ABAMECTIN (177)

EXPLANATION

Abamectin was evaluated in 1992 and 1994 and MRLs were recommended for a number of crops and animal commodities.

The 28th (1996) Session of the CCPR was informed that the LOD of 0.01 mg/kg for abamectin might need to be increased to 0.02 mg/kg (ALINORM 97/24, para 77). The 29th 1997 Session (ALINORM 97/24A, para 105) agreed, on the advice of the *ad hoc* Working Group on Methods of Analysis, to maintain MRLs for abamectin set at or about the LOD at 0.01 mg/kg.

The 29th Session also noted (ALINORM 97/24A, para 89) that the CCRVDF had proposed MRLs for abamectin in animal products and encouraged comment on these proposals.

The Meeting received information on the current registered or approved uses of abamectin on food crops. The Netherlands provided a copy of the official method of analysis for abamectin residues.

The Meeting received information on methods of analysis and residue data from supervised trials on the additional crops apples, potatoes and hops as well as on pears, cucurbits, lettuce and tomatoes. Processing data were available for apples, pears, potatoes and hops.

The predominant residues from the use of abamectin on cropos are avermectin B_{1a}, avermectin B_{1b} and the photoesomers 8,9-*Z*-avermectin B_1 (B_{1a} and B_{1b}).

METHODS OF RESIDUE ANALYSIS

Analytical methods

Abamectin is a mixture of avermectin B_{1a} (80%) and avermectin B_{1b} (20%). In sunlight the photoisomer 8,9-*Z*-avermectin is produced and becomes part of the residue. It is also described as the D-8,9 isomer. Avermectin B_{1a} and 8,9-*Z* avermectin B_{1a} produce the same fluorescent compound in the derivatization step of the analytical methods and hence a single peak on an HPLC chromatogram. Avermectin B_{1b} and its photoisomer 8,9-*Z*-avermectin B_{1b} behave in the same way and appear together in a second peak in the chromatogram.

Analytical methods that measure the components of the residue involve the HPLC separation and fluorescence detection of derivatives formed by converting the cyclohexene ring to an aromatic ring. Analytical methods for abamectin residues in crops, soil, animal tissues, milk and water were reviewed by the 1992 JMPR.

The newer analytical methods rely on a rapid derivatization. The avermectin compounds dissolved in an acetonitrile/triethylamine mixture in the presence of 1-methylimidazole react rapidly with trifluoroacetic anhydride at room temperature to produce the fluorescent derivative. Approximately 3 minutes are required for the reaction as compared with 1 hour in previous methods. Some clean-up steps have also been streamlined.

Cobin (1989), in Method 8920, extracted abamectin residues from cucumbers with methanol. The aqueous methanol extract was washed with iso-octane and passed through a C-8 column that captured the abamectin residues. The C-8 column was connected to 2 small aminopropyl

columns in series and the abamectin rinsed through with methanol. A portion of the extract was evaporated and the abamectin was derivatized and determined by HPLC with fluorescence detection. Recoveries were satisfactory, but recoveries of 8,9-*Z*-avermectin were mostly near 70%, which was lower than those of avermectin B_{1a} and B_{1b}.

Trainor (1991) drew attention to the losses of 8,9-*Z*-avermectin B_{1a} which may occur in emulsions during solvent partition steps. Shaking must be done gently to keep the emulsion layer to a minimum.

Hicks (1992a,b) described Method 8000 for abamectin residues in apples and pears. Samples were first treated with pectinase to hydrolyse the pectin. Abamectin residues were extracted from the apple or pear homogenate with acetonitrile/water, and the extract further diluted with water and loaded onto a small C-8 column. Abamectin was eluted from the column with acetonitrile, which was diluted with water and the abamectin partitioned into hexane. The hexane solution was further cleaned up on an aminopropyl column to produce an extract ready for derivatization and HPLC determination. The LOD for each component of the residue in both apples and pears was 0.002 mg/kg. Good recoveries from spiked samples of apples and pears were obtained for avermectin B_{1a} at 0.0019-0.079 mg/kg, avermectin B_{1b} at 0.0038-0.0059 mg/kg and 8,9-Z-avermectin B_{1a} at 0.0046-0.070 mg/kg.

Cobin (1995) described the method (M-007.1) used for analysing apple samples from the supervised residue trials in Europe. Partially thawed whole apples were chopped in a Hobart food processor with dry ice added to achieve better chopping and to keep samples partially frozen. A portion of the chopped homogenate was then blended with acetonitrile, water and hexane. Abamectin residues were extracted into the hexane phase, which after drying with sodium sulfate was introduced into 2 small aminopropyl columns in series. The columns were washed with hexane, toluene and then dichloromethane. The abamectin residues were eluted from the column with acetone/dichloromethane, derivatized and determined by HPLC as described in other methods.

Macdonald *et al.* (1994) validated Method M-007 for apples. Good recoveries of avermectin B_{1a} were obtained from apples fortified at 0.002, 0.010 and 0.030 mg/kg.

The method (91-1) used for the determination of abamectin in tomatoes was very similar to the later method M-007.1 used for apples (Prabhu, 1991c). Maudsley and Clements (1994) validated method 91-1 for residues in lettuce. Good recoveries were obtained from lettuce fortified with avermectin B_{1a} at 0.002, 0.010, 0.030 and 2.00 mg/kg and with avermectin B_{1b} at 0.002, 0.010 and 0.10 mg/kg.

Method 936-92-4 used for the determination of abamectin residues in potatoes was described by Wehner (1992). Residues were extracted with methanol and the extract, after the addition of water, was passed through a small C-8 column which retained the abamectin residue. Further clean-up was achieved by washing the residue from the C-8 column directly through an aminopropyl column with a small volume of methanol. Part of the methanol solution was concentrated to dryness and the fluorescent derivatives were formed by reaction with a mixture of trifluoroacetic anhydride and 1-methylimidazole in acetonitrile. The LOD for each component of the residue was 0.005 mg/kg. Kvaternick (1993g) validated the method for fortified raw potatoes and achieved good recoveries for avermectin B_{1a} at 0.005-0.100 mg/kg, avermectin B_{1b} at 0.0049 mg/kg and 8,9-*Z*-avermectin B_{1a} at 0.005-0.050 mg/kg.

Morneweck (1992) described Method 92-1 for residues of abamectin in apple pomace, apple juice and apple sauce. Abamectin residues were extracted from wet or dry apple pomace with a hexane/water/acetonitrile mixture. Apple juice and apple sauce were extracted with acetonitrile/water and the extracts passed through a C-8 column, which was washed with acetonitrile to recover the abamectin residues. The extracts of all the commodities were then cleaned up on an aminopropyl column. The procedure then followed that of Method 8000 described above.

Recoveries of 8,9-*Z*-avermectin B_{1a} were consistently near 70% from the various commodities, but those of avermectin B_{1a} and B_{1b} were generally higher.

Johnson (1994a) described Method M-036 for abamectin in dried hops. The hops were rehydrated and extracted with a methanol-water mixture. Clean-up was effected by extraction into hexane and passage of the hexane extract through an aminopropyl solid phase extraction column. The abamectin in the cleaned up extract was derivatized with trifluoroacetic anhydride and determined by HPLC in the normal way. The LODs for avermectin B_{1a}, B_{1b} and 8,9-*Z*-avermectin B_{1a} in spiked dried hops were all 0.005 mg/kg. Method M-044 for abamectin residues in fresh hops is essentially the same as M-036 (Johnson, 1994b).

Duchene *et al.* (1997) validated analytical methods M-036.2 and M-044 for abamectin residues in dried hops, fresh hops and immature hops. Good recoveries from spiked samples were obtained for avermectin B_{1a} (0.0025-0.100 mg/kg), avermectin B_{1b} (0.005 mg/kg) and 8,9-*Z*-avermectin B_{1a} (0.005-0.100 mg/kg). The validated LOD for the 3 components in dried, fresh and immature hops was 0.005 mg/kg.

Many recovery experiments were carried out in the course of method validation and during supervised trials and processing studies. The median and mean recoveries were respectively 87% and 88% for avermectin B_{1a} (n=523), 90% and 89% for avermectin B_{1b} (n=100), and 84% and 83% for 8,9-*Z*-avermectin B_{1a} (n=166).

Some of the analytical methods developed to determine abamectin residues in various substrates which were originally in the form of unpublished reports have now been published in the scientific literature. Prabhu *et al.* (1992) described a rapid method which was used for the analysis of tomatoes in field trials. Samples can be prepared for HPLC analysis in batches of 12 in about 4-6 hours.

Cobin and Johnson (1995) have published a modified version of the method described above for abamectin in apples, and have published the residue method for hops (Cobin and Johnson,1996).

In the official method in The Netherlands (Netherlands, 1996) abamectin residues are extracted with ethyl acetate from a portion of the chopped sample. The residue, after evaporation of the ethyl acetate, is taken up in hexane and loaded on to a small aminopropyl column for clean-up. The column is washed with hexane, toluene and dichloromethane and the washings discarded. Abamectin residues are then eluted with dichloromethane/acetone. After the solvent has been evaporated the residue is taken up in methanol for HPLC analysis with UV detection at 245 nm. Good recoveries were obtained for avermectin B_{1a} in fortified cucumber samples at 0.0135 and 0.0675 mg/kg. The limit of determination was 0.003 mg/kg. The recovery of 8,9-*Z*-avermectin B_{1a} was not determined.

Stability of pesticide residues in stored analytical samples

Information on the stability of abamectin residues in dried hops during frozen storage was provided to the Meeting. Studies on the frozen storage stability of abamectin in numerous crops were reviewed by the 1992 JMPR.

Arenas (1997a) tested the stability of avermectin B_{1a} and 8,9-*Z*-avermectin B_{1a} in spiked dried hops stored below -10°C for 6 months. Dried hop cones without detectable abamectin residues were pulverised, weighed in 5 g lots into small bottles, and spiked at 0.020 mg/kg with the avermectin test materials (Table 1). The freezer temperature was always below -10°C and the average was about -20°C. Samples were analysed by method M-036.

The compounds were stable for the 6 months, with perhaps a slow loss estimated at about 3% per month.

Arenas (1997b) used the same method to test the stability of abamectin in fresh hops during frozen storage between -20°C and -5°C for 5 months (Table 1). Abamectin was again quite stable.

Table 1. Freezer storage stability of avermectin B_{1a} and 8,9-*Z*-avermectin B_{1a} added to dried hops and fresh hop cones (Arenas, 1997a,b). Duplicate samples were analysed on each occasion.

Storage interval, days	Avermectin B_{1a}, mg/kg	Storage interval, days	8,9-Z-avermectin B_{1a}, mg/kg
DRIED HOPS			
0	0.023 0.021	0	0.019 0.017
34	0.018 0.021	36	0.016 0.014
60	0.023 0.018	61	0.015 0.017
96	0.019 0.017	97	0.014 0.015
190	0.018 0.018	189	0.014 0.014
FRESH HOP CONES			
0	0.018 0.018	0	0.016 0.015
130	0.016 0.014	131	0.015 0.015
153	0.016 0.016	154	0.015 0.015

Definition of the residue

The abamectin residue is currently defined by the JMPR as the sum of avermectin B_{1a}, avermectin B_{1b} and D-8,9 isomer of avermectin B_{1a}.

The Meeting noted that the definition proposed by JECFA (1997) for residues in the liver, kidney and fat from animals subject to veterinary treatments with abamectin does not include the 8,9-*Z* isomer (D-8,9 isomer), because it is not present in animal tissues when abamectin is used directly on the animal. The JECFA efinition also does not include avermectin B_{1b}, because avermectin B_{1a} was considered the appropriate marker residue.

The Meeting agreed that the wider definition (to include the 8,9-*Z* isomer) was the appropriate one for a laboratory carrying out enforcement or monitoring analyses because the analyst would not know whether the residue in the animal originated from veterinary uses, animal feed, or both. In practice, the wider definition accommodates both sources.

The inclusion or exclusion of avermectin B_{1b} from the residue definition is a matter of judgement. In many crop situations B_{1b} is commonly present at approximately 10% of the total residue, so its inclusion or exclusion has little effect on the measured residue. The analytical methods measure B_{1a} and B_{1b} by the same procedure; they appear as two peaks on the same chromatogram, so the analytical data for both components are always available from an analysis and may as well be used. The avermectin B_{1b} residue can be calculated from the avermectin B_{1a} standard curve because the reaction yields and response factors for derivatized B_{1a} and B_{1b} are the same.

Avermectin B_{1b} forms a photoisomer 8,9-*Z*-avermectin B_{1b} in the same way as avermectin B_{1a}. The studies reviewed by the JMPR in 1992 were with avermectin B_{1a} so the possibility of 8,9-*Z*-avermectin B_{1b} being produced was not taken into account. In practice the contribution of 8,9-*Z*-avermectin B_{1b} to the residue will be small but for the sake of accuracy it should be recognised that

the HPLC measurement of avermectin B_{1b} residues includes any 8,9-*Z*-avermectin B_{1b}. The Meeting agreed to adjust the residue definition accordingly.

The recommended definition of the residue for compliance with MRLs and estimation of STMRs is

"sum of avermectin B_{1a}, avermectin B_{1b}, 8,9-Z-avermectin B_{1a} and 8,9-Z-avermectin B_{1b}"

USE PATTERN

Table 2. Registered or approved uses of abamectin on food crops. All EC formulations.

Crop	Country	Application				PHI, days
		Method	Rate, kg ai/ha	Spray conc.,kg ai/hl	No.	
Almond	USA		0.014 0.028	0.00019-0.00038	2	21
Apple	Australia	foliar[1]	0.014	0.0014	1	14[23]
Apple	Brazil	foliar[2]	0.0095-0.032	0.0014-0.0018		14
Apple	Canada	foliar[3]	0.014-0.027	0.00036-0.00072	1 or 2[4]	28
Apple	France*	foliar[1]	0.014-0.027	0.0014	2	21
Apple	Israel	foliar[5]		0.0018	6	7
Apple	South Africa	foliar[6] HV	0.014-0.027	0.00063	2 or 4[7]	14
Apple	USA	foliar[8]	0.013-0.026	0.00035-0.00070	2 or 4[7]	28
Celery	Argentina		0.011-0.022	0.0014	4	7
Celery	Cyprus	foliar	0.011-0.022	0.0011	4	7
Celery	France	foliar	0.009		4	7 or 14
Celery	Israel	foliar	0.0054-0.011	0.0009-0.0018	6	7
Celery	Mexico	foliar	0.0054-0.022	0.0011	10	7
Celery	Spain	foliar	0.0054-0.022	0.0011	3	10
Celery	USA	foliar	0.011-0.021		3 or 6[9]	7
Chicory	France	foliar	0.009		4	7 or 14
Citrus	Argentina	foliar HV[10]	0.011-0.027	0.00027-0.00036	2-5	7
Citrus	Brazil	foliar[2]	0.0054-0.011	0.00036-0.00054		7
Citrus	Cyprus	foliar	0.009-0.018	0.00036	6	7
Citrus	Israel	foliar[5]	0.018-0.025		6	7
Citrus	Mexico	foliar[11]	0.0072-0.027	0.00036	3	7
Citrus	South Africa	foliar[6]		0.00018	3	7
Citrus	Spain	foliar[3]	0.014-0.027	0.00072	3	10
Citrus	USA	foliar[8]	0.0066-0.026		2-8[12]	7
Cotton	Argentina	foliar g & a[13]	0.0054-0.011	0.0027-0.011	5-10	20[14]
Cotton	Australia	foliar g & a	0.0054	0.027 max	2	20[15]
Cotton	Brazil	foliar	0.0054-0.011			21
Cotton	Israel	foliar[5]	0.0054-0.011	0.00054	6	7
Cotton	Mexico	foliar	0.009-0.022		4	20[14]
Cotton	South Africa	foliar g & a	0.0054-0.011	0.0054	3	21[16]
Cotton	Spain	foliar	0.0054-0.018	0.0018-0.0036		20
Cotton	USA	foliar g & a	0.011-0.021	note[17]	2	20[14]
Cotton	USA	foliar g & a	0.0053-0.0079	note[18]		
Cucumber	Brazil	foliar[2]	0.0045-0.009	0.0009-0.0018		3
Cucumber	Cyprus	foliar	0.009-0.018	0.0009	4	3
Cucumber	France	foliar	0.022	0.0009	6	3
Cucumber	Germany	greenhouse[19]	0.023		5	3
Cucumber	Israel	foliar	0.0054-0.011	0.0009-0.0018	6	7
Cucumber	Netherlands	foliar gl[20]	0.023	0.00045-0.0009	5	3
Cucumber	Spain	foliar	0.0054-0.022	0.0011	3	3
Cucumber	Switzerland	foliar	0.009- 0.036	0.00045-0.0009	4	3 gl
Cucumber	USA	foliar	0.011-0.021		3 or 6[9]	7
Cucurbits	Argentina		0.011-0.022	0.0014	4	3

