993 JMPR, information has been provided on the field trial application rates in terms of g ai/hl. The residues in Table 4 of the 1990 monograph referred to g ai/hl application rates were as follows.

Rate,	Residue, mg/kg, at PHI, days				
g ai/hl	0	7	14	21	28
60	1.4	1.6	1.0	0.8	
60	1.6	1.3	1.0	0.34	
50	1.7	1.0	0.9	0.27	0.4
50	3.4	0.6	0.64	0.16	0.17
50	3.7	2.9	0.7	---	0.25

Peppers, Green. The 1992 JMPR recommended withdrawal of the 1 mg/kg temporary limit for sweet peppers, because the required information on GAP relevant to the trials in Indonesia, France, Italy and Switzerland had not been provided. Information on Italian GAP was provided to the 1993 Meeting (Table 1, multiple EC applications at 40-70 g ai/hl and a 28-day PHI). Residues in the trials reviewed in 1990 (Table 3) were up to 0.3 mg/kg 29 days after single applications (formulation unspecified) at 0.5 kg ai/ha in Italy and up to 0.06 mg/kg 21 days after 5 applications at this rate in Switzerland. In Indonesian and French trials residues at PHIs of 7 and 14 days respectively, from multiple applications at similar rates, were up to 3.2 mg/kg in Indonesia and 0.05 mg/kg in France.

Tea. The 1990 JMPR recommended a temporary limit of 0.5 mg/kg for tea, based on a 21-day PHI, but

required information on national GAP. The 1992 Meeting was informed that GAP in the country of the supervised trials included application at 40 g ai/hl but this could not be compared with the 1 kg ai/ha rate of the trials. The present Meeting was advised that the 1990 supervised trials had been conducted at a 1.25-fold application rate (see "Use patterns" above).

METHODS OF RESIDUE ANALYSIS

Three analytical methods were provided of which one, REM 28/73 (Blass, 1973), was reviewed by the 1990 JMPR. It is based on methanol extraction and clean-up by liquid/liquid partition and silica gel chromatography with determination by GLC and alkali flame-ionization detection. The second, REM 15/82 (Litzler, 1983), has not previously been submitted to the JMPR but is a micro version of method REM 16/81 (Altenburger, 1981) which was also reviewed in 1990. Method REM 16/81 replaced REM 28/73, but was similar (e.g. hexane replaced benzene as one of the solvents).

In method REM 15/82, 25 g of crop is homogenized with 125 ml methanol and filtered. An 8 ml aliquot (1 g crop) is partitioned with 2 ml hexane and the sample analyzed without further clean-up. Determination is by GLC with a phosphorus/nitrogen detector. The limit of determination was reported as 0.02 mg/kg and chromatograms suggest that levels of 0.02 to 0.05 mg/kg should be easily attainable for citrus peel. Recovery values from 0.05 mg/kg fortification levels were whole citrus 103%, citrus peel 113%, and citrus pulp 108%. Analyses by REM 15/82 and REM 16/81 were comparable at the 0.4 mg/kg level.

The third method, REM 119.01 (Ciba, 1989), is a multi-residue method which has not previously been reviewed by the JMPR. It is intended primarily for the determination of non-polar to slightly polar pesticides (log octanol/water partition coefficient >2) in aqueous materials such as fruits and vegetables. It is based on extraction with aqueous methanol, partitioning into toluene and (normally without further clean-up) determination of the analyte by GLC with an EC or NP detector. Additional clean-up (especially for basic compounds) if needed can be by silica or Florisil chromatography with elution with hexane/ethyl acetate (9:1). In other cases the use of silica solid-phase extraction (SPE) tubes and elution with methanol is recommended.

The general practical limit of determination was reported as about 0.02 mg/kg, but was said to be dependent on the compound and sample matrix. The recovery of profenofos from spinach fortified at 0.1 mg/kg (after Florisil clean-up) was reported to be 70%. The limit of determination for profenofos could not be confirmed by the data provided with the method.

