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Pesticide residues in food — 1992

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Sponsored jointly by FAO and WHO

EVALUATIONS
1992

PART I — RESIDUES

Food
and
Agriculture
Organization
of
the
United
Nations

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Evaluations
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Joint meeting of the
FAO Panel of Experts on Pesticide Residues
in Food and the Environment
and the
WHO Expert Group on Pesticide Residues
Rome, 21-30 September 1992

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These evaluations were prepared under the aegis of two international groups of experts and do not necessarily represent the decisions or the stated policy of the Food and Agriculture Organization of the United Nations or of the World Health Organization.

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1992 JOINT MEETING OF EXPERTS ON PESTICIDE RESIDUES IN FOOD AND THE ENVIRONMENT AND THE WHO EXPERT GROUP ON PESTICIDE RESIDUES

Rome, 21-30 September 1992

PARTICIPANTS

WHO Expert Group on Pesticide Residues

Prof. U.G. Ahlborg
Head, Unit of Toxicology
Karolinska Institutet
Institute of Environmental Medicine
01 Stockholm
Sweden

Dr. V. Benes
Head, National Reference Centre for Pesticides
National Institute of Public Health
Prague Czechoslovakia

Dr. A.L. Black (Rapporteur)
Medical Services Adviser in Toxicology
Department of Community Services and Health
Canberra, Australia

Dr. J.F. Borzelleca (Vice-Chairman)
Professor Pharmacology, Toxicology
Medical College of Virginia
Virginia Commonwealth University
Richmond, Virginia, USA

Dr. P. Fenner-Crisp
Director, Health Effects Division
Office of Pesticide Programs
US Environmental Protection Agency
Washington, D.C., USA

Prof. A. Rico
Head, Chemical & Metabolic Toxicology Laboratory (INRA)
Ecole Nationale Vétérinaire
Toulouse, France

Dr. P. Yao
Professor of Toxicology
Institute of Occupational Medicine, CAPM
Ministry of Public Health
Beijing, China

FAO Panel of Experts on Pesticide Residues in Food and the Environment

Dr. A. Ambrus (Rapporteur)
Budapest Plant Health and
Soil Conservation Station
Budapest, Hungary

Dr. R. Greenhalgh
Ottawa, Ontario, Canada
Tel: 613-749-6541
Telefax: 613-731-9064

Mr. D.J. Hamilton (Chairman)
Senior Principal Scientist
Agricultural Chemistry
Department of Primary Industries
Brisbane, Queensland, Australia

Mr. N.F. Ives
Health Effects Division
US Environmental Protection Agency
Washington, D.C., USA

Dr. J.-R. Lundehn
Federal Biological Research Centre for
Agriculture and Forestry (BBA)
Braunschweig, Germany

Mr. K. Voldum-Clausen
National Food Agency of Denmark
Soborg, Denmark

Mr. Wu Ji Zhuang
Associate Professor
Head of the Department of Research Chemicals
China Import and Export
Commodity Inspection Institute
Beijing, China

Secretariat

Dr. E. Bosshard (WHO Temporary Advisor)
Fed. Office of Public Health
Division of Food Science
Institute of Toxicology
Zürich, Switzerland

Dr. J.R.P. Cabral
International Agency for Research on Cancer
Lyon, France

Mrs. M. Caris (WHO Temporary Adviser)
Toxicological Evaluation Division
Bureau of Chemical Safety
Health and Welfare Canada
Ottawa, Ontario, Canada

Dr. S. Caroldi (WHO Temporary Adviser)
Università di Padova
Istituto di Medicina del Lavoro
Padova, Italy

Dr. E. Casadei
Joint FAO/WHO Food Standards Programme
Food and Agriculture Organization
Rome, Italy

Mr. D. J. Clegg (WHO Temporary Adviser)
Ontario, Canada

Dr. M.A. Clevenger (WHO Temporary Advisor)
Senior Toxicologist
Toxicology Branch I
Health Effects Division
Office of Pesticide Programs
US Environmental Protection Agency
Washington, D.C., USA

Dr. W.H. van Eck (Chairman CCPR)
Food and Product Safety Division
Ministry of Welfare, Health and
Cultural Affairs
Rijswijk, The Netherlands

Dr. J.L. Herrman (WHO Joint Secretary)
International Programme on Chemical Safety
World Health Organization
Geneva, Switzerland

Dr. J.-J. Larsen (WHO Temporary Adviser)
Head, Department of General Toxicology
Institute of Toxicology
National Food Agency
Ministry of Health
Søborg, Denmark

Mr. A.F. Machin (FAO Consultant)
London, United Kingdom

Dr. T.C. Marrs (WHO Temporary Adviser)
Medical Toxicology & Environmental Health
Department of Health
London, United Kingdom

Mr. W.J. Murray (FAO Joint Secretary)
Pesticide Residues Specialist
Plant Protection Service
Food and Agriculture Organization
Rome, Italy

Dr. A. Takanaka (WHO Temporary Advisor)
Head, Division of Pharmacology
Biological Safety Research Center
National Institute of Hygienic Sciences
Tokyo, Japan

Dr. E.M. den Tonkelaar (WHO Temporary Advisor)
Toxicologist
Toxicology Advisory Centre
National Institute of Public Health
and Environmental Protection
Bilthoven, The Netherlands