Crop	Country	Application				PHI, days
		Method	Rate, kg ai/ha	Spray conc.,kg ai/hl	No.	
Egg plant	France	foliar	0.022		6	3
Egg plant	Germany		0.023-0.009			
Egg plant	Germany	greenhouse[19]	0.023		5	3
Egg plant	Israel	foliar	0.0054-0.011	0.0009-0.0018	6	7
Egg plant	Netherlands	foliar gl[20]	0.023	0.00045-0.0009	4	3[21]
Egg plant	Switzerland	foliar	0.009-0.036	0.00045-0.0009	4	3 gl
Endive	France	foliar f[22]	0.009		4	28
Endive	Netherlands		0.014	0.0009	4	14[21]
Gherkin	Netherlands	foliar gl[20]	0.023	0.00045-0.0009	5	3
Hops	Czech Republic	foliar	0.022	0.0007	2	28
Hops	Germany	foliar	0.023	0.0011	2	28
Hops	USA		0.022		2	28
Lamb's lettuce	France	foliar f[22]	0.009		4	28
Lettuce	Cyprus	foliar	0.009-0.018	0.0009	4	7
Lettuce	France	foliar f[22]	0.009		4	28
Lettuce	France	foliar	0.009		4	7 or 14
Lettuce	Spain	foliar	0.011-0.022	0.0009-0.0018	3	14
Lettuce, Head	Netherlands		0.014	0.0009	4	14[21]
Lettuce, Head	USA	foliar	0.011-0.021		3 or 6[9]	7
Lettuce, Iceberg	Netherlands		0.014	0.0009	4	14[21]
Melon	Cyprus	foliar	0.009-0.018	0.0009	4	3
Melon	France	foliar	0.022	0.0009	6	3
Melon	Germany	greenhouse[19]	0.023		5	3
Melon	Israel	foliar	0.0054-0.011	0.0009-0.0018	6	7
Melon	Spain	foliar	0.022	0.0011	3	3
Melon	USA	foliar	0.011-0.021		3 or 6[9]	7
Nectarine	Israel	foliar	0.014	0.009		
Peach	Israel	foliar				
Peanuts	Israel	foliar		0.00054		
Pear	Argentina	foliar HV[10]	0.014-0.027	0.00072-0.0014	2-4	14
Pear	Australia	foliar[1]	0.014	0.0014	1	14[23]
Pear	Canada	foliar[3]	0.014-0.027	0.00036-0.00072	1 or 2[4]	28
Pear	Cyprus	foliar[24]	0.011-0.029	0.00054-0.00072	6	7
Pear	France	foliar[10]	0.014	0.0014	2	15
Pear	France	foliar	0.023	0.0014	4	15
Pear	Greece		0.014-0.036	0.0014-0.0018		10
Pear	Israel	foliar[5]		0.0014	6	7
Pear	Italy	foliar[25]	0.014-0.027	0.0014	2	14
Pear	South Africa	foliar[6] HV	0.014-0.027	0.00063	2 or 4[7]	7
Pear	Spain	foliar[3]	0.014-0.027	0.0014	2	10
Pear	Switzerland	foliar	0.023-0.027	0.0014	4	21
Pear	USA	foliar[8]	0.013-0.026	0.00035-0.00070	2 or 4[7]	28
Peppers	Argentina	foliar HV	0.0.009-0.022	0.0009-0.0013	4	3
Peppers	Brazil	foliar[2]	0.009-0.018	0.0009-0.0018		3
Peppers	Cyprus	foliar[24]	0.009-0.018	0.0009	4	3
Peppers	France	foliar	0.022		6	3
Peppers	Israel	foliar	0.0054-0.011	0.0009-0.0018	6	7
Peppers	Spain	foliar	0.0054-0.022	0.0011	3	3
Peppers (bell)	USA	foliar	0.011-0.021		3 or 6[9]	7
Peppers, sweet	Germany	greenhouse[19]	0.023		5	3
Peppers, Sweet	Netherlands	foliar gl[20]	0.023	0.00045-0.0009	4	3[21]
Peppers, Sweet	Switzerland	foliar	0.009-0.036	0.00045-0.0009	4	3 gl
Pome fruit	New Zealand	foliar[11] HV	0.027	0.00068	1	14
Potato	Brazil	foliar[2]	0.009-0.018	0.0011-0.0023		14
Potato	Israel	foliar	0.011	0.0018	6	7
Potato	USA	foliar	0.011-0.021		3 or 6[9]	14
Radish	Netherlands	foliar gl[20]	0.014	0.0009	1	14
Squash	Cyprus	foliar	0.009-0.018	0.0009	4	3

Crop	Country	Application				PHI, days
		Method	Rate, kg ai/ha	Spray conc.,kg ai/hl	No.	
Squash	USA	foliar	0.011-0.021		3 or 6[9]	7
Strawberry	Argentina	foliar HV	0.011-0.022	0.0014-0.0018	4	3
Strawberry	Australia	foliar	0.011-0.022	0.0018	2	3[26]
Strawberry	Brazil	foliar[2]	0.009-0.017	0.009-0.0014		3
Strawberry	Cyprus	foliar	0.018	0.0009	4	3
Strawberry	France	foliar	0.023		4	3
Strawberry	Israel	foliar[5]	0.009	0.0009	6	7
Strawberry	Mexico	foliar	0.009-0.022	0.0018	4	3
Strawberry	New Zealand	foliar HV	0.011	0.0018	3	3
Strawberry	South Africa	foliar HV	0.022		4	3
Strawberry	Spain	foliar	0.011-0.022	0.0014-0.0018	4	3
Strawberry	Switzerland	foliar	0.009-0.014	0.00045	4	
Strawberry	USA	foliar	0.021		4	3
Tomato	Argentina	foliar	0.009-0.022	0.0009-0.0013	4-9	3
Tomato	Australia	foliar HV	0.0054-0.0081	0.0011-0.0016	2	3[26]
Tomato	Brazil	foliar[2]	0.0068-0.022	0.0014-0.0018		3
Tomato	Cyprus	foliar	0.011-0.022	0.0011	4	3
Tomato	France	foliar	0.022	0.0009	6	3
Tomato	Germany		0.009-0.023			
Tomato	Germany	greenhouse[19]	0.023		5	3
Tomato	Greece			0.011-0.0018		3,7
Tomato	Israel	foliar	0.0054-0.011	0.0009-0.0018	6	3
Tomato	Italy	foliar	0.0054-0.022	0.0011	2	7
Tomato	Mexico	foliar	0.0054-0.022	0.0011-0.0018	3	3
Tomato	Netherlands	foliar gl[20]	0.023	0.00045-0.0009	4	3[21]
Tomato	New Zealand	foliar HV gl[20]	0.0081	0.0011-0.0016	3	3
Tomato	South Africa	foliar HV	0.0054-0.022	0.0011	5	3
Tomato	Spain	foliar	0.0054-0.022	0.0011		3 7 gl
Tomato	Switzerland	foliar	0.009-0.018	0.00045-0.0009	4	3 gl
Tomato	USA	foliar	0.011-0.021		3 or 6[9]	7
Walnut	USA		0.014-0.028	0.00019-0.00038	2	21
Watermelon	Brazil	foliar[2]	0.0045-0.009	0.0009-0.0018		7
Watermelon	Cyprus	foliar	0.009-0.018	0.0009	4	3
Watermelon	Israel	foliar	0.0054-0.011	0.0009-0.0018	6	7
Watermelon	Spain	foliar	0.0054-0.022	0.0011		3
Zucchini	France	foliar		0.0009	6	3
Zucchini	Germany		0.009-0.023			
Zucchini	Germany	greenhouse[19]	0.023		5	3
Zucchini	Netherlands	foliar gl[20]	0.023	0.00045-0.0009	5	3

*Proposed registration
[1] Plus summer oil
[2] Plus mineral or vegetable oil.
[3] Plus paraffinic oil.
[4] At the higher rate, 1 application is permitted; at the lower rate, 2.
[5] Plus ultrafine oil.
[6] Plus light mineral spray oil.
[7] At the higher rate, 2 applications are permitted; at the lower rate, 4.
[8] Plus horticultural spray oil.
[9] At the higher rate, 3 applications are permitted; at the lower rate, 6.
[10] Plus summer mineral oil.
[11] Plus agricultural spray oil.
[12] At the highest rate, 2 applications are permitted; at the lowest rate, 8.
[13] g & a - ground and aerial application
[14] Do not graze or feed cotton foliage.
[15] Do not graze or cut for stockfood for 20 days after application.
[16] Do not allow animals to feed on treated foliage.
[17] Late season
[18] Early season.
[19] Do not use during the months of November till February.

[20] gl: glasshouse.
[21] Only from 1 March to 1 November.
[22] Outdoor use only.
[23] Do not feed treated produce to livestock for 14 days after application.
[24] Plus narrow range oil.
[25] Plus agricultural spray mineral oil.
[26] Do not feed treated produce to livestock for 3 days after application.

RESIDUES RESULTING FROM SUPERVISED TRIALS

Residue data from supervised trials on fruits, vegetables and hops are summarized in Tables 3-10. Detailed comparisons of national GAP with the conditions in the trials which were considered to be valid for the estiamtion of maximum residue levels and STMRs are shown in the "interpretation" Tables 11-17.

Table 3. Apples. *Australia, France, Germany, Italy, New Zealand, Spain, UK, USA*
Table 4. Pears. *USA*
Table 5. Cucurbits. *Brazil, France, Mexico, Spain*
Table 6. Cucurbits *USA*
Table 7. Tomatoes. *Netherlands*
Table 8. Lettuce. France, Netherlands, Spain
Table 9. Potatoes. *Brazil, USA*
Table 10. Hops. *Germany, USA*

Limits of detection and determination are generally reported as 0.002 and 0.005 mg/kg respectively. Where these limits apply, residues in the residue tables reported as NQ are detected but <0.005 mg/kg, while residues reported as ND are <0.002 mg/kg. Residues, application rates and spray concentrations have generally been rounded to 2 significant figures or, for residues near the LOD, to 1 significant figure. The listed B_{1a} residue includes avermectin B_{1a} and its photoisomer 8,9-*Z*-avermectin B_{1a}, and the B_{1b} residue includes avermectin B_{1b} and 8,9-*Z*-avermectin B_{1b}.

Although all trials included control plots, no control data are recorded in the tables except where residues were detected in the controls. Residues are not corrected for recovery.

The trials were fully reported as well as summarized..

Abamectin was applied to apple orchards in supervised trials in 3 States in Australia in 1995 using handgun sprayers or airblast back-pack misters. The trials were with 2 treated replicates of 1 or 8 trees.

Apple trees were treated with abamectin in a large programme of supervised trials in France, Germany, Italy, Spain and the UK from 1991 to 1994 (Table 4). Spray equipment and plot sizes varied but the size of each field sample was consistently 12 apples.

Plot sizes in the French apple trials were 3 or 4 trees or a 3-4 m row. Trees were sprayed with a motorised knapsack sprayer, a plot sprayer or by tractor with an airblast sprayer. Apple trees in the German trials of 1991 were sprayed with a pressurised back-pack sprayer. Sub-plot sizes were 1 or 6 trees. In the Italian trials plots of 3-4 trees were sprayed with a handgun motor-driven pump sprayer.

The analytical report for apple trial 115-94-0004R from New Zealand was unclear as to whether the treatment had included a spraying oil. Also some results were reported as total residues instead of as the separate B_{1a} and B_{1b} components.

In Spain apple orchards were sprayed using a tractor-mounted orchard sprayer in 1993. Plots were 3-5 trees. In 1994 the trees were sprayed by motorised knapsack or handgun motor pump. In the UK trials of 1991 the trees were sprayed with a back-pack airblast sprayer. Plots were 1 or 2 trees. The oil used as a spray additive in trial 074-91-0004R was rape seed oil.

In a programme of supervised trials on apples in the USA abamectin was used on common varieties in seven apple-growing states from 1990 to 1992 (Table 3). Abamectin in association with a horticultural spraying oil (9.4 l/ha) was applied by handgun sprayers or tractor driven airblast sprayers. Treated plots consisted of 16-18 trees with sampling of the 4 inner trees. In the 1990 trials the four trees were sampled as 4 replicate subplots, but in 1991 and 1992 they were sampled as 2 replicate subplots each of 2 trees. The field sample was 12 apples. In trial 001-91-1024R 9 mm of rain fell on the final day of treatment so samples were taken 1 day later instead of on the day of treatment.

Abamectin was applied to pear trees in 4 supervised trials in California, the USA, by commercial airblast orchard sprayer (Table 4). The plot size was 16 trees and samples for analysis were taken from the 4 central trees. There was little rainfall during the trials and irrigation was by furrow in two of the trials and by sprinkler in the other two, but the sprinklers were beneath the trees and irrigation water would not have contacted the fruit. Field samples were of 12 pears and 11-12 kg were taken for processing.

Trials on cucurbits in Brazil, France, Mexico and Spain are summarized in Table 5. In each trial in Mexico a field sample from each of 4 replicate plots was analysed. Abamectin was applied by knapsack in all trials except one on cucumbers (002-90-0016R) where a manual sprinkling pump was used. Spray concentrations were progressively decreased through the number of applications in each trial to maintain the required application rate because larger volumes of spray were required for good coverage as the plants approached maturity. Plot sizes were 8-563 m^2 for cucumbers, 23-563 m^2 for pickling cucumbers, 11-763 m^2 for cantaloupe and 46-648 m^2 for honey-dew melons. Field samples were 5-10 fruit for cucumbers, 0.5 kg for pickling cucumbers, and 4 mature fruit for cantaloupes and honey-dew melons.

In melon trials in Brazil abamectin was applied by knapsack to plot sizes of 30-90 m^2. A field sample of 6 melons (4.2-9 kg) was taken from each plot for analysis. The edible pulp was analysed rather than whole melons. Abamectin was applied by knapsack to melons in 60 m^2 plots in supervised trials in France. Field samples consisted of 4-5 fruit. In Spain abamectin was applied by CO_2 pressurized back-pack sprayer to 6 m^2 plots of melons in glasshouses with each plot comprising 4 subplots. Samples of 4-5 fruit were taken from the subplots for analysis.

Glasshouse tomatoes growing on a rockwool substrate were treated with abamectin using a motor driven high-pressure sprayer equipped with a hand-held wand in 2 trials in The Netherlands in March-April 1993. Plot sizes were 19 m^2. In 4 glasshouse tomato trials in The Netherlands in September -October 1993 abamectin was applied 4 times at weekly intervals to plots of 30 m^2 . The final applications were in the first week (2 trials) or third week (2 trials) of October.

Trials on lettuce are summarized in Table 8. Head lettuce were sprayed by knapsack or compressed air experimental sprayer in field trials in France in 1992. There were 4 replicates of 5-10 m^2 in the trial design. The field sample comprised 6 lettuce. The design and procedures were very similar in Spanish trials on head and leaf lettuce also in 1992. Old leaves were discarded from the harvested lettuce in the field.

Abamectin was applied by hand-held sprayer to head lettuce in a series of glasshouse trials in The Netherlands in 1993 and 1994. Four applications were made in each trial at intervals of approximately 5-7 days. The plots were 22.5 m^2. The number of heads in a field sample varied because of growth during the sampling period, but the sample weight was about 2.5 kg. The trials

coincided with the change of season because Netherlands GAP specifies that the use on glasshouse lettuce should be between 1 March and 1 November.

Trials on potatoes were carried out in Brazil and the USA (Table 9). In a series of trials in Brazil in 1994 abamectin was applied to the potato foliage by knapsack sprayer with 2 replicates of 20 m^2 plots in each trial. Field samples were 2 kg of tubers.

In 4 trials in the USA in 1992 abamectin was applied 6 times at an exaggerated rate at 6-9 day intervals by CO_2 pressurised sprayers (some treatments included a paraffin crop oil at 9.4 l/ha). Plot sizes ranged from 50 to 100 m^2. One field sample (2-3 kg tubers) was taken from each of 2 subplots or split plots within each plot. The tubers were commercially acceptable for harvest and during field sampling adhering soil was removed as far as possible with a clean dry brush; the tubers were not washed. Similar practices were followed in the US trials in 1993 except that abamectin was applied at the US recommended label rate.

The US trial 001-94-1022 was designed to produce potatoes for processing. Abamectin was applied 6 times, with intervening intervals of 7 days, at an exaggerated rate (0.11 kg ai/ha). Diquat was applied 2 days after the final abamectin application to kill the potato vines and promote tuber bulking. Maturity for the variety Russet Nugget is determined by frost or vine-kill.

Trials on hops were conducted in Germany and the USA (Table 10). Abamectin was applied by tractor-driven airblast sprayers in 8 supervised trials in Germany in 1994 and 1996. The 2 applications in each trial were approximately 21 days apart. Plot sizes ranged from 288 m^2 to 504 m^2. Field samples were taken from the middle rows of the plots. In 1994 fresh hops were dried for 6 hours at 62°C to produce dry hops. In 1996 the mature cones were dried in a commercial hop kiln for approximately 3 hours to produce the dry hops, the final samples of which were at least 500 g.

In 4 supervised trials in the USA in 1994 abamectin was applied twice to hops by tractor-driven airblast sprayers. The plots consisted of 5-7 rows approximately 9 m long. Field samples of 1-2 kg of cones were taken from the middle rows and dried at 38-60°C for 12 hours to produce the dry hops which were analysed. The dry weight was approximately 30% of the fresh weight and the moisture content of the dry hops was close to 9%.

Table 3. Abamectin residues in apples resulting from foliar applications in supervised trials in Australia, France, Germany, Italy, New Zealand, Spain, the UK and the USA. Double-underlined residues are from treatments according to GAP and are valid for estimating maximum residue levels and STMRs. All EC formulations.