APPRAISAL

Profenofos was reviewed by the 1990 JMPR, which recommended TMRLs for a number of commodities pending the receipt of relevant information on registered national uses. The 1992 Meeting reviewed substantial information on GAP, confirmed or revised several recommendations and withdrew others for which GAP or residue data were inadequate. Additional GAP and/or supervised trials data were considered desirable for bulb onions and soya beans, and clarification of GAP for tea was required.

The Meeting received clarification of GAP for tea, additional information on GAP for other commodities for which residue data had previously been submitted, supervised trials data on beans, cotton, maize and chilli peppers and details of artichoke trials on which data had previously been submitted.

Artichoke. The 1992 Meeting considered the summary data on one supervised trial in Spain and one in Italy insufficient to support an MRL. The present Meeting received details (in Spanish) of the Spanish trial. The Meeting confirmed the 1992 conclusion.

Beans, dry. The Meeting re-examined the trials data reviewed by the 1990 JMPR in the context of new information on GAP in Italy. It could not directly compare the trials with Italian GAP, because the GAP application rates were in terms of g ai/hl whereas the rates in the Brazilian and Swiss trials were expressed as kg ai/ha. With maximum residues of 0.02 mg/kg from four trials in Brazil and Switzerland after 20-29 days compared with an Italian 21-day PHI, the data suggest that residues in dry beans would not exceed 0.02 or 0.05 mg/kg, especially in view of the residues at comparable levels in green beans after 21 days.

However, because (1) a limit for dry beans would require the reference of Brazilian and Swiss results to Italian GAP, (2) a true comparison of the Italian GAP with the trials application rates could not be made and (3) the rates applied to green beans suggest that the trials on dry beans may not have been at maximum GAP rates, the Meeting agreed not to recommend a limit for dry beans. This could be reconsidered at a future Meeting if information is provided to allow comparison of the application rates in the trials with Italian GAP (or if information on Swiss and Brazilian GAP is provided).

Beans, green. The trials in Italy and Switzerland in 1990 could be related to new information on Italian GAP, and new trials data on common beans from Malaysia could be related to previous information on GAP in the Philippines and Thailand. In one Italian trial the highest residue from applications according to GAP at the 21-day Italian PHI was 0.02 mg/kg. In the other 1.4 mg/kg was recorded after 28 days, but the 28-day and 6/7-day samples appeared to have been mislabelled. If so, the 28-day value would be 0.02 mg/kg. Residues were only 0.02 mg/kg in the Swiss trials after 11 days (the longest PHI). Maximum residues in the Malaysian trials were 0.05 mg/kg (corrected for a 0.02 mg/kg control) at the Philippine 7-day PHI and at application rates comparable to those of the Philippines.

Although additional trials on green beans are desirable, the Meeting concluded that 6 trials in three different countries in three different years would be marginally sufficient to support a limit for green beans. The Meeting assumed that samples were mislabelled in one Italian trial and noted that (1) Italian GAP apparently allows spray concentrations up to 70 g ai/hl and more than 1 application whereas the trials were with single treatments at 50 g ai/hl; (2) in the Malaysian trials the maximum residues at the Philippine 7-day PHI would be 0.07 mg/kg if uncorrected for the 0.02 mg/kg control, while the analytical recoveries were 75%. The Meeting therefore recommended a limit of 0.1 mg/kg for common beans, based on a 7-day PHI. A 0.05 mg/kg limit would suffice for a 21-day PHI.

Brussels sprouts. The 1992 JMPR withdrew the 1990 temporary estimate of 0.5 mg/kg for Brussels sprouts because required information on GAP had not been provided. The present Meeting compared new information on GAP in South Africa with the 1990 JMPR summary of supervised trials data. The highest residues reflecting GAP rates after 9 or more days compared to the South African 10-day PHI were: The Netherlands, 0.25 mg/kg (one trial); Switzerland, 0.2 mg/kg (four trials) and South Africa, 0.42 mg/kg (one trial). Maximum residues in one Swiss trial were 1.1 and 0.41 mg/kg after 7 and 14 days respectively, but the rate could not be related to South African GAP.

Although comparison of European trials with South African GAP was not ideal, because some of the data could now be compared with GAP and because of the diversity of the trials, the Meeting confirmed the 1990 estimate of 0.5 mg/kg. Although the Meeting concluded that there was no need for it to be temporary, additional trials according to South African GAP or information on European GAP relevant to the previous European trials are desirable.

Cabbage. The 1992 JMPR recommended replacing the 0.5 mg/kg TMRL by an MRL of 1 mg/kg to accommodate 7-day PHIs which were GAP in two countries. Neither the 1990 nor 1992 Meetings could closely match available information on GAP to the trials data. The present Meeting reviewed additional information on GAP for Italy and South Africa. Only the latter could be closely related to the trials results and with a maximum residue of 0.13 mg/kg from GAP in that country did not require either a 0.5 or 1 mg/kg limit. The Meeting confirmed the 1992 JMPR conclusion that a 1 mg/kg limit was required to accommodate PHIs of 7 days.

Cauliflower. The 1992 JMPR withdrew a 1990 temporary estimate of 0.2 mg/kg (based on a 14-day PHI), since required information on GAP had not been provided. The Meeting compared new information on GAP for Italy and South Africa with the 1990 data from Germany, South Africa and Switzerland and reviewed an additional South African trial not previously provided. Maximum residues approximately reflecting GAP were 0.18 mg/kg in Switzerland and 0.57 mg/kg in South Africa. The highest residue in the German trials under the conditions of South African GAP was 0.2 mg/kg. Although most of the results could not be closely matched to GAP the Meeting noted that the data were from a diversity of locations at different times and covered the range of known GAP, and concluded that a 0.5 mg/kg limit, based on a 10-day PHI, could be supported.

Citrus fruits. Because information required by the 1990 JMPR had not been provided, the 1992 Meeting recommended withdrawal of the 1 mg/kg TMRL for oranges. The Meeting reviewed the 1990 data and new data on mandarins in the light of new information on GAP in Italy and South Africa, the countries in which all the citrus trials had been conducted.

The maximum residue in oranges treated strictly according to GAP was 0.58 mg/kg, and from exaggerated conditions (threefold spray concentration, PHI 17 days instead of 60 days) 1.8 mg/kg. None of the trials on mandarins were exactly according to GAP. The highest residue from a GAP application rate was 0.3 mg/kg, but from seven applications whereas one is permitted. The maximum residue from a single application at the GAP rate was 1.03 mg/kg but this was at 22 days and the GAP PHI is 60 days. In lemons the only residue reflecting GAP was 0.16 mg/kg, with 1.2 mg/kg at the GAP rate but a PHI of 21 instead of 60 days. In grapefruit residues were 0.31 mg/kg from GAP application rates, but seven applications and at a PHI of 164 days. The persistence of the residues in peel and the slight influence of the PHI on residue levels gave some support to consideration of results at intervals other than the GAP PHI. Residues were almost entirely in the peel. While most of the data did not closely match GAP, the Meeting concluded that they would support a 1 mg/kg limit for oranges but were insufficient to support limits for other citrus fruits.

Cotton seed. The 1992 Meeting recommended replacement of the 1 mg/kg TMRL by an MRL of 3 mg/kg. The present Meeting reviewed additional data which did not require a change in the 1992 recommendation.

Maize and sweet corn. The 1992 JMPR recommended withdrawal of the TMRL of 0.05* mg/kg for maize because relevant GAP was not available. Of the four countries from which maize trials were reviewed by the 1990 JMPR, relevant information on GAP and reports of supervised trials were received from Spain. Two of the trials had previously been provided. Italian GAP was also reported, but trials data only on residues in whole maize plants. Trials on sweet corn reported from Canada were possibly the same as those previously provided. There was no relevant information on GAP.