Country, year	Application			PHI, days	Residues, mg/kg[1]		Ref
(variety)	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Australia (NSW), 1995 (Granny Smith)	0.014 + oil	0.0008	1	0 14 21	0.015 0.015 <u>0.003</u> 0.002 NQ NQ	ND ND ND ND ND ND	114-95-0001R
Australia (Tas), 1995 (Red Delicious)	0.014 + oil	0.0007	1	0 14 21	0.013 0.012 <u>0.005</u> 0.002 0.002 0.004	NQ NQ ND ND ND ND	114-95-0003R
Australia (Vic), 1995 (Fuji)	0.014 + oil	0.0007	1	0 14 21	0.009 0.007 ND <u>NQ</u> ND ND	ND ND ND ND ND ND	114-95-0002R
France, 1991 (Golden Delicious)	0.027 + oil	0.0015-0.0019	2	0 28	0.006 0.015 0.003 0.004 0.004 NQ NQ NQ	ND 0.002 ND ND ND (4)	066-91-0017R
France, 1991 (Golden Delicious)	0.054 + oil	0.0031 -0.0037	2	0 28	0.016 0.015 0.010 0.008 0.003 ND 0.003	0.002 0.002 ND ND ND (3)	066-91-0017R

Country, year	Application			PHI, days	Residues, mg/kg[1]		Ref
(variety)	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
France, 1991 (Jonagold)	0.027	0.002	2	0 7 14 18 26	0.008 0.011 0.013 0.007 NQ 0.004 0.003 0.008 NQ 0.004 0.003 NQ 0.002 0.003 0.004 NQ NQ NQ ND ND	ND ND NQ ND ND (4) ND (4) ND (4) ND (4)	066-91-0016R
France, 1991 (Jonagold)	0.027 + oil	0.002	2	0 7 14 18 26	0.025 0.018 0.018 0.013 0.007 0.011 0.008 0.009 0.004 0.005 0.009 0.006 NQ 0.012 0.008 0.006 0.002 0.004 0.003	0.003 NQ NQ NQ ND (3) ND (4) ND ND NQ ND ND (4)	066-91-0016R
France, 1991 (Jonagold)	0.054	0.004	2	0 7 14 18 26	0.020 0.027 0.038 0.021 0.005 0.012 0.003 0.008 0.004 0.009 NQ 0.005 0.003 0.008 ND 0.005 0.002 0.002 ND 0.002	NQ 0.003 0.004 0.002 ND NQ ND ND ND (4) ND (4) ND (4)	066-91-0016R
France, 1991 (Jonagold)	0.054 + oil	0.004	2	0 7 14 18 26	0.029 0.043 0.033 0.037 ND 0.023 0.021 0.024 0.008 0.015 0.011 0.014 0.008 0.016 0.025 0.020 0.007 0.005 0.005 0.007	0.003 0.005 0.004 0.004 ND 0.002 0.002 0.002 ND NQ ND NQ ND NQ 0.002 0.002 ND (4)	066-91-0016R
France, 1993 (Golden Delicious)	0.014 + oil	0.0012	2	0 28	0.006 0.010 ND ND	NQ NQ ND ND	066-93-0016R
France, 1993 (Golden Delicious)	0.014	0.0012	2	0 28	NQ NQ ND ND	ND ND ND ND	066-93-0016R
France, 1993 (Golden Delicious)	0.014 + oil	0.0012	2	0 28	0.005 0.007 ND ND	ND ND ND ND	066-93-0016R
France, 1993 (Golden Delicious)	0.027	0.0025	2	0 28	0.030 0.029 0.003 0.005	0.004 0.004 ND ND	066-93-0016R
France, 1993 (Golden Delicious)	0.014 + adj	0.0008 -0.0009	2	0 28	0.002 NQ ND ND	ND ND ND ND	066-93-0017R
France, 1993 (Golden Delicious)	0.014	0.0008 -0.0009	2	0 28	0.003 0.002 ND ND	ND ND ND ND	066-93-0017R
France, 1993 (Golden Delicious)	0.014 + adj	0.0008 -0.0009	2	0 28	0.004 NQ ND ND	ND ND ND ND	066-93-0017R
France, 1993 (Golden Delicious)	0.027 + adj	0.0015 -0.0018	2	0 28	0.010 0.014 ND NQ	NQ NQ ND ND	066-93-0017R
France, 1993 (Idared 106)	0.014 + oil	0.0014	1 2	21 0 7 14 21 28	ND ND 0.017 0.013 NQ ND NQ ND ND NQ ND ND	ND ND NQ NQ ND ND ND ND ND ND ND ND	066-93-0015R
France, 1993 (Idared 106)	0.014	0.0014	1 2	21 0 7 14 21 28	ND ND 0.016 0.016 ND ND ND ND NQ NQ ND ND	ND ND NQ 0.002 ND ND ND ND ND ND ND ND	066-93-0015R
France, 1993 (Idared 106)	0.014 + oil	0.0014	1 2	21 0 7 14 21 28	ND ND 0.012 0.003 NQ ND ND NQ NQ NQ ND ND	ND ND NQ ND ND ND ND ND ND ND ND ND	066-93-0015R

Country, year	Application			PHI, days	Residues, mg/kg[1]		Ref
(variety)	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
France, 1993 (Red Chief)	0.014 + adj[2]/	0.0014	1 2	21 0 7 14 21 28	ND ND 0.003 0.009 NQ ND ND ND ND ND ND ND	ND ND ND NQ ND ND ND ND ND ND ND ND	066-93-0014R
France, 1993 (Red Chief)	0.014	0.014	1 2	21 0 7 14 21 28	ND ND 0.009 0.013 ND ND ND ND ND ND ND ND	ND ND NQ NQ ND ND ND ND ND ND ND ND	066-93-0014R
France, 1993 (Red Chief)	0.014 + adj	0.014	1 2	21 0 7 14 21 28	ND ND 0.003 0.014 0.004 NQ ND NQ ND ND ND ND	ND ND ND 0.002 ND ND ND ND ND ND ND ND	066-93-0014R
France, 1994 (Golden Delicious)	0.014	0.0014	1 2	21 0 7 14 21 25	ND ND 0.005 0.008 ND ND ND ND ND ND ND ND	ND ND ND NQ ND ND ND ND ND ND ND ND	066-94-0003R
France, 1994 (Golden Delicious)	0.014 + oil	0.0014	1 2	21 0 7 14 21 25	ND NQ 0.014 0.011 0.002 0.003 NQ NQ NQ NQ ND ND	ND ND 0.002 0.002 ND ND ND ND ND ND ND ND	066-94-0003R
France, 1994 (Golden Delicious)	0.014	0.0014	2	0 26	0.003 0.002 ND ND	ND ND ND ND	066-94-0004R
France, 1994 (Golden Delicious)	0.014 + oil	0.0014	2	0 26	0.007 0.008 ND NQ	NQ NQ ND ND	066-94-0004R
Germany, 1991 (Golden Delicious Smoothee M9)	0.027	0.0027	2	0 7 14 21 28	0.019 0.014 0.013 0.017 ND (3) ND (4) ND (4) ND (4)	NQ (4) ND (3) ND (4) ND (4) ND (4)	072-91-0005R
Germany, 1991 (Golden Delicious Smoothee M9)	0.027 + oil	0.0027	2	0 7 14 21 28	0.026 0.022 0.022 0.020 0.008 0.006 0.005 0.009 0.007 0.007 0.003 0.007 0.007 0.006 0.004 0.006 0.005 0.004 0.004 0.004	0.003 0.002 0.003 0.002 ND (4) ND (4) ND (4) ND (4)	072-91-0005R
Germany, 1991 (Golden Delicious)	0.027 + oil	0.0019 -0.0022	2	0 28	0.030 0.023 0.021 0.014 0.008 0.007 0.007 0.005	0.003 0.002 0.002 NQ ND (4)	072-91-0004R
Germany, 1991 (Golden Delicious)	0.027	0.0020 -0.0025	2	0 7 14 21 28	0.022 0.018 0.009 0.004 0.003 0.002 0.002 ND 0.003 NQ ND NQ NQ ND ND NQ ND ND ND	0.002 NQ ND ND ND (4) ND (4) ND (3) ND (4)	072-91-0006R
Germany, 1991 (Golden Delicious)	0.027 + oil	0.0020 -0.0025	2	0 7 14 21 28	0.026 0.031 0.031 0.027 0.009 0.018 0.013 0.014 0.013 0.010 0.007 0.013 0.013 0.008 0.009 0.010 0.006 0.006	0.002 0.003 0.003 0.002 ND NQ NQ NQ NQ NQ ND NQ NQ ND NQ NQ ND ND	072-91-0006R

Country, year	Application			PHI, days	Residues, mg/kg[1]		Ref
(variety)	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Italy, 1993 (Golden Delicious)	0.014 + adj	0.014	1 2	21 0 7 14 21 28	ND ND 0.006 0.005 NQ ND ND ND ND ND ND ND	ND ND ND ND ND ND ND ND ND ND ND ND	067-93-0005R
Italy, 1993 (Golden Delicious)	0.014	0.014	1 2	21 0 7 14 21 28	ND ND 0.002 NQ ND ND ND ND ND ND ND ND	ND ND ND ND ND ND ND ND ND ND ND ND	067-93-0005R
Italy, 1993 (Golden Delicious)	0.014 + adj	0.014	1 2	21 0 7 14 21 28	ND ND 0.005 0.007 ND ND ND ND ND ND ND ND	ND ND ND NQ ND ND ND ND ND ND ND ND	067-93-0005R
Italy, 1993 (Red Chief)	0.014 + adj	0.0010	2	0 28	0.005 0.002 ND ND	ND ND ND ND	067-93-0007R
Italy, 1993 (Red Chief)	0.014	0.0010	2	0 28	0.003 0.003 ND ND	ND ND ND ND	067-93-0007R
Italy, 1993 (Red Chief)	0.014 + adj	0.0010	2	0 28	0.003 0.003 ND ND	ND ND ND ND	067-93-0007R
Italy, 1993 (Red Chief)	0.027	0.0022	2	0 28	0.006 0.007 ND ND	ND ND ND ND	067-93-0007R
Italy, 1993 (Red Chief)	0.014 + oil	0.0010	2	0 28	0.005 0.004 ND ND	ND ND ND ND	067-93-0006R
Italy, 1993 (Red Chief)	0.014	0.0010	2	0 28	0.003 0.003 ND ND	ND ND ND ND	067-93-0006R
Italy, 1993 (Red Chief)	0.014 + oil	0.0010	2	0 28	0.004 0.003 ND ND	ND ND ND ND	067-93-0006R
Italy, 1993 (Red Chief)	0.027 + oil	0.0020	2	0 28	0.015 0.008 ND ND	ND ND ND ND	067-93-0006R
Italy, 1993 (Staymann Red)	0.014 + oil	0.001	1 2	21 0 7 14 22 28	ND ND 0.003 0.006 ND ND ND ND ND ND ND ND	ND ND ND ND ND ND ND ND ND ND ND ND	067-93-0004R
Italy, 1993 (Staymann Red)	0.014	0.001	1 2	21 0 7 14 22 28	ND ND 0.004 NQ ND ND ND ND ND ND ND ND	ND ND ND ND ND ND ND ND ND ND ND ND	067-93-0004R
Italy, 1993 (Staymann Red)	0.014 + oil	0.001	1 2	21 0 7 14 22 28	ND ND 0.004 0.005 ND ND ND ND ND ND ND ND	ND ND ND ND ND ND ND ND ND ND ND ND	067-93-0004R
Italy, 1994 (Starkcrimson)	0.014	0.0014	1 2	21 0 7 14 21 28	ND ND 0.011 0.014 ND ND ND ND ND ND ND ND	ND ND NQ 0.002 ND ND ND ND ND ND ND ND	067-94-0005R

Country, year	Application			PHI, days	Residues, mg/kg[1]		Ref
(variety)	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Italy, 1994	0.014	0.0014	1	21	NQ ND	ND ND	067-94-
(Starkcrimson)	+oil		2	0	0.015 0.019	0.003 0.003	0005R
				7	NQ ND	ND ND	
				21	ND ND	ND ND	
				28	ND ND	ND ND	
New Zealand, 1994	0.027	0.0014	2	0	0.014 0.018	ND NQ	115-94-
(Braeburn)	+oil			7	0.012 0.005	ND ND	0005R
				14	0.003 0.004	ND ND	
				21	0.002 ND	ND ND	
				28	0.003 ND	ND ND	
				35	NQ 0.002	ND ND	
New Zealand, 1994	0.027	0.0014	2	0	0.018 0.019	0.002 0.002	115-94-
(Gala)	+oil?			7	0.006 0.006	ND ND	0004R
				14	0.007 0.003	ND ND	
				21	0.003 ND c 0.005	ND ND c ND	
				28	0.003 0.004	ND ND	
				35	NQ 0.003	ND ND	
Spain, 1991 (Golden	0.027	0.0021	2	0	0.011 0.012 0.019 0.013	NQ ND NQ NQ	065-91-
Delicious)				28	0.004 NQ NQ NQ	ND (4)	0008R
Spain, 1991 (Red	0.027	0.0022	2	0	0.013 0.014 0.014 0.012	NQ NQ 0.002 NQ	065-91-
Delicious, Red Chief)				28	ND NQ ND ND	ND (4)	0007R
Spain, 1991 (Red	0.027	0.0022	2	0	0.005 0.010 0.004	ND ND ND	065-91-
Delicious, Red Chief)		-0.0026		7	ND 0.003 0.006	ND ND ND	0009R
				14	ND ND ND	ND ND ND	
				21	ND ND ND	ND ND ND	
				28	ND ND ND	ND ND ND	
Spain, 1991 (Red	0.027	0.0022	2	0	0.009 0.016 0.014 0.011	ND NQ NQ NQ	065-91-
Delicious, Red Chief)	+ oil	-0.0026		7	0.002 0.005 NQ 0.003	ND (4)	0009R
				14	NQ 0.004 0.003 0.003	ND (4)	
				21	ND NQ 0.003 NQ	ND (4)	
				28	NQ 0.004 0.003 NQ	ND (4)	
Spain, 1993 (Golden	0.014	0.0011	2	0	0.005 0.005	ND ND	065-93-
Delicious)	+ oil			28	ND ND	ND ND	0006R
Spain, 1993 (Golden	0.014	0.0011	2	0	0.005 0.007	ND ND	065-93-
Delicious)				28	ND ND	ND ND	0006R
Spain, 1993 (Golden	0.014	0.0011	2	0	0.003 0.004	ND ND	065-93-
Delicious)	+ oil			28	ND ND	ND ND	0006R
Spain, 1993 (Golden	0.027	0.0023	2	0	0.018 0.012	NQ NQ	065-93-
Delicious)	+ oil			28	ND ND	ND ND	0006R
Spain, 1993 (Golden	0.014	0.0012	2	0	NQ NQ	ND ND	065-93-
Delicious)	+ adj[2]			28	ND ND	ND ND	0007R
Spain, 1993 (Golden	0.014	0.0012	2	0	0.005 0.011	ND NQ	065-93-
Delicious)				28	ND ND	ND ND	0007R
Spain, 1993 (Golden	0.014	0.0012	2	0	0.009 ND	NQ ND	065-93-
Delicious)	+ adj			28	ND ND	ND ND	0007R
Spain, 1993 (Golden	0.027	0.0025	2	0	0.017 0.014	0.002 NQ	065-93-
Delicious)	+ adj			28	ND NQ	ND ND	0007R
Spain, 1993 (Well Spur)	0.014	0.0014	1	21	ND ND	ND ND	065-93-
			2	0	0.006 0.007	ND ND	0005R
				7	ND ND	ND ND	
				14	ND ND	ND ND	
				21	ND ND	ND ND	
				28	ND ND	ND ND	
Spain, 1993 (Well Spur)	0.014	0.0014	1	21	ND 0.003	ND ND	065-93-
	+ adj		2	0	0.007 0.009	ND NQ	0005R
				7	NQ NQ	ND ND	
				14	ND NQ	ND ND	
				21	NQ NQ	ND ND	
				28	NQ ND	ND ND	

Country, year	Application			PHI, days	Residues, mg/kg[1]		Ref
(variety)	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Spain, 1993 (Well Spur)	0.014 + adj	0.0014	1 2	21 0 7 14 21 28	ND NQ 0.003 0.004 ND NQ NQ ND ND NQ ND ND	ND ND ND ND ND ND ND ND ND ND ND ND	065-93-0005R
Spain, 1994 (Golden Delicious)	0.014	0.014	2	0 30	0.004 0.004 ND ND	ND ND ND ND	065-94-0009R
Spain, 1994 (Golden Delicious)	0.014 + oil	0.014	2	0 30	0.004 0.005 ND ND	ND ND ND ND	065-94-0009R
UK, 1991 (Cox's Orange Pippin)	0.027 + oil	0.0020	2	0 28	0.026 0.019 0.027 0.020 0.005 0.005 0.010 0.007	0.003 0.002 0.003 0.002 ND (4)	074-91-0003R
UK, 1991 (Cox's Orange Pippin)	0.054 + oil	0.0038 -0.0041	2	0 28	0.044 0.013 0.039 0.028 0.016 0.008 0.010 0.010	0.006 NQ 0.004 0.003 NQ ND ND ND	074-91-0003R
UK, 1991 (Cox's Orange Pippin)	0.027	0.0013 -0.0016	2	0 7 14 21 28	0.026 0.034 0.018 0.021 NQ 0.002 NQ NQ ND ND ND NQ NQ ND ND ND ND (4)	0.002 0.003 NQ NQ ND (4) ND (4) ND (4) ND (4)	074-91-0004R
UK, 1991 (Cox's Orange Pippin)	0.027 + oil	0.0013 -0.0016	2	0 7 14 21 28	0.035 0.033 0.044 0.043 0.009 0.010 0.011 0.009 0.006 0.007 0.008 0.007 0.006 0.004 0.009 0.006 0.005 0.005 0.006 0.005	0.003 0.003 0.004 0.004 ND NQ NQ ND ND (4) ND (4) ND (4)	074-91-0004R
UK, 1991 (Cox's Orange Pippin)	0.054	?	2	0 7 14 21 28	0.056 0.061 0.069 0.051 0.006 0.007 0.012 0.018 0.007 0.004 0.005 0.008 0.003 0.003 0.004 0.005 0.004 0.002 0.003 0.003	0.006 0.007 0.008 0.007 ND ND NQ NQ ND (4) ND (4) ND (4)	074-91-0004R
UK, 1991 (Cox's Orange Pippin)	0.054 + oil	0.0025 -0.0031	2	0 7 14 21 28	0.068 0.069 0.072 0.067 0.030 0.025 0.032 0.029 0.013 0.016 0.021 0.029 0.013 0.020 0.019 0.015 0.012 0.012 0.008 0.015	0.007 0.008 0.008 0.008 0.003 0.002 0.003 0.003 NQ NQ NQ 0.003 NQ (4) ND ND ND NQ	074-91-0004R
USA (CA), 1991 (Golden Delicious)	0.027 +oil	0.0038	2	0 28	0.019 0.020 0.010 0.008	0.003 0.003 NQ ND	001-91-6016R 618-936-AP
USA (CA), 1991 (Granny Smith)	0.027 +oil	0.0010	2	0 28	0.009 0.010 ND ND	ND NQ ND ND	001-91-6024R 618-936-AP
USA (GA), 1992 (Red Delicious)	0.027 +oil	0.0072	2	0 28	0.047 0.045 ND NQ	0.006 0.005 ND ND	001-92-0027R 618-936-AP
USA (MI), 1990 (Golden Delicious)	0.028 +oil	0.0010	2	0 3 7 14 28 45	0.011 0.042 0.026 0.091 0.010 0.010 0.008 0.006 0.009 0.010 0.010 0.006 0.005 0.005 0.010 0.005 0.004 0.006 0.003 0.003 0.004 0.006 0.006 0.005	ND 0.005 0.004 ND NQ (4) NQ NQ NQ ND ND ND NQ NQ ND ND NQ ND ND (4)	001-90-5018R 618-936-AP