While the 1990 monograph states that residues in grain from trials in France, Mexico, Spain and Switzerland did not exceed 0.02 mg/kg, the only trials submitted for review by the present Meeting which could reasonably be compared with GAP were from Spain. Even these trials were with granular

applications which are not current GAP. Residue levels resulting from granular and EC applications may be quite different. The maximum residue in maize grain in the Spanish trials (from application rates which are GAP for EC formulations) was 0.06 mg/kg 100 days after the last application when not corrected for a 0.03 mg/kg control value. Residues in the grain after 40 and 51 days were <0.02 mg/kg.

The Meeting had no reason to expect residues in grain to exceed the 0.05 mg/kg TMRL on the basis of available information, but concluded that there were insufficient data from trials according to GAP to recommend a limit for a commodity as important as maize. Since some of the samples were stored for 8 months before analysis, the Meeting was also concerned that no storage stability data were available and noted that there was no information on processing.

The Meeting recommended a complete resubmission of all studies on maize and relevant GAP for review at a future Meeting when additional information on GAP relevant to the available residue data and/or additional data from trials according to known GAP become available. Any future submission should include information on maize processing, storage stability studies and sufficient information on residues in forage and fodder to permit the estimation of maximum residue levels for these feed items so that the need for MRLs for animal products can be assessed.

Onions, Bulb. The 1990 JMPR recommended a temporary limit of 0.2 mg/kg, pending the availability of relevant information on GAP. Because the information on GAP provided to the 1992 Meeting did not closely match the trials data, which were limited, the 1992 Meeting concluded that the proposal could not be lowered but recommended its conversion to a full MRL. Information on GAP in South Africa was provided to the Meeting. Maximum residues from applications approximating GAP were 0.05 mg/kg, after 16 days compared with the GAP PHI of 14 days (the 1990 recommendation was based on 7 days). Because only few results from two countries were available, and these from only 2 applications compared with the 3 or 4 permitted, the Meeting concluded that the available data reflecting GAP were inadequate and agreed to withdraw the previous recommendation.

Peaches. Because data were limited (5 trials in Italy) and the required information on GAP had not been provided, the 1992 JMPR recommended withdrawal of the TMRL of 0.5 mg/kg. Information on Italian GAP (40-70 g ai/hl, 60-day PHI) was provided to the Meeting, which was informed that the 60-day PHI was originally established for early-season application, although in practice later treatments may be needed. There was no evidence of approved uses at shorter PHIs.

Residues did not exceed 0.4 mg/kg from GAP rates after 28 days, but the data were limited, there were no results at the 60-day PHI, there was no information on approved PHIs shorter than 60 days, and only single applications were made although multiple treatments are allowed by GAP. The Meeting therefore concluded that the information was still inadequate to support a limit.

Peppers, Chilli. Nine supervised trials in three countries showed maximum residues from treatments approximating GAP of 4.7 and 6 mg/kg (duplicate analyses, 1.2 times the GAP rate) at the 14-day GAP PHI. The results support a 5 mg/kg limit.

Peppers, Sweet. The 1992 JMPR recommended withdrawal of the 1 mg/kg TMRL because the information on GAP had not been provided. Information on GAP in Italy was
provided to the Meeting (the trials were in Italy, Switzerland and France). Maximum residues were 0.29 mg/kg 29 days after single applications at 0.5 or 0.7 kg ai/ha in the Italian trials; 0.06 mg/kg after 21 days in the Swiss trial and 0.05 mg/kg after 14 days in the French trial at comparable application rates. However, the application rates in the trials were expressed as kg ai/ha and could not be related to the Italian GAP which was in terms of g ai/hl. Also only single applications were made in the Italian trials while multiple applications are permitted by GAP, although 3 to 5 applications were made in the

Swiss and French trials at comparable application rates with residues not exceeding 0.5 mg/kg even at shorter PHIs.