Country, year	Application			PHI, days	Residues, mg/kg[1]		Ref
(variety)	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
USA (MI), 1990 (Golden Delicious)	0.056 +oil	0.0020	2	0 3 7 14 28 45	0.049 0.031 0.040 0.033 0.020 0.011 0.018 0.012 0.011 0.009 0.021 0.016 0.013 0.006 0.008 0.006 0.005 0.009 0.004 0.004 0.004 0.004 0.004 0.004	0.008 0.006 0.006 0.007 0.003 NQ 0.003 NQ NQ NQ 0.003 NQ NQ ND ND ND ND (4) ND (4)	001-90-5018R 618-936-AP
USA (MI), 1991 (Jonathan)	0.027 +oil	0.0036	2	1 7 14 28	0.008 0.008 0.002 0.003 NQ NQ NQ 0.002	ND ND ND ND ND ND ND ND	001-91-1024R 618-936-AP
USA (NC), 1992 (Red Delicious)	0.026 +oil	0.0071	2	0 28	0.031 0.027 0.003 NQ	0.003 0.003 ND ND	001-92-0026R 618-936-AP
USA (NY), 1990 (Twenty Ounce)	0.028 +oil	0.0007	2	0 3 7 14 28	0.011 0.012 0.030 0.018 NQ 0.004 0.011 0.012 0.002 0.003 0.004 0.005 0.002 NQ 0.003 0.002 ND NQ 0.003 NQ	0.002 0.002 0.004 0.003 ND ND NQ NQ ND (4) ND (4) ND (4)	001-90-5016R 618-936-AP
USA (NY), 1990 (Twenty Ounce)	0.056 +oil	0.0015	2	0 3 7 14 28	0.033 0.028 0.028 0.035 0.062 0.011 0.016 0.009 0.015 0.007 0.003 0.008 0.003 0.002 0.003 0.004 0.002 NQ 0.003 0.003	0.004 0.004 0.004 0.005 0.009 NQ NQ NQ 0.003 NQ ND NQ ND (4) ND (4)	001-90-5016R 618-936-AP
USA (NY), 1991 (Red Delicious)	0.027 +oil	0.0038	2	0 7 14 28	0.040 0.037 0.008 0.008 0.011 0.011 0.007 0.007	0.004 0.004 ND NQ NQ NQ ND ND	001-91-3000R 618-936-AP
USA (NY), 1992 (Rome Beauty)	0.027 +oil	0.0072	2	0 28	0.020 0.020 NQ 0.004	0.002 0.003 ND ND	001-92-3020R 618-936-AP
USA (OR), 1992 (Golden Delicious)	0.027 +oil	0.0008	2	0 28	0.022 0.017 0.003 ND	0.003 NQ ND ND	001-92-6012R 618-936-AP
USA (OR), 1992 (Red Delicious)	0.027 +oil	0.0081	2	0 28	0.009 0.016 ND ND	ND NQ ND ND	001-92-1014R 618-936-AP
USA (WA), 1991 (Red Delicious)	0.027 +oil	0.0011	2	0 28	0.012 0.010 ND NQ	NQ NQ ND ND	001-91-1021R 618-936-AP
USA (WA), 1991 (Red Delicious)	0.026 +oil	0.0037	2	0 7 14 28	0.021 0.027 0.008 0.005 0.007 0.004 0.002 0.003	NQ 0.003 ND ND ND ND ND ND	001-91-1023R 618-936-AP
USA (WA), 1992 (Red Delicious)	0.027 +oil	0.0072	2	0 28	0.018 0.019 NQ ND	0.002 NQ ND ND	001-92-1018R 618-936-AP

1 NQ: not quantified; detected but <0.002 mg/kg.
ND: not detected, <0.001 mg/kg.
2 adj: adjuvant - silicone polyether copolymer surfactant.

Table 4. Abamectin residues in Bartlett pears resulting from foliar applications in supervised trials in California, USA, 1992.

Application				PHI,	Residues, mg/kg[1]		Ref
Form	kg ai/ha	kg ai/hl	No.	days	B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
EC + oil	0.027		2	0 21	0.020 0.004	0.002 ND	001-92-6016R
EC + oil	0.027		2	0 21	0.014 (0.015 0.012) 0.006 (0.005 0.006)	<0.002 (NQ NQ) <0.001 (ND ND)	001-92-6017R
EC + oil	0.027		2	0 21	0.023 (0.030 0.016) 0.007 (0.006 0.009)	0.002 (0.003 NQ) <0.002 (ND NQ)	001-92-6018R
EC + oil	0.027		2	0 21	0.021 (0.021 0.020) 0.009 (0.011 0.008)	0.002 (0.002 0.002) <0.002 (NQ NQ)	001-92-6019R

1 NQ: not quantified; detected but <0.002 mg/kg.
ND: not detected, <0.001 mg/kg.

Table 5. Abamectin residues in cucurbits resulting from foliar applications in supervised trials in Brazil, France, Mexico and Spain. Double-underlined residues are from treatments according to GAP and are valid for estimating maximum residue levels and STMRs.

Country, year (variety)	Application				PHI,	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	kg ai/hl	No.	days	B1a + 8,9-Z-B1a	B1b + 8,9-Z-B1b	
CUCUMBER								
Mexico, 1990	EC	0.023	0.009-0.017	10	0 3 7	0.014 0.007 0.012 0.007 NQ 0.009 0.007 0.011 0.007 0.006 0.006 0.006	ND (4) ND (4) ND (4)	002-90-0011R
Mexico, 1990 (Poinset 76 & 1810)	EC	0.045	0.018-0.034	10	0 3 7	0.015 0.015 0.026 0.013 0.009 0.009 0.008 0.018 0.016 0.009 0.006 0.006	ND NQ (3) ND (4) ND (4)	002-90-0011R
Mexico, 1990 (Jet Set)	EC	0.023	0.009-0.017	9	0 3 7	0.024 0.013 0.015 0.012 0.014 0.014 0.009 0.011 0.007 0.006 0.005 NQ	NQ NQ ND ND ND (4) ND (4)	002-90-0012R
Mexico, 1990 (Jet Set)	EC	0.045	0.018-0.034	9	0 3 7	0.010 0.026 0.010 0.010 0.013 0.024 0.026 0.014 0.006 0.006 0.006 NQ	ND NQ ND ND ND NQ NQ ND ND (4)	002-90-0012R
Mexico, 1990 (Dasher II)	EC	0.023	0.005-0.017	9	0 3 7	ND (4) ND (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0016R
Mexico, 1990 (Dasher II)	EC	0.045	0.010-0.034	9	0 3 7	NQ NQ ND NQ ND (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0016R
PICKLING CUCUMBER								
Mexico, 1989 (Carolina)	EC	0.023	0.009-0.017	7	0 3 7	0.005 0.009 0.006 0.011 ND NQ ND ND ND (4)	ND (4) ND (4) ND (4)	002-90-0013R
Mexico, 1989 (Carolina)	EC	0.045	0.018-0.034	7	0 3 7	0.038 0.023 0.013 0.009 NQ 0.007 NQ NQ ND ND ND NQ	NQ ND ND ND ND (4) ND (4)	002-90-0013R
Mexico, 1990 (Carolina)	EC	0.023	0.009-0.017	8	0 3 7	0.006 0.008 0.006 NQ NQ ND 0.008 NQ ND (4)	ND (4) ND (4) ND (4)	002-90-0014R
Mexico, 1990 (Carolina)	EC	0.045	0.019-0.034	8	0 3 7	0.012 0.025 0.007 0.015 ND 0.020 NQ NQ ND (4)	ND (4) ND (4) ND (4)	002-90-0014R

Country, year (variety)	Application				PHI,	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	kg ai/hl	No.	days	B1a + 8,9-Z-B1a	B1b + 8,9-Z-B1b	
Mexico, 1990 (Carolina)	Control plot				0 3 7	0.011 NQ 0.005 NQ 0.22 0.036 0.066 ND ND (4)	ND (4) 0.017 NQ NQ ND ND (4)	002-90-0014R
Mexico, 1990 (Flury)	EC	0.023	0.003-0.007	6	0 3 7	NQ (4) ND ND ND NQ ND (4)	ND (4) ND (4) ND (4)	002-90-0015R
Mexico, 1990 (Flury)	EC	0.045	0.006-0.014	6	0 3 7	0.008 0.008 0.007 0.008 NQ 0.008 0.008 NQ ND (4)	ND (4) ND (4) ND (4)	002-90-0015R
MELON, CANTALOUPE								
Brazil, 1993 (Amarelo CAC)	EC	0.014	0.0018	4	0 3 7	pu ND ND pu ND ND pu ND ND	pu ND ND pu ND ND pu ND ND	015-93-0034R
Brazil, 1993 (Amarelo CAC)	EC	0.029	0.0036	4	0 3 7	pu ND ND pu ND ND pu ND ND	pu ND ND pu ND ND pu ND ND	015-93-0034R
Brazil, 1994 (Bonus II)	EC	0.014	0.0018	4	0 3 7	pu ND ND pu ND ND pu ND ND	pu ND ND pu ND ND pu ND ND	015-93-0035R
Brazil, 199 (Bonus II)	EC	0.029	0.0036	4	0 3 7	pu ND ND pu ND ND pu ND ND	pu ND ND pu ND ND pu ND ND	015-93-0035R
Brazil, 1994 (Amarelo CAC)	EC	0.014	0.0018	4	0 3 7	pu ND ND pu ND ND pu ND ND	pu ND ND pu ND ND pu ND ND	015-93-0036R
Brazil, 1994 (Amarelo CAC)	EC	0.029	0.0036	4	0 3 7	pu ND ND pu ND ND pu ND ND	pu ND ND pu ND ND pu ND ND	015-93-0036R
France, 1991 (Pancha)	EC	0.023	0.0028	4	0 3 7	NQ ND NQ NQ ND (4) ND (4)	ND (4) ND (4) ND (4)	066-91-0003R
France, 1991 (Pancha)	EC	0.045	0.0056	4	0 3 7	0.008 0.010 0.008 0.013 NQ NQ ND NQ ND NQ ND ND	ND ND ND NQ ND (4) ND (4)	066-91-0003R
France, 1991 (Pancha)	EC	0.023	0.0032	4	0 3 7	NQ NQ 0.009 0.008 NQ ND ND ND ND (4)	ND (4) ND (4) ND (4)	066-91-0004R
France, 1991 (Pancha)	EC	0.045	0.0064	4	0 3 7	NQ 0.013 NQ 0.013 NQ (4) ND (4)	ND (4) ND (4) ND (4)	066-91-0004R
France, 1991 (Panchito)	EC	0.023	0.0030	4	0 3 7	NQ 0.020 NQ 0.014 NQ NQ ND ND ND (4)	ND NQ ND ND ND (4) ND (4)	066-91-0005R
France, 1991 (Panchito)	EC	0.045	0.0060	4	0 3 7	0.013 0.010 0.012 0.007 NQ (4) ND (4)	ND (4) ND (4) ND (4)	066-91-0005R
Mexico, 1990 (Durango)	EC	0.023	0.010-0.026	12	0 3 7	0.012 0.007 0.006 0.010 NQ (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0035R
Mexico, 1990 (Durango)	EC	0.045	0.021-0.052	12	0 3 7	0.046 0.024 0.027 0.041 NQ NQ 0.007 0.006 NQ (4)	0.005 NQ NQ NQ ND ND NQ ND ND (4)	002-90-0035R
Mexico, 1990 (Durango)	EC	0.023	0.009-0.052	14	0 3 7	0.012 0.012 0.015 0.018 ND NQ NQ NQ NQ ND ND ND	ND ND ND NQ ND (4) ND (4)	002-90-0036R
Mexico, 1990 (Durango)	EC	0.045	0.019-0.11	14	0 3 7	0.034 0.026 0.023 0.040 0.010 NQ 0.013 0.007 NQ NQ 0.005 0.005	NQ (4) ND (4) ND (4)	002-90-0036R
Mexico, 1990 (Easy Rider)	EC	0.023	0.005-0.016	7	0 3 7	ND ND ND NQ ND (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0037R

Country, year (variety)	Application				PHI,	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	kg ai/hl	No.	days	B1a + 8,9-Z-B1a	B1b + 8,9-Z-B1b	
Mexico, 1990 (Easy Rider)	EC	0.045	0.011-0.032	7	0 3 7	NQ NQ ND NQ ND (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0037R
Spain, 1991 (Rochet-Solo)	EC	0.022	0.0022	4 gl	0 3 7	0.005 (NQ ND NQ 0.007) ND (ND (4)) ND (ND (4))	ND (ND (4)) ND (ND (4)) ND (ND (4))	065-91-0003R
Spain, 1991 (Rochet-Solo)	EC	0.043	0.0043	4 gl	0 3 7	0.008 (0.011 0.008 0.007 0.006) NQ (NQ NQ ND NQ) ND (ND (4))	ND (ND (4)) ND (ND (4)) ND (ND (4))	065-91-0003R
Spain, 1991 (Rochet-Solo)	EC	0.022	0.0022	4 gl	0 3 7	NQ (NQ ND NQ NQ) ND (ND (4)) ND (ND (4))	ND (ND (4)) ND (ND (4)) ND (ND (4))	065-91-0004R
Spain, 1991 (Rochet-Solo)	EC	0.043	0.0043	4 gl	0 3 7	0.008 (NQ 0.010 0.011 0.006) NQ (NQ (4)) NQ (NQ ND NQ ND)	ND (ND (4)) ND (ND (4)) ND (ND (4))	065-91-0004R
MELON , HONEY DEW								
Mexico, 1990 (Hy-mark)	EC	0.023	0.009-0.049	14	0 3 7	0.009 0.008 0.006 0.006 NQ 0.005 NQ NQ NQ (4)	ND (4) ND (4) ND (4)	002-90-0038R
Mexico, 1990 (Hy-mark)	EC	0.045	0.018-0.098	14	0 3 7	0.011 0.014 0.012 0.013 NQ NQ 0.009 0.007 0.011 0.013 NQ 0.011	ND (4) ND (4) ND (4)	002-90-0038R
Mexico, 1990 (Hy-mark)	control plot				0 3 7	ND 0.011 ND ND ND (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0038R
Mexico, 1990 (Green Flesh)	EC	0.023	0.003-0.007	9	0 3 7	0.007 NQ NQ NQ NQ (4) NQ NQ ND ND	ND (4) ND (4) ND (4)	002-90-0039R
Mexico, 1990 (Green Flesh)	EC	0.045	0.006-0.014	9	0 3 7	0.009 0.010 0.007 0.008 0.007 NQ NQ ND NQ NQ NQ ND	ND (4) ND (4) ND (4)	002-90-0039R
Mexico, 1990 (Honey Dew)	EC	0.023	0.011	8	0 3 7	ND (4) ND (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0040R
Mexico, 1990 (Honey Dew)	EC	0.045	0.023	8	0 3 7	ND (4) ND (4) ND (4)	ND (4) ND (4) ND (4)	002-90-0040R
Mexico, 1990 (Green Flesh)	EC	0.023	0.004-0.006	7	0 3 7	0.006 NQ NQ NQ ND ND NQ ND ND (4)	ND (4) ND (4) ND (4)	002-90-0042R
Mexico, 1990 (Green Flesh)	EC	0.045	0.007-0.012	7	0 3 7	0.008 NQ NQ 0.007 NQ NQ ND ND ND (4)	ND (4) ND (4) ND (4)	002-90-0042R

[1] NQ: not quantified; detected but <0.005 mg/kg.
ND: not detected, <0.002 mg/kg.
[2] pu: residues in edible pulp
[3] gl: glasshouse trial.

Table 6. Abamectin residues in cucurbits resulting from foliar applications in supervised trials in the USA. Double-underlined residues are from treatments according to GAP and are valid for estimating maximum residue levels and STMRs.

CUCURBITS, Country, year (variety)	Application				PHI, days	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
WATERMELON								
TX, 1992 (Royal Sweet)	EC	0.021	0.011	4	0 7	ND ND ND ND	ND ND ND ND	001-91-1025R 618-936-93127
CA,1991 (Calsweet)	EC	0.021	0.011	4	0 7	NQ NQ ND ND	ND ND ND ND	001-91-6010R 618-936-93127
CANTALOUPE								
TX, 1992 (Caravelle)	EC	0.021	0.023	4	0 7	NQ 0.005 ND ND	ND ND ND ND	001-91-1026R 618-936-93127
AZ, 1992 (Top Mark)	EC	0.021	0.011	4	0 7	0.010 0.006 ND ND	ND ND ND ND	001-91-1027R 618-936-93127
CA, 1992 (Top Mark)	EC	0.021	0.023	4	0 7	0.008 NQ ND ND	ND ND ND ND	001-91-6011R 618-936-93127
FL, 1992 (Planters Jumbo)	EC	0.021	0.011	4	0 7	0.008 0.005 ND ND	ND ND ND ND	001-92-0019R 618-936-93127
GA, 1992 (Planters Jumbo)	EC	0.021	0.011	4	0 7	0.012 0.015 ND ND	ND NQ ND ND	001-92-0020R 618-936-93127
SC, 1992 (Edisto)	EC	0.021	0.010	4	0 7	NQ NQ ND ND	ND ND ND ND	001-92-0021R 618-936-93127
MI, 1992 (Super-star)	EC	0.021	0.010	4	0 7	0.011 0.013 ND ND	ND ND ND ND	001-92-1001R 618-936-93127
PA, 1992 (Ball 1776)	EC	0.022	0.011	4	0 7	NQ NQ ND ND	ND ND ND ND	001-92-3014R 618-936-93127
CA, 1992 (Top Mark)	EC	0.022	0.011	5	0 7	0.006 0.006 ND ND	ND ND ND ND	001-92-6013R 618-936-93127
SUMMER SQUASH, ZUCCHINI								
FL, 1992 (Dixie Hybrid VGB 960)	EC	0.021	0.011	4	0 3 7	0.007 0.007 ND ND ND ND	ND ND ND ND ND ND	001-92-0029R 618-936-93127
TX, 1992 (Onyx)	EC	0.021	0.015	4	0 3 7	0.005, NQ ND ND ND ND	ND ND ND ND ND ND	001-92-1020R 618-936-93127
NY, 1992 (Yellow Crookneck)	EC	0.021	0.011	4	0 3 7	NQ NQ ND ND ND ND	ND ND ND ND ND ND	001-92-3019R 618-936-93127
CA, 1992 (Crookneck)	EC	0.025	0.011	4	0 3 7	0.012 0.011 0.009 NQ ND ND	ND ND ND ND ND ND	001-92-6014R 618-936-93127
CUCUMBER								
SC, 1992 (Ashley)	EC	0.021	0.010	4	0 3 7	0.015 0.012 ND ND ND ND	ND ND ND ND ND ND	001-92-0030R 618-936-93127

CUCURBITS, Country, year (variety)	Application				PHI, days	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
MI, 1992 (Calypso Hybrid)	EC	0.022	0.012	4	0 3 7	NQ ND ND ND ND ND	ND ND ND ND ND ND	001-92-1019R 618-936-93127
PA, 1992 (Market-more 76)	EC	0.022	0.012	4	0 3 7	NQ NQ ND ND ND ND	ND ND ND ND ND ND	001-92-3018R 618-936-93127
CA, 1992 (Dasher II)	EC	0.021	0.011	4	0 3 7	0.013 0.010 NQ NQ NQ ND	ND ND ND ND ND ND	001-92-6015R 618-936-93127

[1] NQ: not quantified; detected but <0.005 mg/kg.
ND: not detected, <0.002 mg/kg.

Table 7. Abamectin residues in tomatoes resulting from foliar applications in supervised trials in The Netherlands, 1993. Double-underlined residues are from treatments according to GAP and are valid for estimating maximum residue levels and STMRs. All glasshouse trials.

Variety	Application				PHI, days	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	kg ai/hl	No.		B1a + 8,9-Z-B1a	B1b + 8,9-Z-B1b	
Cesar	EC	0.023	0.0011	4	0 3 7	0.019 0.024 0.010 0.017 0.007 0.012	ND NQ ND ND ND ND	070-93-0005R
Pronto	EC	0.023	0.0011	4	0 3 7	0.018 0.017 0.011 0.012 0.008 0.010	ND ND ND ND ND ND	070-93-0006R
Pronto	EC	0.023	0.0011	4	0 3 7	0.015 0.015 0.007 0.011 0.009 0.012	ND ND ND ND ND ND	070-93-0003R
Pronto	EC	0.023	0.0011	4	0 3 7	NQ 0.011 NQ 0.007 NQ 0.006	ND ND ND ND ND ND	070-93-0002R
Pronto	EC	0.045	0.0023	4	0 3 7	0.022 0.011 0.022 0.025 0.013 0.020	ND ND NQ NQ ND NQ	070-93-0002R
Pronto	EC	0.023	0.0011	4	0 3 7	0.005 0.009 NQ 0.009 NQ 0.007	ND ND ND ND ND ND	070-93-0001R
Pronto	EC	0.045	0.0023	4	0 3 7	0.012 0.017 0.010 0.016 0.011 0.048	ND ND ND ND ND NQ	070-93-0001R
Trust	EC	0.023	0.0011	4	0 3 7	NQ 0.006 NQ 0.006 NQ 0.007	ND ND ND ND ND ND	070-93-0004R

[1]NQ: not quantified; detected but <0.005 mg/kg.
ND: not detected, <0.002 mg/kg.

Table 8. Abamectin residues in lettuce resulting from foliar applications in supervised trials in France, The Netherlands and Spain. Double-underlined residues are from treatments according to GAP and are valid for estimating maximum residue levels and STMRs.

Country, year	Application				PHI, days	Residues, mg/kg[1]		Ref
(variety)	Form	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
HEAD LETTUCE								
France, 1992 (Balisto)	EC	0.0113	0.0020 -0.0028	4	0 6 13	0.22 0.27 0.15 0.14 ND (4) ND (4)	0.025 0.030 0.017 0.017 ND (4) ND (4)	066-92-0001R
France, 1992 (Balisto)	EC	0.025	0.0039 -0.0056	4	0 6 13	0.23 0.36 0.34 0.36 NQ NQ 0.002 NQ ND (4)	0.026 0.041 0.037 0.042 ND (4) ND (4)	066-92-0001R
France, 1992 (Divina)	EC	0.0113	0.0019 -0.0023	4	0 7 14	0.18 0.20 0.26 0.28 0.003 0.002 0.004 0.003 NQ NQ NQ 0.002	0.020 0.022 0.028 0.029 ND (4) ND (4)	066-92-0003R
France, 1992 (Divina)	EC	0.0225	0.0038 -0.0045	4	0 7 14	0.28 0.30 0.36 0.45 0.004 0.004 0.007 0.005 NQ NQ NQ 0.005	0.029 0.032 0.037 0.046 ND (4) ND (4)	066-92-0003R
France, 1992 (Scarole Maral)	EC	0.0113	0.0019	4	0 7 14	0.086 0.18 0.15 0.16 0.010 0.012 0 010 0.021 0.002 0.003 0.005 0.005	0.007 0.019 0.015 0.016 ND NQ ND NQ ND (4)	066-92-0002R
France, 1992 (Scarole Maral)	EC	0.0225	0.0038	4	0 7 14	0.23 0.30 0.31 0.29 0.029 0.041 0.028 0.025 0.010 0.011 0.009 0.013	0.024 0.032 0.032 0.030 0.003 0.004 0.003 NQ ND (4)	066-92-0002R
Netherlands, 1993 (Kirsten)	EC	0.014	0.0014	4 gl	0 7 14	0.26 0.26 (Oct) [2] 0.016 0.020 0.017 0.020	0.017 0.019 NQ NQ 0.004 0.005	070-93-0007R
Netherlands, 1993 (Kirsten)	EC	0.027	0.0027	4 gl	0 7 14	0.23 0.25 (Oct) 0.13 0.091 0.096 0.084	0.020 0.022 0.006 0.004 0.009 0.006	070-93-0007R
Netherlands, 1993 (Kirsten)	EC	0.014	0.0014	4 gl	0 7 14	0.25 0.28 (Oct) 0.071 0.074 0.026 0.027	0.024 0.028 0.006 0.007 0.002 0.002	070-93-0008R
Netherlands, 1993 (Kirsten)	EC	0.027	0.0027	4 gl	0 7 14	0.53 0.51 (Oct) 0.10 0.15 0.059 0.097	0.051 0.043 0.008 0.011 0.005 0.009	070-93-0008R
Netherlands, 1994 (Rex)	EC	0.014	0.0014	4 gl	0 7 14	0.32 0.37 (Mar) 0.052 0.069 0.020 0.026	0.025 0.0032 0.004 0.006 0.002 0.003	070-94-0002R
Netherlands, 1994 (Vivaldi)	EC	0.014	0.0014	4 gl	0 7 14	0.33 0.25 (Mar) 0.038 0.027 0.012 0.014	0.025 0.021 0.004 0.003 NQ NQ	070-94-0001R
Spain, 1992 (Trocadero)	EC	0.022	0.0022 -0.0044	4	0 7 14	0.96 0.87 0.94 0.79 0.051 0.076 0.067 0.054 0.024 0.020 0.026 0.025	0.10 0.091 0.095 0.083 0.006 0.009 0.009 0.007 0.003 NQ 0.002 0.002	065-92-0001R
Spain, 1992 (Trocadero)	EC	0.043	0.0043 -0.0086	4	0 7 14	1.5 1.7 1.6 1.5 0.15 0.25 0.20 0.14 0.067 0.091 0.072 0.080	0.15 0.18 0.16 0.16 0.016 0.025 0.020 0.015 0.005 0.008 0.006 0.009	065-92-0001R
Spain, 1992 (Trocadero)	EC	0.022	0.0022 -0.0044	4	0 7 14	1.6 1.7 1.9 1.1 0.14 0.10 0.17 0.18 0.037 0.033 0.027 0.027	0.17 0.18 0.20 0.12 0.014 0.011 0.016 0.018 0.003 0.004 0.003 0.002	065-92-0002R
Spain, 1992 (Trocadero)	EC	0.043	0.0043 -0.0086	4	0 7 14	0.86 1.9 1.8 1.1 0.12 0.15 0.093 0.14 0.023 0.022 0.031 0.020	0.089 0.19 0.18 0.11 0.010 0.015 0.009 0.014 0.002 NQ 0.002 NQ	065-92-0002R

Country, year	Application				PHI, days	Residues, mg/kg[1]		Ref
(variety)	Form	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
LEAF LETTUCE								
Spain, 1992 (Summer Blond)	EC	0.022	0.0022 -0.0044	4	0 7 14	0.20 0.16 0.17 0.19 0.007 0.008 0.009 0.004 NQ ND ND NQ	0.021 0.018 0.018 0.021 ND (4) ND (4)	065-92-0003R
Spain, 1992 (Summer Blond)	EC	0.043	0.0043 -0.0086	4	0 7 14	0.36 0.44 0.30 0.46 0.025 0.025 0.028 0.024 0.004 0.005 0.002 0.003	0.041 0.045 0.030 0.053 0.002 ND 0.002 NQ ND (4)	065-92-0003R
Spain, 1992 (Romaine, Inverna)	EC	0.022	0.0022 -0.0044	4	0 7 14	0.21 0.17 0.18 0.24 0.005 0.004 0.003 0.004 0.002 NQ ND ND	0.025 0.019 0.021 0.028 ND (4) ND (4)	065-92-0004R
Spain, 1992 (Romaine, Inverna)	EC	0.043	0.0043 -0.0086	4	0 7 14	0.40 0.22 0.54 0.42 0.006 0.005 0.005 0.005 0.003 0.002 NQ 0.002	0.047 0.025 0.061 0.048 ND (4) ND (4)	065-92-0004R

1 NQ: not quantified; detected but <0.002 mg/kg
ND: not detected, <0.001 mg/kg
[2]Because of the seasonal restriction on use specified in Netherlands GAP the month of the final application is reported.
gl: glasshouse

Table 9. Abamectin residues in potatoes resulting from foliar applications in supervised trials in Brazil and the USA.

Country, year (variety)	Application				PHI, days	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	Kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Brazil (SP), 1994 (Achat)	EC	0.018	0.0023	4	0 3 7	<0.005 <0.005 <0.005 <0.005 <0.005 <0.005		015-94-9050R
Brazil (SP), 1994 (Achat)	EC	0.036	0.0045	4	0 3 7	<0.005 <0.005 <0.005 <0.005 <0.005 <0.005		015-94-9050R
Brazil (SP), 1994 (Achat)	EC	0.018	0.0023	4	0 3 7	<0.005 <0.005 <0.005 <0.005 <0.005 <0.005		015-94-9052R
Brazil (SP), 1994 (Achat)	EC	0.036	0.0045	4	0 3 7	<0.005 <0.005 <0.005 <0.005 <0.005 <0.005		015-94-9052R
Brazil (SP), 1994 (Bintje)	EC	0.018	0.0023	4	0 3 7	<0.005 <0.005 <0.005 <0.005 <0.005 <0.005		015-94-9051R
Brazil (SP), 1994 (Bintje)	EC	0.036	0.0045	4	0 3 7	<0.005 <0.005 <0.005 <0.005 <0.005 <0.005		015-94-9051R
USA (FL), 1992 (Atlantic)	EC	0.112	0.025	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	001-92-0038R
USA (FL), 1992 (Atlantic)	EC	0.112 + oil	0.025	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	001-92-0038R
USA (NY), 1992 (Katahdin)	EC	0.11	0.040	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	618-936-3671 001-92-5017R
USA (NY), 1992 (Katahdin)	EC	0.11 + oil	0.040	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	618-936-3671 001-92-5017R
USA (OR), 1992 (Russet)	EC	0.11	0.040	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	618-936-3671 001-92-5019R

Country, year (variety)	Application				PHI, days	Residues, mg/kg[1]		Ref
	Form	kg ai/ha	Kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
USA (OR), 1992 (Russet)	EC	0.11 + oil	0.040	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	618-936-3671 001-92-5019R
USA (PA), 1992 (Katahdin)	EC	0.11	0.040	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	618-936-3671 001-92-5018R
USA (PA), 1992 (Katahdin)	EC	0.11 + oil	0.040	6	0 3 7	ND ND ND ND ND ND	ND ND ND ND ND ND	618-936-3671 001-92-5018R
USA (CA), 1993 (Norkotah)	EC	0.021 + oil	0.0056	6	0 14	ND ND ND ND	ND ND ND ND	001-93-5006R
USA (CA), 1993 (Red LaSoda)	EC	0.021 + oil	0.0059	6	0 14	ND ND ND ND	ND ND ND ND	001-93-5005R
USA (FL), 1993 (Red La Soda)	EC	0.021 + oil	0.0045	6	0 14	ND ND ND ND	ND ND ND ND	618-936-3671 001-93-0002R
USA (ID), 1993 (Russet Burbank)	EC	0.020 + oil	0.045	6	0 14	ND ND ND ND	ND ND ND ND	001-93-1004R
USA (ID), 1993 (Russet Burbank)	EC	0.021 + oil	0.011	6	0 14	ND ND ND ND	ND ND ND ND	001-93-1005R
USA (MD), 1993 (Superior)	EC	0.021 + oil	0.0076	6	0 14	ND ND ND ND	ND ND ND ND	001-93-7000R
USA (MI), 1993 (Snowden)	EC	0.021 + oil	0.011	6	0 14	ND ND ND ND	ND ND ND ND	001-93-1007R
USA (NY), 1993 (Katahdin)	EC	0.021 + oil	0.014	6	0 14	ND ND ND ND	ND ND ND ND	001-93-7001R
USA (WA), 1993 (Russet Burbank)	EC	0.021 + oil	0.0044	6	0 14	ND ND ND ND	ND ND ND ND	001-93-5004R
USA (CO), 1994 (Russet Nugget)	EC	0.11	0.030	6	0 14	ND ND ND ND	ND ND ND ND	001-94-1022R
USA (ND), 1994 (Norchip)	EC	0.021 + oil	0.014	6	0 14	ND ND ND ND	ND ND ND ND	001-94-1017R
USA (FL), 1993 (FL 1625)	EC	0.021 + oil	0.011	6	0 14	ND ND ND ND	ND ND ND ND	001-93-7002R

[1] ND: not detected, <0.002 mg/kg

Table 10. Abamectin residues in hops resulting from foliar applications in supervised trials in Germany and the USA. Double-underlined residues are from treatments according to GAP and are valid for estimating maximum residue levels and STMRs.