Because the trials application rates could not be compared with the GAP provided, the Meeting concluded that the information was still inadequate to support a limit for sweet peppers. If it is shown that the trial application rates correspond to GAP, the data suggest that 0.5 mg/kg would not be exceeded after the Italian 28-day PHI.

Tea. The required clarification of the application rate used in the supervised trials reviewed by the 1990 JMPR enabled the Meeting to confirm the 1990 estimate. The Meeting concluded that the TMRL could be replaced by an MRL of 0.5 mg/kg for "Teas (tea and herb teas)".

Additional clarification of GAP in uses on beans and sweet peppers was provided to the Meeting too late for consideration.

RECOMMENDATIONS

The residue levels listed below are recommended for use as MRLs.

Definition of the residue: profenofos.

Commodity		Recommended MRL (mg/kg)		PHI on which based, days
CCN	Name	New	Previous	
VB 0402	Brussels sprouts	0.5	0.5 T[1]	10
VB 0404	Cauliflower	0.5	0.2 T[1]	10
VP 0526	Common beans (pods and/or immature seeds)	0.1	-	7
VA 0385	Onions, Bulb	W	0.2	
FC 0004	Oranges, Sweet, Sour	1	1 T[1]	60
VO 0444	Peppers, Chilli	5	-	14
DT 0171	Teas (tea and herb teas) 5	0.5	0.5 T	21

[1] 1990 JMPR proposal, recommended for withdrawal by the 1992 JMPR.

FURTHER WORK OR INFORMATION

Desirable

1. Additional soya bean processing study conducted with beans with finite residues to permit determination of concentration factors in all processed fractions (1992 JMPR).

2. Additional soya bean data reflecting GAP in countries in which the trials were conducted and/or additional information on GAP for the countries for which data have already been provided (1992 JMPR).

3. Additional residue data on common beans with relevant information on GAP, with multiple applications where these are GAP.

4. Clarification of the Italian trial on green beans where two samples appear to have been mislabelled.

5. Additional supervised trials on Brussels sprouts according to South African GAP, or information on European GAP relevant to the previous European trials.

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2. Spain, 1991a. Analytical Report 12373. Submitted to the 1993 JMPR by Subdirección General de Sanidad Vegetal (MAPA).

3. Spain, 1991b. Analytical Reports 199/77; 74/1003 and CGF 7524. Submitted to the 1993 JMPR by Subdirección General de Sanidad Vegetal (MAPA).

Table 2 References (beans)

1. 1990 JMPR Monograph

2. Ciba, 1993. Profenofos (171). JMPR 1993 Follow-up Documentation, October 1993. Summary Table 1, Unpublished Ciba-Geigy AG Report 1007/92.

3. Ciba, 1993. Profenofos (171). JMPR 1993 Follow-up Documentation, October 1993. Summary Table 1, Unpublished Ciba-Geigy AG Report 1008/92.

Table 3 References (peppers)

1. Ciba-Geigy 1984a. Determination of Residues in Chilli Pepper (Pimientos; whole fruit) After Application of SELECRON 500 EC. Unpublished Ciba-Geigy report No. RVA 1040/84.

2. Ciba-Geigy 1984b. Determination of Residues in Chilli Pepper (Pimientos; whole fruit) After Application of SELECRON 500 EC. Unpublished Ciba-Geigy report No. RVA 1041/84. Previously submitted to the 1990 JMPR.

3. Ciba-Geigy 1984c. Determination of Residues in Chilli Pepper (Pimientos; whole fruit) After Application of SELECRON 500 EC. Unpublished Ciba-Geigy report No. RVA 1042/84.

4. Ciba-Geigy 1984d. Determination of Residues in Chilli Pepper (Pimientos; whole fruit) After Application of SELECRON 500 EC. Unpublished Ciba-Geigy report No. RVA 1043/84.