Country, year (variety)	Application				PHI, days	Residues, mg/kg [1,2]		Ref
	Form	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Germany, 1994 (Hallertau Mittelfruw)	EC	0.023	0.0022 +0.0011	2	0 14 21 28 21 28	fh 0.11 0.12 fh 0.003 0.003 fh ND NQ fh NQ NQ dh 0.004 0.005 dh <u>ND</u> ND	fh 0.010 0.012 fh ND ND fh ND ND fh ND ND dh ND ND dh ND ND	072-94-0008R
Germany, 1994 (Hallertau Mittelfruw)	EC	0.023 + adj	0.0022 +0.0011	2	0 14 21 28 21 28	fh 0.24 0.31 fh 0.003 0.004 fh 0.002 0.003 fh 0.002 ND dh 0.004 0.007 dh <u>ND</u> ND	fh 0.025 0.030 fh ND ND fh ND ND fh ND ND dh ND ND dh ND ND	072-94-0008R

Country, year (variety)	Application				PHI, days	Residues, mg/kg [1,2]		Ref
	Form	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Germany, 1994 (Hallertauer Tradition)	EC	0.022	0.0031 +0.0015	2	0 14 21 28 21 28	fh 0.23 0.21 fh 0.011 0.008 fh 0.008 0.006 fh 0.006 0.006 dh 0.029 0.031 dh 0.022 0.020	fh 0.026 0.022 fh ND ND fh ND ND fh ND ND dh ND NQ dh ND ND	072-94-0005R
Germany, 1994 (Hallertauer Tradition)	EC	0.022 + adj	0.0031 +0.0015	2	0 14 21 28 21 28	fh 0.44 0.82 fh 0.022 0.016 fh 0.010 0.012 fh 0.007 0.006 dh 0.031 0.024 dh 0.022 0.012	fh 0.049 0.087 fh 0.002 ND fh ND ND fh ND ND dh ND ND dh ND ND	072-94-0005R
Germany, 1994 (Perle)	EC	0.023	0.0031 +0.0015	2	0 14 21 28 21 28	fh 0.25 0.29 fh 0.015 0.011 fh 0.005 0.006 fh 0.006 0.005 dh 0.034 0.029 dh 0.025 0.020	fh 0.026 0.031 fh ND ND fh ND ND fh ND ND dh NQ ND dh ND ND	072-94-0007R
Germany, 1994 (Perle)	EC	0.023 + oil	0.0031 +0.0015	2	0 14 21 28 21 28	fh 0.20 0.35 fh 0.016 0.009 fh 0.010 0.006 fh 0.005 0.006 dh 0.035 0.036 dh 0.030 0.025	fh 0.021 0.037 fh ND ND fh ND ND fh ND ND dh NQ NQ dh ND ND	072-94-0007R
Germany, 1994 (Perle)	EC	0.023	0.0031 +0.0015	2	0 14 21 28 21 28	fh 0.23 0.31 fh 0.011 0.018 fh 0.008 0.10 fh 0.003 0.003 dh 0.043 0.041 dh 0.017 0.022	fh 0.024 0.031 fh ND ND fh ND ND fh ND ND dh NQ NQ dh ND ND	072-94-0006R
Germany, 1994 (Perle)	EC	0.023 + oil	0.0031 +0.0015	2	0 14 21 28 21 28	fh 0.40 0.28 fh 0.014 0.011 fh 0.010 0.013 fh 0.006 0.005 dh 0.046 0.044 dh 0.017 0.012	fh 0.036 0.027 fh ND ND fh ND ND fh ND ND dh NQ NQ dh ND ND	072-94-0006R
Germany, 1996 (Hallertauer Frühreifer)	EC	0.023	0.0011	2	0 29 29	ih 0.15 0.14 fh ND NQ dh 0.011 0.012	ih 0.010 0.009 fh ND ND dh ND ND	072-96-0011R 96092
Germany, 1996 (Hersbrucker)	EC	0.023	0.0011	2	0 30 30	ih 0.17 0.28 fh ND ND dh ND ND	ih 0.011 0.019 fh ND ND dh ND ND	072-96-0012R 96092
Germany, 1996 (Northern Brewer)	EC	0.023	0.0009	2	0 28 28	ih 0.12 0.10 fh ND NQ dh ND NQ	ih 0.008 0.007 fh ND ND dh ND ND	072-96-0014R 96092

Country, year (variety)	Application				PHI, days	Residues, mg/kg [1,2]		Ref
	Form	kg ai/ha	kg ai/hl	No.		B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Germany, 1996 (Perle)	EC	0.023		2	0 30 30	ih 0.23 0.22 fh NQ 0.008 dh 0.009 <u>0.011</u>	ih 0.015 0.015 fh ND ND dh ND ND	072-96-0013R 96092
USA (ID), 1994 (Galena)	EC	0.021	0.0045	2	0 28	dh 0.67 0.59 dh 0.055 <u>0.057</u>	dh 0.072 0.064 dh NQ NQ	001-94-1007R 618-936-94035
USA (OR), 1994 (Nugget)	EC	0.022	0.0045	2	0 28	dh 0.97 0.81 dh 0.009 <u>0.015</u>	dh 0.096 0.081 dh ND ND	001-94-1008R 618-936-94035
USA (WA), 1994 (Cluster)	EC	0.021	0.0045	2	0 28	dh 0.16 0.15 dh 0.017 <u>0.023</u>	dh 0.015 0.015 dh ND ND	001-94-1006R 618-936-94035
USA (WA), 1994 (Galena)	EC	0.021	0.0045	2	0 27	dh 0.59 0.73 dh 0.044 <u>0.078</u>	dh 0.059 0.073 dh NQ <u>0.008</u>	001-94-1005R 618-936-94035

[1] NQ: not quantified; detected but <0.005 mg/kg.
ND: not detected, <0.0025 mg/kg.
[2] ih: immature hops, fh: fresh hops, dh: dry hops.
adj: adjuvant - a non-ionic surfactant containing lecithin derived from soya bean oil.

Table 11. Interpretation Table for abamectin residues in apples from trials in Table 3. GAP and trial conditions are compared for treatments considered valid for estimating maximum residue levels and STMRs.

	Use pattern				Trial	Residues, mg/kg, abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
Australian GAP	0.014	0.0014	1	14		
Australian trial	0.014	0.0007	1	14	114-95-0003R	0.005
Australian trial	0.014	0.0007	1	14	114-95-0002R	<0.002
Australian trial	0.014	0.0008	1	14	114-95-0001R	0.003
NZ GAP	0.027	0.00068	1	14		
NZ trial	0.027	0.0014	2	14	115-94-0005R	0.004
NZ trial	0.027	0.0014	2	14	115-94-0004R	0.007
US GAP	0.026	0.0007	2	28		
US trial	0.028	0.0007	2	28	001-90-5016R	0.003
US trial	0.027	0.0008	2	28	001-92-6012R	0.003
US trial	0.027	0.0010	2	28	001-91-6024R	<0.001
US trial	0.028	0.0010	2	28	001-90-5018R	0.006
US trial	0.027	0.0011	2	28	001-91-1021R	<0.002
US trial	0.027	0.0036	2	28	001-91-1024R	0.002
US trial	0.027	0.0037	2	28	001-91-1023R	0.003
US trial	0.027	0.0038	2	28	001-91-6016R	0.012
US trial	0.027	0.0038	2	28	001-91-3000R	0.007
US trial	0.026	0.0071	2	28	001-92-0026R	0.003
US trial	0.027	0.0072	2	28	001-92-0027R	<0.002
US trial	0.027	0.0072	2	28	001-92-3020R	0.004
US trial	0.027	0.0072	2	28	001-92-1018R	<0.002
US trial	0.027	0.0081	2	28	001-92-1014R	<0.001

Table 12. Interpretation table for abamectin residues in pears from trials in Table 4 and the 1992 Evaluations. GAP and trial conditions are compared for treatments considered valid for estimating maximum residue levels and STMRs.

	Use pattern				Trial	Residues, mg/kg, abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
Argentinian GAP	0.027	0.0014	4	14		
Argentinian trial	0.027	0.00063	3	14	1992 ref 58	<0.005
French GAP	0.023	0.0014	4	15		
French trial	0.027	0.0014	3	14	1992 ref 196	<0.002
Italian GAP	0.027	0.0014	2	14		
Italian trial	0.027	0.0014	3	14	1992 ref 139	<0.005
Italian trial	0.027	0.0014	3	14	1992 ref 139	<0.002
Italian trial	0.027	0.0014	3	14	1992 ref 140	<0.005
Italian trial	0.027	0.0014	3	14	1992 ref 198	<0.005
US GAP	0.026		2	28		
US trial	0.027		2	21	001-92-6016R	0.004
US trial	0.027		2	21	001-92-6017R	0.006
US trial	0.027		2	21	001-92-6018R	0.009
US trial	0.027		2	21	001-92-6019R	0.011

Table 13. Interpretation table for abamectin residues in melons from trials in Tables 5 and 6. GAP and trial conditions are compared for treatments considered valid for estimating maximum residue levels and STMRs.

	Use pattern				Trials	Residues, mg/kg abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
Spanish GAP	0.022	0.0011	3	3		
Spanish trial	0.022	0.0022	4 gl	3	065-91-0003R	<0.002
Spanish trial	0.022	0.0022	4 gl	3	065-91-0004R	<0.002
French trial	0.023	0.0028	4	3	066-91-0003R	<0.002
French trial	0.023	0.0032	4	3	066-91-0004R	<0.005
French trial	0.023	0.0030	4	3	066-91-0005R	<0.005
US GAP	0.021		3	7		
US trial	0.021	0.023	4	7	001-91-1026R	<0.002
US trial	0.021	0.011	4	7	001-91-1027R	<0.002
US trial	0.021	0.023	4	7	001-91-6011R	<0.002
US trial	0.021	0.011	4	7	001-92-0019R	<0.002
US trial	0.021	0.011	4	7	001-92-0020R	<0.002
US trial	0.021	0.010	4	7	001-92-0021R	<0.002
US trial	0.021	0.010	4	7	001-92-1001R	<0.002
US trial	0.022	0.011	4	7	001-92-3014R	<0.002
US trial	0.022	0.011	5	7	001-92-6013R	<0.002

gl: glasshouse

Table 14. Interpretation table for abamectin residues in cucumbers and gherkins from trials in Table 6 and the 1992 Evaluations. GAP and trial conditions are compared for treatments considered valid for estimating maximum residue levels and STMRs.

	Use pattern				Trials	Residues, mg/kg abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
CUCUMBER						
US GAP	0.021		3	7		
US trial	0.021	0.010	4	7	001-92-0030R	<0.002
US trial	0.022	0.012	4	7	001-92-1019R	<0.002
US trial	0.022	0.012	4	7	001-92-3018R	<0.002
US trial	0.021	0.011	4	7	001-92-6015R	<0.005
German GAP	0.023		5 gl	3		
French trial	0.023	0.0011	4 gl	3	1992 ref 17	<0.002
French trial	0.023	0.0011	4 gl	3	1992 ref 17	<0.005
Spanish GAP	0.022	0.0011	3	3		
Spanish trial	0.023	0.004	5 gl	3	1992 ref 13	0.006
Spanish trial	0.023	0.007	5 gl	3	1992 ref 13	0.008
Italian trial	0.023	0.0023	5	3	1992 ref 169	<0.005
Italian trial	0.023	0.0023	4 gl	3	1992 ref 16	<0.005
Italian trial	0.023	0.0023	4	3	1992 ref 16	<0.002
Netherlands GAP	0.023	0.0009	5 gl	3		
Netherlands trial	0.023	0.0011	4 gl	3	1992 ref 161	0.008
Netherlands trial	0.023	0.0011	5 gl	3	1992 ref 161	0.007
GHERKIN						
Netherlands GAP	0.023	0.0009	5 gl	3		
Netherlands trial	0.023	0.0011	5 gl	3	1992 ref 165	<0.002
Netherlands trial	0.023	0.0011	5 gl	3	1992 ref 165	<0.002

gl: glasshouse

Table 15. Interpretation table for abamectin residues in tomatoes from trials in Table 7 and the 1992 Evaluations. GAP and trial conditions are compared for treatments considered valid for estimating maximum residue levels and STMRs.

	Use pattern				Trials	Residues, mg/kg abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
Argentinian GAP	0.022	0.0013	9	3		
Argentinian trial	0.020	0.0009	7	3	1992 ref 60	<0.005
Argentinian trial	0.027	0.0009	5	3	1992 ref 61	<0.002
Argentinian trial	0.028	0.0018	9	3	1992 ref 62	<0.002
Brazil GAP	0.022	0.0018		3		
Brazil trial	0.027	0.0018	10	7[1]	1992 ref 125	0.017
Brazil trial	0.023	0.0018	10	3	1992 ref 126	<0.005
Brazil trial	0.028	0.0036	6	3	1992 ref 126	<0.005
German GAP	0.023		5 gl	3		
French trial	0.024	0.0005	5 gl	3	1992 ref 123	<0.005
French trial	0.023	0.0005	5 gl	3	1992 ref 127	<0.002
French trial	0.020	0.0007	10 gl	3	1992 ref 128	<0.002
Italian GAP	0.022		2	7		
Italian trial	0.022	0.0011	10	7	1992 ref 209	<0.002
Italian trial	0.022	0.0011	10	7	1992 ref 210	<0.002
Netherlands GAP	0.023	0.0009	4 gl	3		
Netherlands trial	0.023	0.0011	4 gl	3	070-93-0001R	0.009
Netherlands trial	0.023	0.0011	4 gl	3	070-93-0002R	0.007
Netherlands trial	0.023	0.0011	4 gl	7[1]	070-93-0004R	0.007
Netherlands trial	0.023	0.0011	4 gl	3	070-93-0005R	0.017

	Use pattern				Trials	Residues, mg/kg abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
Netherlands trial	0.023	0.0011	4 gl	3	070-93-0006R	0.012
Netherlands trial	0.023	0.0011	4 gl	3	070-93-0003R	0.012
Netherlands trial	0.023	0.0011	5 gl	3	1992 ref 217	0.008
Netherlands trial	0.023	0.0011	5 gl	3	1992 ref 218	0.005
Spanish GAP	0.022	0.0011		3		
Spanish trial	0.019	0.0011	10 gl	3 (f)	1992 ref 130	<0.005 (<0.005)
Spanish trial	0.019	0.0005	10 gl	3 (f)	1992 ref 131	0.009 (<0.005)
Spanish trial	0.027	0.0011	10	3	1992 ref 132	<0.005
Spanish trial[2]	0.015	0.0011	10	3	1992 ref 129	<0.005
US GAP	0.021		3	7		
US trial	0.022	0.024	10	7	1992 ref 124	<0.002
US trial	0.022	0.0036	10	3	1992 ref 124	<0.002
US trial	0.022	0.012	10	3	1992 ref 124	<0.002
US trial	0.022	0.0047	10	3	1992 ref 124	<0.002
US trial	0.022	0.017	10	3	1992 ref 124	<0.002
US trial	0.022	0.0078	10	3	1992 ref 124	<0.002
US trial	0.022	0.0044	10	3	1992 ref 124	<0.002
US trial	0.022	0.0043	10	7	1992 ref 124	<0.002
US trial	0.022	0.012	10	3	1992 ref 124	<0.005
US trial	0.022	0.0024	10	7	1992 ref 124	<0.005
US trial	0.022	0.0053	12	7	1992 ref 183	<0.002
US trial	0.022	0.0068	10	5	1992 ref 184	<0.002
US trial	0.022	0.0043	10	7	1992 ref 185	<0.005
US trial	0.022	0.0059	10	7	1992 ref 186	<0.002
US trial	0.022	0.0023	10	7	1992 ref 187	<0.005
US trial	0.022	0.0047	8	3	1992 ref 188	<0.002
US trial	0.022	0.0047	10	7	1992 ref 191	0.005
US trial	0.022	0.024	10	5	1992 ref 193	<0.002

gl: glasshouse
[1]Residue on day 7 higher than on day 3
[2]The companion trial at 0.030 kg ai/ha resulted in residues of 0.007 mg/kg on day 3

Table 16. Interpretation table for abamectin residues in lettuce from trials in Table 8 and the 1992 Evaluations. GAP and trial conditions are compared for treatments considered valid for estimating maximum residue levels and STMRs.

	Use pattern				Trials	Residues, mg/kg abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
Head Lettuce						
Netherlands GAP	0.014	0.0009	4	14		
Netherlands trial	0.014	0.0014	4 gl	14	070-93-0007R	0.025
Netherlands trial	0.014	0.0014	4 gl	14	070-93-0008R	0.029
Netherlands trial	0.014	0.0014	4 gl	14	070-94-0002R	0.029
Netherlands trial	0.014	0.0014	4 gl	14	070-94-0001R	0.016
French GAP	0.009		4	7 or 14		
French trial	0.0113	0.0028	4	6	066-92-0001R	<0.001
French trial	0.0113	0.0023	4	7	066-92-0003R	0.004
French trial	0.0113	0.0019	4	7	066-92-0002R	0.023
Spanish GAP	0.022	0.0018	3	14		
Spanish trial	0.022	0.0044	4	14	065-92-0001R	0.028
Spanish trial	0.022	0.0044	4	14	065-92-0002R	0.040
French trial	0.025	0.0056	4	13	066-92-0001R	<0.002
French trial	0.0225	0.0045	4	14	066-92-0003R	0.005
French trial	0.0225	0.0038	4	14	066-92-0002R	0.013
US GAP	0.021		3	7		

	Use pattern				Trials	Residues, mg/kg abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
US trial	0.022	0.0047	7	7	1992 ref 154	0.005
US trial	0.022	0.0047	7	7	1992 ref 154	0.007
US trial	0.022	0.023	8	7	1992 ref 151	<0.002
US trial	0.022	0.023	8	7	1992 ref 151	<0.002
US trial	0.022	0.0047	8	7	1992 ref 155	<0.002
US trial	0.022	0.0047	8	7	1992 ref 155	<0.002
US trial	0.022	0.049	8	7	1992 ref 159	<0.002
US trial	0.022	0.0064	9	7	1992 ref 159	0.030
US trial	0.022	0.0064	9	7	1992 ref 159	0.026
US trial	0.022	0.0059	8	7	1992 ref 159	<0.002
US trial	0.022	0.0059	8	7	1992 ref 159	<0.002
US trial	0.022	0.0078	8	7	1992 ref 159	<0.002
US trial	0.022	0.0078	8	7	1992 ref 159	<0.002
US trial	0.022	0.024	8	7	1992 ref 162	<0.002
US trial	0.022	0.024	8	7	1992 ref 162	<0.002
US trial	0.022	0.036	9	7	1992 ref 162	0.006
US trial	0.022	0.036	9	7	1992 ref 162	0.027
US trial	0.022	0.071	6	7	1992 ref 162	<0.002
US trial	0.022	0.071	6	7	1992 ref 162	<0.002
Leaf lettuce						
Spanish GAP	0.022	0.0018	3	14		
Spanish trial	0.022	0.0044	4	14	065-92-0003R	<0.002
Spanish trial	0.022	0.0044	4	14	065-92-0004R	0.002

gl: glasshouse

Table 17. Interpretation table for abamectin residues in dry hops from trials in Table 10. GAP and trial conditions are compared for treatments considered valid for estimating maximum residue levels and STMRs.

	Use pattern				Trials	Residues, mg/kg abamectin
	kg ai/ha	kg ai/hl	No of appl	PHI, days		
German GAP	0.023	0.0009	2	28		
German trial	0.023	0.0022	2	28	072-94-0008R	<0.003
German trial	0.023	0.0022	2	28	072-94-0008R	<0.003
German trial	0.022	0.0031	2	28	072-94-0005R	<0.003
German trial	0.022	0.0031	2	28	072-94-0005R	0.022
German trial	0.023	0.0031	2	28	072-94-0007R	0.025
German trial	0.023	0.0031	2	28	072-94-0007R	0.030
German trial	0.023	0.0031	2	28	072-94-0006R	0.022
German trial	0.023	0.0031	2	28	072-94-0006R	0.017
German trial	0.023	0.0011	2	29	072-96-0011R	0.012
German trial	0.023	0.0011	2	30	072-96-0012R	<0.003
German trial	0.023	0.0009	2	28	072-96-0014R	<0.005
German trial	0.023		2	30	072-96-0013R	0.011
US GAP	0.022		2	28		
US trial	0.021	0.0045	2	28	001-94-1007R	0.062
US trial	0.022	0.0045	2	28	001-94-1008R	0.015
US trial	0.021	0.0045	2	28	001-94-1006R	0.023
US trial	0.021	0.0045	2	27	001-94-1005R	0.086

FATE OF RESIDUES IN STORAGE AND PROCESSING

The Meeting received information on the fate of abamectin during the processing of apples, pears, potatoes and hops.

A processing study on apples by Morneweck (1992) was reviewed by the 1992 JMPR and the residue data are summarized in the 1992 Residue Evaluations. Processing factors are recorded in Table 18 and were calculated from the B_{1a} rather than the B_{1a} + B_{1b} residues because B_{1b} was undetectable in the initial apples and its inclusion in the calculation would have added an extra error to the processing factor. Avermectin B_{1b} constitutes about 10% of the total residue and probably behaves in the same way as B_{1a} in processing. In cases where no residue was detectable in the processed commodity the processing factor is reported as 0 with a "less than" factor in parentheses calculated from the LOD.

The results suggest that abamectin residues are on the peel only and are reasonably stable during hot drying of the pomace. In products such as juice and apple sauce, which contain no peel, residues are not detectable.

Table 18. Processing factors for apple products (Morneweck, 1992), calculated as the residue levels of B_{1a} in the processed commodities divided by its level in the initial unwashed apples. B_{1a} includes avermectin B_{1a} and its photoisomer 8,9-*Z*-avermectin B_{1a}.

Commodity	Processing factor
Apples, whole unwashed	
Apples, peeled and cored	0 (<0.12)
Apple juice, raw	0 (<0.062)
Apple juice, clarified	0 (<0.062)
Pomace, wet	4.9
Pomace, dry	17.3
Pomace, rehydrated	14.8
Apple sauce	0 (<0.12)

Abamectin was applied twice at 0.027 kg ai/ha with an interval of 14 days to Bartlett pears which were harvested 1-2 hours after the second application for processing (Johnson 1993). The fruit were processed in 11-12 kg lots into canned pear halves and pear purée (Figure 1). Residue levels in the various commodities and calculated processing factors are shown in Table 9.

The processing factors were again calculated from the B_{1a} rather than the B_{1a}+B_{1b} residues because the initial B_{1b} levels were only slightly above the LOD. The processing factors are essentially zero because no residues were detected in any of the final processed commodities or even their immediate precursors. It is likely that vigorous washing and peeling would effectively remove a surface residue such as abamectin.

Figure 1. Processing of pears (Johnson, 1993).

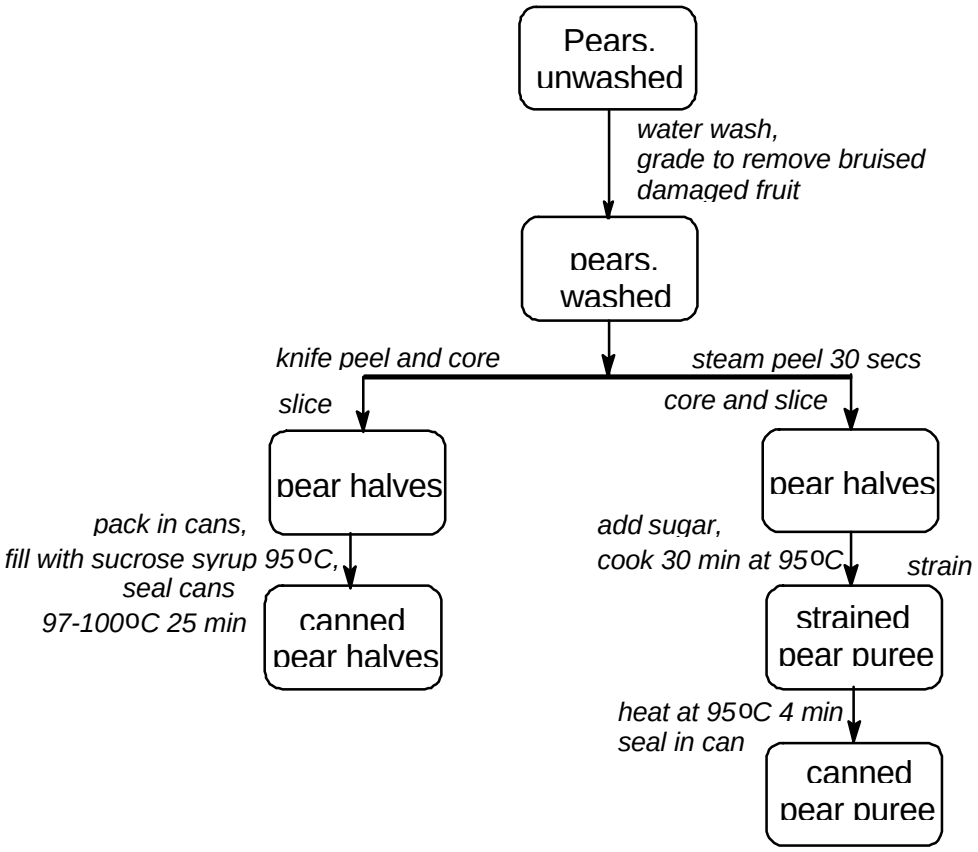


Table 19. Abamectin residues in canned pears and purée produced from Bartlett pears treated twice with abamectin (+ oil) at 0.027 kg ai/ha and harvested 1-2 hours after the second application in the USA (Johnson, 1993). Processing factors were calculated as the residue level of B_{1a} in the processed commodities divided by its level of B_{1a} in the initial unwashed pears.

Commodity	Residues, mg/kg		Processing factor
	B_{1a} + 8,9-Z-B_{1a}	B_{1b} + 8,9-Z-B_{1b}	
Unwashed pears	0.0216	0.0025	
Pear halves (knife peeled and cored)	<0.001	<0.001	
Canned pear halves	<0.001	<0.001	0 (<0.046)
Unwashed pears	0.0208	0.0025	
Pear halves (steam peeled and cored)	<0.001	<0.001	
Pear purée, strained	<0.001	<0.001	0 (<0.048)
Pear purée, canned	<0.001	<0.001	0 (<0.048)

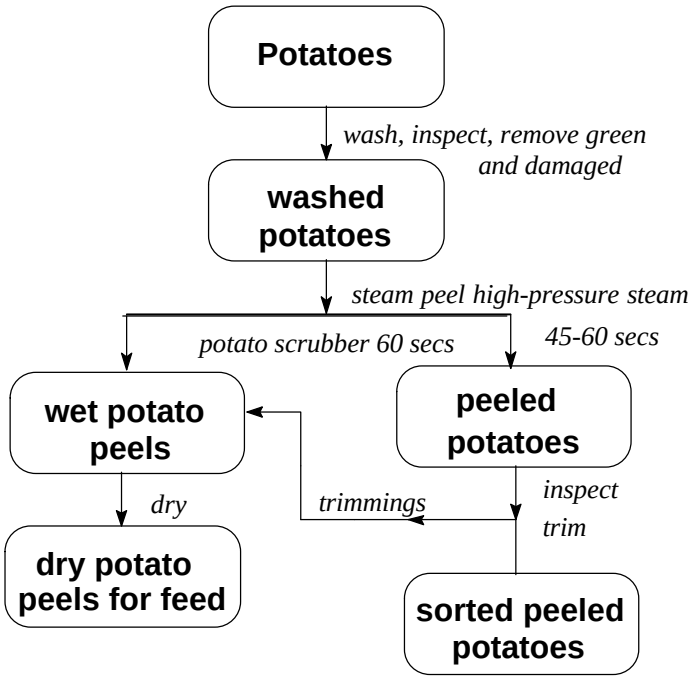
Abamectin was applied at 0.11 kg ai/ha (5 times the label rate) on 6 occasions to the foliage of potatoes in a processing trial in the USA (Colorado) (001-94-1022). Potatoes (135 kg) were harvested 14 days after the final application and processed to peeled potatoes and potato peels (Englar, 1994b). The variety, Russet Nugget, is especially grown for processing.

The process (Figure 2) was designed to simulate commercial practice. The first stage was tub washing for 5-10 minutes to simulate flume washing. The next stage was inspection and sorting to remove cull potatoes. The potatoes were then treated with high-pressure steam followed by a

scrubber to remove the skin loosened by the steam. The final stage was inspection and trimming of damaged or unsuitable tissue with the trimmings added to the peel. The peel was hydraulically pressed, dried to less than 10% moisture and then hammer milled. In a commercial operation, it would be used to feed cattle.

Kvaternick *et al.* (1995) reported that no abamectin residues were detected (<0.002 mg/kg each of B_{1a} and B_{1b}) in the unwashed and washed potatoes and the wet potato peels. Because no residues were detected in these commodities the dry peels and peeled potatoes were not analysed.

Figure 2. Processing of potatoes (Englar, 1994b).



Englar (1994a) described the commercial processing of hops and its laboratory simulation. In the commercial operation freshly harvested hop cones are dried to approximately 7-10% moisture and then ground to release the bitter principles from the lupulin glands. The ground hops are extracted repeatedly with hexane and the extracted (spent) hops are pressed, dried and pelletized. In the laboratory simulation the dried and ground hops (1.3 kg) were placed in a glass column (135 × 10.2 cm) and extracted with hexane, circulated at 0.5 l/min, for approximately 3.5 hours. The hops were finally extracted with fresh hexane and dried overnight at ambient temperature to produce the spent hops. The extract contains flavour components and is used in the brewing industry while the spent hops become a minor feed commodity.

Hops harvested 27 days after the final treatment in trial 001-94-1005R (Table 10) were processed. The abamectin residues decreased by 19 and 40% (Table 11).

Table 20. Abamectin residues depletion in dry and spent hops (Englar 1994a). See Table 10 for deatails of treatment and harvesting of the hops in trial 001-94-1005R used for processing.

Abamectin residues, mg/kg				Processing factor
Dried hops		Spent hops		
B_{1a}	B_{1b}	B_{1a}	B_{1b}	
0.086	0.0075	0.069	0.0063	0.81
0.082	0.0073	0.049	<0.005	0.60

Johnson (1995b) measured the abamectin residues in fresh and dry hops from supervised residue trials in Germany (Table 10). The hops were dried for 6 hours at 62°C in kilns; the weight of the dried product was approximately 20% of the fresh weight. Processing (drying) factors were calculated for avermectin B_{1a} for 13 cases where the residues were above the LOQ in both the fresh and dried hops. Avermectin B_{1b} was not included in the calculation because it was not detected. The processing factors (in rank order) were 2.22, 2.53, 2.55, 2.64, 3.48, 3.97, 4.22, 4.43, 4.56, 4.60, 5.15, 5.79 and 6.98. The mean was 4.09, so on average about 80% of the abamectin survived the drying process.

Residues in the edible portion of food commodities

Abamectin residues were not detected in the pulp of melons from supervised trials in Brazil where treatment was at 0.014 and 0.029 kg ai/ha. The melons were harvested 0, 3 and 7 days after the final treatment.

Abamectin residues were not detected (<0.001 mg/kg) in peeled and cored apples, raw juice, clarified juice or apple sauce produced from treated apples, or in pear halves or purée from treated pears.

NATIONAL MAXIMUM RESIDUE LIMITS

The Meeting was aware that the following MRLs had been established for abamectin.

Country	MRL, mg/kg	Commodity
Argentina	0.01	Cotton seed, citrus fruit, cucumber, melon, pear, pepper, tomato, watermelon
	0.02	Strawberry
	0.05	Celery
Australia	0.005	Cattle meat, milk
	0.01	Apple, cotton seed, pear, tomato
	0.02	Strawberry
	0.1	Cattle edible offal, cattle fat
Brazil	0.001	Milk
	0.005	Citrus fruit, cotton seed, potato
	0.01	Apple, bell pepper, cucumber, meat, tomato, watermelon
	0.02	Strawberry
Canada	0.02	Apple, pear
France	0.01	Apple, pear
	0.02	Courgette, cucumber, egg plant, endive, lambs' lettuce, lettuce, melon, pepper, strawberry, tomato
Germany	0.02	Cucumber, egg plant, sweet pepper, strawberry, tomato, zucchini
	0.05	Hops

Country	MRL, mg/kg	Commodity
Israel	0.005	Cotton seed, milk
	0.01	Apple, celery, citrus fruit, cucurbits, egg plant, pear, potato, strawberry, tomato
	0.02	Pepper
Italy	0.01	Pear, tomato
Mexico	0.005	Cotton seed
	0.01	Tomato
	0.02	Citrus, strawberry
	0.05	Celery
Netherlands	0.01	Cucumber, gherkin, zucchini
	0.02	Egg plant, pepper, tomato
	0.05	Endive, iceberg lettuce, lettuce
New Zealand	note[1]	Apple, pear, strawberry, tomato
South Africa	0.01	Apple, pear
	0.02	Strawberry
	0.05	Cotton seed, tomato
Spain	0.01	Celery, citrus fruit, cotton seed, cucurbits, lettuce, pear, pepper, strawberry, tomato
Switzerland	0.01	Cucumber, egg plant, pear, strawberry, sweet pepper, tomato
USA	0.005	Almond nutmeat, cotton seed, cucurbits (cucumbers, squashes, melons), milk, potato, walnuts
	0.01	Bell pepper, tomato
	0.015	Cattle, fat
	0.02	Apple, cattle meat, cattle meat byproducts, citrus whole fruit, pear, strawberry
	0.05	Celery, head lettuce
	0.07	Tomato pomace
	0.1	Apple wet pomace, almond hulls, citrus dried pulp, citrus oil,
	0.2	Hops dried

[1]Not required as residue levels are <0.01 mg/kg when product is used according to label instructions

APPRAISAL

Abamectin was first evaluated at the 1992 JMPR and subsequently in 1994. MRLs have been recommended for a number of crops and animal commodities.

The Meeting received information on current registered uses, methods of analysis and data on residues in supervised trials on the additional crops apples, potatoes and hops as well as new trials on pears, cucurbits, lettuce and tomatoes. Processing data were available for apples, pears, potatoes and hops.

The predominant residues from the use of abamectin on crops are avermectin B_{1a}, avermectin B_{1b} and the photoisomers 8,9-*Z*-avermectin B_1 (B_{1a} and B_{1b}) produced during exposure to sunlight. Analytical methods that measure the components of the residue rely on HPLC separation and fluorescence detection of derivatives formed by converting the cyclohexene ring to an aromatic ring. The abamectin residue appears as two peaks on the chromatogram (B_{1a} and its photoisomer in one peak and B_{1b} and its photoisomer in the other). The LOD for each peak is in the range 0.002-0.005 mg/kg.

Abamectin residues were shown to be stable in samples of fresh and dried hops during freezer storage for the periods tested (150-190 days).

The Meeting noted that the definition proposed by JECFA (1997) for residues in the liver, kidney and fat of animals subject to veterinary treatment with abamectin does not include the 8,9-*Z*-isomer *()*-8,9- isomer), because it is not present in animal tissues when abamectin is used directly on

the animal. However, residues in animal tissues arising from residues in animal feed would include the 8,9-*Z*- isomer. The Meeting agreed that the wider definition (including the 8,9-*Z*- isomer) was appropriate for a laboratory carrying out enforcement or monitoring analyses because the analyst would not know whether the residue in the animal originated only from veterinary treatment or also from the feed. The wider definition accommodates both situations.

Inclusion or exclusion of avermectin B_{1b} from the definition of the residue is a matter of judgement. In many crop situations B_{1b} is present at approximately 10% of the total residue and the analytical methods measure B_{1a} and B_{1b} by the same procedure so B_{1b} results are always available and may as well be used.

Avermectin B_{1b} forms a photoisomer 8,9-*Z*-avermectin B_{1b} in sunlight in the same way as avermectin B_{1a} does. The studies of photolysis were with avermectin B_{1a}, so when the JMPR reviewed the studies in 1992 the possibility of 8,9-*Z*-avermectin B_{1b} being produced was not taken into account. In practice the contribution of 8,9-*Z*-avermectin B_{1b} to the residue will be small but it should be recognized that the HPLC measurement of avermectin B_{1b} residues includes any 8,9-*Z*-avermectin B_{1b}. The Meeting agreed to revise the definition of the residue accordingly, and recommended the following definition for compliance with MRLs and for the estimation of dietary intake.

Sum of avermectin B_{1a}, avermectin B_{1b}, 8,9-Z-avermectin B_{1a} and 8,9-Z-avermectin B_{1b}.

The Meeting received data from supervised residue trials on apples, pears, cucumbers, melons, summer squash, tomatoes, lettuce, potatoes and hops.

The B_{1b} component, when its residues were measurable, was consistently about 10% or less of the total residue. For the purposes of evaluation, when B_{1a} was positively detected and B_{1b} was not detectable the total residue was calculated by taking the undetectable residue to be zero.

When both components in a trial were not detectable (ND) the total residue was taken as below the limit of detection. A residue reported as NQ (not quantifiable, detected but below the limit of determination LOD) is treated as equal to the LOD when it is to be added to a measurable residue.

The method of calculating the total residue for various situations is illustrated by the examples below.