5. Ciba-Geigy 1984e. Determination of Residues in Red Pepper (whole fruit) After Application of SELECRON 500 EC. Unpublished Ciba-Geigy report No. RVA 1018/83. Previously submitted to the 1990 JMPR.

6. Ciba-Geigy 1984f. Determination of Residues in Red Pepper (whole fruit) After Application of SELECRON 500 EC. Unpublished Ciba-Geigy report No. RVA 1017/83.

7. Ciba-Geigy 1986. Determination of Residues in Red Pepper (Chilli) After Application of SELECRON 500 EC. Unpublished Ciba-Geigy report No. 1034/85. Previously submitted to the 1990 JMPR.

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9. Ciba-Geigy 1992. Determination of Residues of Profenofos in Chilli Pepper - Field Trial. Unpublished Ciba-Geigy report No. 112591.

10. 1990 JMPR Monograph, Page 358, Table 10, Italy (1985), Profenofos on Sweet, Red, Green Peppers, Report 1116/85.

Previously submitted to the 1990 JMPR.

11. 1990 JMPR Monograph, Page 358, Table 10, Italy (1985), Profenofos on Sweet, Red, Green Peppers, Report 1117/85. Previously submitted to the 1990 JMPR.

12. 1990 JMPR Monograph, Page 358 Table 10, Switzerland (1978), Profenofos on Sweet, Red, Green Peppers, Report 38/79. Previously submitted to the 1990 JMPR.

13. 1990 JMPR Monograph, Page 358, Table 10, Switzerland (1979), Profenofos on Sweet, Red, Green Peppers, Report 1032/79. Previously submitted to the 1990 JMPR.

14. 1990 JMPR Monograph, Page 358, Table 10, France (1978), Profenofos on Sweet, Red, Green Peppers, Report F 38/78. Previously submitted to the 1990 JMPR.

Table 4 References (citrus fruits)

	1990 JMPR			1990 JMPR	
Ref.	Table	Report	Ref.	Table	Report
1	2	1220/84	12	3	1246/82
2	3	103/79	13	3	1247/82
3	3	1268/81	14	3	1248/82
4	3	1252/82	15	2	1265/81
5	3	1251/82	16	2	1266/81
6	2	1119/85	17	2	1266/81
7	3	102/79	18	2	1249/82
8	3	1219/84	19	2	1250/82
9	3	37/77			
10	3	60/77			
11	3	1245/82			

20. Ciba, 1993. Profenofos (171). JMPR 1993 Follow-up Documentation, October 1993. Summary Table III, and Unpublished Ciba-Geigy AG Report 1118-85, "Determination of Residues of Parent Compound in Tangerines After Application of Profenofos EC 23.3%."

21. Ciba, 1993. Profenofos (171). JMPR 1993 Follow-up Documentation, October 1993. Summary Table III, and Unpublished Ciba-Geigy AG Report 1114-79 "Determination of Residues in Tangerines after Application of SELECRON EC 500, June, 19, 1980".

Table 5 references (maize and sweet corn)

Canada

Altenburger, E. 1980. Determination of Residues in Sweet Corn (Grain, Leaves) as CGA 15324 (Parent Compound) and as CGA 55960 (Common Moiety) after Application of Selecron 720 EC. Unpublished Ciba-Geigy Reports 1082/79 and 1150/79, Dec. 15, 1980.

Italy

Altenburger, E. 1982. Determination of Residues in Maize (Whole Plant) after a Single Application of SELECRON 500 EC. Unpublished Ciba-Geigy Reports 1082/79 and RVA 1118/81, Feb. 3, 1982.

Spain

Reports 199/77 (March 10, 1978); 74/1003 (Report date illegible) and CGF 75/24 (November 13, 1975) submitted by Angel Martinez de Tehada, Spanish Ministerio De Agricultura Pesca y Alimentación, June 30, 1993 for 1993 JMPR review.