B_{1a}	B_{1b}	Total residue
0.013	NQ (>0.001 but <0.002)	0.015
0.006	ND (<0.001)	0.006
NQ	ND	<0.002
ND	ND	<0.001

Abamectin is registered for single applications on apples in Australia at 0.014 kg ai/ha with harvest after an interval of 14 days. In three trials corresponding to this use pattern the abamectin residues were <0.002, 0.003 and 0.005 mg/kg.

Abamectin is permitted for use on pome fruit in New Zealand with one application at 0.027 kg ai/ha and a PHI of 14 days. Abamectin residues in apples were 0.004 and 0.007 mg/kg in two New Zealand trials where GAP was followed except that two applications were made instead of one.

Abamectin is registered in the USA for two applications on apples at a rate of 0.026 kg ai/ha with harvest 28 days after the final application. In 14 US trials according to these conditions

abamectin residues in rank order (median underlined) were <0.001 (2), <0.002 (3), 0.002, 0.003 (4), 0.004, 0.006, 0.007 and 0.012 mg/kg.

The residue data from Australia, New Zealand and the USA appear to be from one population and can therefore be combined. The residues of abamectin in apples in rank order in the 19 trials (median underlined) were <0.001 (2), <0.002 (4), 0.002, 0.003 (5), 0.004 (2), 0.005, 0.006, 0.007 (2) and 0.012 mg/kg.

The Meeting estimated a maximum residue level of 0.02 mg/kg and an STMR level of 0.003 mg/kg for abamectin in apples.

In the USA abamectin is registered for use on pears at 0.013-0.026 kg ai/ha with two applications permitted at the higher rate and a 28-day PHI. Data from four US trials were provided. The results of supervised trials on pears had previously been reported to the 1992 JMPR. A number of residue decline trials on pears in the USA had shown that the typical half-life was approximately 18 days. At such a rate residues at harvest 21 and 37 days after the final treatment would be ±30% of those at 28 days. The range of pre-harvest intervals for acceptance of the residues was therefore taken as 21-37 days. Abamectin residues in pears from the four trials according to US GAP were 0.004, 0.006, 0.009 and 0.011 mg/kg.

The 1992 monograph recorded one pear trial according to Argentinian GAP, (abamectin <0.005 mg/kg), one according to French GAP (<0.002 mg/kg) and four according to Italian GAP (<0.002 and <0.005 (3) mg/kg).

The residues in the trials in different countries appear to be of the same order, giving residues in rank order (median underlined) of <0.002 (2), 0.004, <0.005 (4), 0.006, 0.009 and 0.011 mg/kg.

The Meeting estimated a maximum residue level for abamectin in pears of 0.02 mg/kg, to replace the previous estimate of 0.01* mg/kg, and an STMR level of 0.005 mg/kg.

In the USA melons may be treated with abamectin at 0.011-0.021 kg ai/ha on three occasions at the higher rate and harvested 7 days after the final treatment. Abamectin residues were not detectable (<0.002 mg/kg) in 9 trials in the USA on cantaloupes according to US GAP, except that there were 4 or 5 applications instead of 3, or in two trials on watermelons under the same conditions. Because the use patterns are the same, watermelons and melons can be evaluated together.

Melons may be treated with abamectin three times at rates up to 0.022 kg ai/ha and harvested three days after the final application according to the registered use in Spain. Abamectin residues were not detected (<0.002 mg/kg) in cantaloupes treated according to Spanish GAP, except that there were four applications, in two glasshouse trials in Spain. Three trials on cantaloupe in France with the same treatment yielded residues of <0.002, <0.005 and <0.005 mg/kg.

Trials on cantaloupes in Brazil and Mexico and on honey-dew melons in Mexico could not be evaluated because there was no information on corresponding GAP. In the Brazilian trials the edible pulp was analysed for abamectin and no residues were detected in any samples in any trial, suggesting that abamectin residues are probably absent from the edible parts of melons.

In summary abamectin residues in melons from trials according to GAP were <0.002, <0.005 and <0.005 mg/kg in France, <0.002 mg/kg (2)) in Spain, <0.002 (9) mg/kg in the USA and <0.002 mg/kg (2) in watermelons in the USA. The residues in melons and watermelons in rank order were <0.002 (14) and <0.005 (2) mg/kg.

The Meeting estimated maximum residue levels of 0.01* mg/kg as being a practical limit of determination, and an STMR level of 0.002 mg/kg, for abamectin in melons and watermelons.

Abamectin is registered for use in the USA on cucumbers and squash at 0.011-0.021 kg ai/ha with three applications at the higher or six at the lower rate, and harvest 7 days after the final treatment. In four US trials on cucumbers at 0.021 or 0.022 kg ai/ha, but with four applications instead of three, residues were undetectable in three trials (<0.002 mg/kg) and below the LOD in the other (<0.005 mg/kg). In four US trials on zucchini (summer squash) under the same conditions no abamectin residues were detectable (<0.002 mg/kg).

Mexican trials on cucumbers and pickling cucumbers could not be evaluated because no information on relevant GAP was available.

The registered use of abamectin on glasshouse cucumbers in Germany permits 5 applications of 0.023 kg ai/ha with harvest three days after the final application. Treatment is not permitted between November and February. Two French trials according to this use pattern were recorded in the 1992 monograph. The resultant abamectin residues were <0.002 and <0.005 mg/kg. A third trial with applications during October and November produced a residue of 0.034 mg/kg, but the conditions were no longer according to GAP.

GAP for abamectin on cucumbers in Spain permits three applications at 0.022 kg ai/ha with harvest three days after the last. Two glasshouse trials in Spain and three trials in Italy (one glasshouse) according to this use pattern but with 4 or 5 applications were recorded in the 1992 monograph. The residues were <0.002, <0.005 (2), 0.006 and 0.008 mg/kg.

GAP for glasshouse cucumbers in The Netherlands allows 5 applications of 0.023 kg ai/ha and harvest three days after the final application. In two trials on cucumbers under these conditions the residues were 0.007 and 0.008 mg/kg, as recorded in the 1992 monograph.

In summary, the residues in cucumbers from trials according to GAP were <0.002 (3) and <0.005 mg/kg in the USA, <0.002 and <0.005 mg/kg in France, <0.002, <0.005 (2), 0.006 and 0.008 mg/kg in Spain and Italy, and 0.007 and 0.008 mg/kg in The Netherlands. The residues in rank order (median underlined) were <0.002 (5), <0.005 (4), 0.006, 0.007 and 0.008 (2) mg/kg.

The Meeting estimated a maximum residue level for abamectin in cucumbers of 0.01 mg/kg, to replace the previous estimate of 0.05 mg/kg, and an STMR of 0.005 mg/kg.

The four trials on summer squash in the USA were evaluated with the support of the four on cucumbers. Abamectin residues from the 8 trials were <0.002 (7) and <0.005 mg/kg.

The Meeting estimated a maximum residue level for abamectin on summer squash of 0.01* mg/kg as being a practical limit of determination, and an STMR of 0.002 mg/kg.

Abamectin is registered for four applications to glasshouse tomatoes in The Netherlands at 0.023 kg ai/ha with a PHI of three days. Abamectin residues in tomatoes from trials which complied with GAP were 0.007 (2), 0.009, 0.012 (2) and 0.017 mg/kg. Two of the tomato trials in The Netherlands reported in the 1992 monograph (refs 211 and 212) were not according to current GAP because applications were made during the months of November and December. Current GAP restricts the treatment of glasshouse tomatoes to the months of March to October when photodegradation of abamectin residues is sufficient. Two other trials (refs 217 and 218) were according to current GAP because abamectin was applied in May and June. The residues from these two trials were 0.008 and 0.005 mg/kg.

GAP in Argentina permits 9 applications of abamectin at 0.022 kg ai/ha to tomatoes with a 3-day PHI. In the three trials with conditions close to GAP (0.020-0.028 kg ai/ha and 5-9 applications) recorded in the 1992 monograph the residues were <0.002 (2) and <0.005 mg/kg.

In Brazil abamectin may be applied to tomatoes at 0.022 kg ai/ha with harvest three days after the final application. Three Brazilian trials recorded in the 1992 monograph were close to these conditions, with residues of <0.005 (2) and 0.017 mg/kg.

Three French trials recorded in 1992 were evaluated according to German GAP (5 applications of 0.023 kg ai/ha applied to glasshouse tomatoes with harvest three days after the final application). Tomatoes were treated 10 times in one trial, but it was evaluated because residues apparently disappeared quickly and the number of applications would not influence the final residue. The residues were <0.002 (2), and <0.005 mg/kg.

Two Italian trials recorded in 1992 complied with the Italian application rate (0.022 kg ai/ha) and PHI (7 days), but there were ten applications instead of two. The results were again considered acceptable because the residues were disappearing quickly. The residues in both trials were <0.002 mg/kg.

In Spain abamectin may be used on tomatoes at 0.022 kg ai/ha with a PHI of three days. The residues in tomatoes from four trials recorded in the 1992 monograph with application rates in the range 0.015-0.027 kg ai/ha were <0.005 (3) and 0.009 mg/kg.

GAP in the USA specifies three applications of 0.021 kg ai/ha and harvest 7 days after the final application. Eighteen US trials are recorded in the 1992 monograph at this application rate and a PHI of 7 days or less, but with 8-12 applications. The residues had usually disappeared within a few days so it is unlikely that early applications had any influence on the final residues. The residues were <0.002 (13), <0.005 (4) and 0.005 mg/kg.

In summary, the residues in tomatoes from trials according to GAP were 0.005, 0.007 (2), 0.008, 0.009, 0.012 (2) and 0.017 mg/kg in The Netherlands, <0.002 (2) and <0.005 mg/kg in Argentina, <0.005 (2) and 0.017 mg/kg in Brazil, <0.002 (2) and <0.005 mg/kg in France, <0.002 (2) mg/kg in Italy, <0.005 (3) and 0.009 mg/kg in Spain and <0.002 (13), <0.005 (4) and 0.005 mg/kg in the USA. The residues in rank order (median underlined and Netherlands results in bold) were <u>0.002</u> (19), <0.005 (11), 0.005, **0.005**, **0.007 (2)**, **0.008**, 0.009, **0.009, 0.012 (2), 0.017** and 0.017 mg/kg.

The residues in The Netherlands appear to belong to a different population from the others, with a median of 0.0085 mg/kg.

The Meeting estimated a maximum residue level for abamectin in tomatoes of 0.02 mg/kg, the same as the previous estimate, and an STMR of 0.0085 mg/kg.

GAP in The Netherlands permits four applications of abamectin to <u>lettuce</u> at 0.014 kg ai/ha with harvest 14 days after the final application, but only from 1 March to 1 November. In four glasshouse trials in The Netherlands according to GAP the residues in head lettuce were 0.016, 0.025, 0.029 and 0.029 mg/kg.

Abamectin may be used four times on lettuce in France at 0.009 kg ai/ha with harvest 7 days after the final application. In three French trials where the application rate was approximately 25% higher than this, but within the acceptable range for evaluation, the residues were <0.001, 0.004 and 0.023 mg/kg.

In Spain abamectin may be applied three times to lettuce at 0.022 kg ai/ha with harvest 14 days after the final application. In two Spanish and three French trials at this rate and PHI, but with

four applications instead of three, the abamectin residues were <0.002, 0.005, 0.013, 0.028 and 0.040 mg/kg.

Trials on lettuce in the USA recorded in the 1992 monograph could not be evaluated because the number of applications, 6-10, was excessive for a sometimes persistent residue compared with the three applications permitted.

In summary, the residues in head lettuce from trials according to GAP were 0.016, 0.025, 0.029 and 0.029 mg/kg in The Netherlands, <0.001, 0.004 and 0.023 mg/kg in France and <0.002, 0.005, 0.013, 0.028 and 0.040 mg/kg in Spain. The residues reported in 1992 in rank order (median underlined) were 0.016, 0.016, 0.033, 0.047, 0.059 and 0.077 mg/kg.

The Meeting estimated a maximum residue level for abamectin in almonds of 0.01* mg/kg as being a practical limit of determination and, because no residues were detected in the trials at normal and double rates, an STMR of 0 mg/kg. The Meeting also estimated maximum residue and STMR levels for abamectin on almond hulls of 0.1 mg/kg and 0.040 mg/kg respectively.

GAP in the USA for walnuts is the same as for almonds. Abamectin residues were not detected (<0.002 mg/kg) in walnuts from six US trials recorded in 1992 according to the maximum US application rate but harvested after 14 days, or in those from four other trials at a double rate.

The Meeting estimated a maximum residue level for abamectin in walnuts of 0.01* mg/kg as being a practical limit of determination, and an STMR of 0 mg/kg.

Abamectin is registered for use on hops in Germany and the USA with two applications of 0.023 and 0.022 kg ai/ha respectively and a PHI of 28 days. The residues in dry hops from 12 German and 4 US trials according to GAP in rank order (median underlined) were <0.003 (4), <0.005, 0.011, 0.012, 0.015, 0.017, 0.022 (2), 0.023, 0.025, 0.030, 0.062 and 0.086 mg/kg.

The Meeting estimated maximum residue and STMR levels of 0.1 mg/kg and 0.016 mg/kg respectively.

A feeding study on dairy cows recorded in the 1992 monograph showed that residues in the milk, liver, muscle, fat and kidney did not exceed 0.004, 0.020, 0.002, 0.014 and 0.005 mg/kg respectively at a feeding level of 0.1 ppm. The residues in animal commodities arising from the consumption of abamectin-treated almond hulls should not exceed current draft MRLs.

Information on the fate of abamectin residues during the processing of apples, pears, potatoes and hops was provided.

Abamectin residues were not detectable in the juice or sauce produced from treated apples, but were concentrated in pomace, a result expected from the nature of abamectin as a surface residue. The calculated processing factors were <0.062 for juice, <0.12 for apple sauce and 17.3 for dry pomace. The "<" signs indicate derivation from the LOD for abamectin in the processed commodities.

The supervised trials median residues for the processed commodities (STMR-Ps) calculated from the processing factors and the STMR level for apples (0.003 mg/kg) are apple juice 0.00019 mg/kg, apple sauce 0.00036 mg/kg and dry apple pomace 0.052 mg/kg.

Abamectin residues were not detectable in pear halves or pear purée produced from treated pears. The calculated processing factors were canned pear halves <0.046 and pear purée <0.048.

The STMR-Ps for the processed commodities calculated from the processing factors and the STMR for pears (0.005 mg/kg) were canned pear halves 0.00023 mg/kg and pear purée 0.00024 mg/kg.

The processing study on potatoes could not be completed because no abamectin residues were detectable in the treated potatoes.

Abamectin-treated hops were processed by exhaustive hexane extraction of dry hops to produce a solvent extract and spent hops. The extract contains flavour components and is used in the brewing industry while the spent hops become a minor feed commodity. Most of the abamectin residues remained in the spent hops. The mean processing factor from dry hops to spent hops was 0.71.

The mean processing factor for abamectin residues during the conversion of fresh hops to dry hops was 4.09, suggesting that approximately 80% of the abamectin survived the drying process.

The 1992 JMPR recommended MRLs for cattle meat and offal of 0.01* and 0.05 mg/kg respectively on the basis of possible abamectin residues in animal feed commodities.

On the basis of veterinary uses the 1996 JECFA recommended MRLs for residues defined as avermectin B_{1a} of 100 µg/kg for cattle fat and liver, and 50 µg/kg for kidney.

The Meeting agreed that MRLs should accommodate both agricultural and veterinary uses where the necessary information is available, and agreed to replace the recommendation for edible offal with recommendations for MRLs in fat, liver and kidney in line with the levels recommended by JECFA.

It is not clear whether the current recommendation for cattle meat (0.01 mg/kg) would accommodate veterinary uses. The Meeting recommended that JECFA be requested to suggest an appropriate maximum residue level in cattle meat, and to consider accepting the broader definition of the residue to accommodate the residues which occur as a result of agricultural as well as veterinary uses.

RECOMMENDATIONS

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

Definition of the residue (for compliance with MRL and for estimation of dietary intake): Sum of avermectin B_{1a}, avermectin B_{1b}, 8,9-*Z*-avermectin B_{1a} and 8,9-*Z*-avermectin B_{1b}.

Commodity		Recommended MRL, mg/kg		Based on PHI, days	STMR, mg/kg	STMR-P, mg/kg
CCN	Name	new	current			
TN 0660	Almond	0.01*		21	0	
	Almond hulls	0.1		21	0.040	
FP 0226	Apple	0.02	-	14-28	0.003	
MF 0812	Cattle fat	0.1 V	-			
MO 1289	Cattle kidney	0.05 V	Note[1]			
MO 1281	Cattle liver	0.1 V	Note[1]			
MO 0812	Cattle, Edible offal of	W	0.05			
VC 0424	Cucumber	0.01	0.05	3-7	0.005	
DH 1100	Hops, dry	0.1	-	28	0.016	
VL 0482	Lettuce, Head	0.05	-	7-14	0.020	
VC 0046	Melons, except Watermelon	0.01*	-	3-7	0.002	

Commodity		Recommended MRL, mg/kg		Based on PHI, days	STMR, mg/kg	STMR-P, mg/kg
CCN	Name	new	current			
FP 0230	Pear	0.02	0.01*	14-21	0.005	
VR 0589	Potato	0.01*	-	0-14	0	
VC 0431	Squash, Summer	0.01*	-	7	0.002	
VO 0448	Tomato	0.02	0.02	3	0.0085	
TN 0678	Walnut	0.01*		14	0	
VC 0432	Watermelon	0.01*	-	7	0.002	
	Apple juice					0.00019
	Apple sauce					0.00036
	Canned pears					0.00023
	Pear purée					0.00024

* MRL at or about limit of determination.
W: previous recommendation withdrawn.
V: includes residues which may arise from veterinary uses.
[1]The current recommendation for Cattle edible offal is to be replaced by recommendations for Cattle kidney and Cattle liver to accommodate JECFA recommendations arising from veterinary uses with abamectin.

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