Dr. G. Vettorazzi (WHO Temporary Advisor)
International Toxicology Information
Centre, San Sebastian, Spain

Mr. M. Watson (WHO Temporary Adviser)
Head, Risk Evaluation Branch
Pesticide Safety Division
Ministry of Agriculture, Fisheries and Food
Rothamsted, Harpenden, United Kingdom

ABBREVIATIONS WHICH MAY BE USED

AChE	acetylcholinesterase
ADI	acceptable daily intake
AFID	alkali flame-ionization detector or detection
ai	active ingredient
ALAT	alanine aminotransferase
approx.	approximate
ASAT	aspartate aminotransferase
at. wt.	atomic weight
b.p.	boiling point
bw	body weight
c	centi- (x 10^{-2})
°C	degree Celsius (centigrade)
CCPR	Codex Committee on Pesticide Residues
ChE	cholinesterase
cm	centimetre
CNS	central nervous system
cu	cubic
cv	coefficient of variation
DFG	Deutsche Forschungsgemeinschaft
DL	racemic (optical configuration, a mixture of dextro- and laevo-; preceding a chemical name)
DP	dustable powder
DS	powder for dry seed treatment
EC	(1) emulsifiable concentrate (2) electron-capture [detector for chromatograph]
ECD	electron-capture detector or detection
EMDI	estimated maximum daily intake
EPA	Environmental Protection Agency
ERL	extraneous residue limit
F_1	filial generation, first
F_2	filial generation, second
f.p.	freezing point
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
FID	flame-ionization detector
FPD	flame-photometric detector
g	gram
µg	microgram
GAP	good agricultural practice(s)
GC-MS	gas chromatography-mass spectrometry
GC-MSD	gas chromatography with mass-selective detection
G.I.	gastro-intestinal
GL	guideline level
GLC	gas-liquid chromatography
GPC	gel-permeation chromatography
GSH	glutathione
h	hour(s)
ha	hectare
Hb	haemoglobin
hl	hectolitre
HPLC	high-performance liquid chromatography
IBT	Industrial Bio-Test Laboratories
i.d.	internal diameter
i.m.	intramuscular
i.p.	intraperitoneal

IPCS	International Programme on Chemical Safety
IR	infrared
IRDC	International Research and Development Corporation (Mattawan, Michigan, USA)
i.v.	intravenous
JMPR	Joint FAO/WHO Meeting on Pesticide Residues (Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and a WHO Expert Group on Pesticide Residues)
k	kilo- (x 10^3)
kg	kilogram
l	litre
LC	liquid chromatography
LC_{50}	lethal concentration, 50%
LD_{50}	lethal dose, median
LOAEL	lowest observed adverse effect level
LOD	limit of determination (see also "*" at end of Table)
LSC	liquid scintillation counting or counter
m	metre
MFO	mixed function oxidase
mg	milligram
µg	microgram
µm	micrometre (micron)
min	minute(s)
ml	millilitre
MLD	minimum lethal dose
mm	millimetre
M	molar
mo	month(s)
m.p.	melting point
MRL	Maximum Residue Limit (this term replaces "Tolerance")
MTD	maximum tolerated dose
n	normal (defining isomeric configuration)
NCI	National Cancer Institute (United States)
NMR	nuclear magnetic resonance
no.	number
NOAEL	no-observed-adverse-effect level
NOEL	no-observed-effect level
NPD	nitrogen-phosphorus detector or detection
NTE	neuropathy target esterase
o	*ortho* (indicating position in a chemical name)
OP	organophosphorus pesticide
p	*para* (indicating position in a chemical name)
PHI	pre-harvest interval
ppm	parts per million. (Used only with reference to the concentration of a pesticide in an experimental diet. In all other contexts the terms mg/kg or mg/l are used).
PT	prothrombin time
PTT	partial thromboplastin time
RAC	raw agricultural commodity
RBC	red blood cell
s.c.	subcutaneous
SC	suspension concentrate (= flowable concentrate)
SD	standard deviation
SE	standard error
SG	water-soluble granule
SL	soluble concentrate
SP	water-soluble powder

sp./spp.	species (only after a generic name)
sp gr	specific gravity
sq	square
t	tonne (metric ton)
TADI	Temporary Acceptable Daily Intake
tert	tertiary (in a chemical name)
TLC	thin-layer chromatography
TMDI	theoretical maximum daily intake
TMRL	Temporary Maximum Residue Limit
TPTA	triphenyltin acetate
TPTH	triphenyltin hydroxide
UDMH	1,1-dimethylhydrazine (unsymmetrical dimethylhydrazine)
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration
UV	ultraviolet
v/v	volume ratio (volume per volume)
WG	water-dispersible granule
WHO	World Health Organization
wk	week
WP	wettable powder
wt	weight
wt/vol	weight per volume
w/w	weight per weight
yr	year
<	less than
≤	less than or equal to
>	greater than
≥	greater than or equal to
*	(following residue levels, e.g. 0.01* mg/kg): level at or about the limit of determination

INTRODUCTION

The report of the Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues, held in Rome, 21-30 September 1992, contains a summary of the evaluations of residues in foods of the various pesticides considered as well as information on the general principles followed by the Meeting. The present document contains summaries of the residues data considered, together with the recommendations made.

The Evaluations are issued in two parts:

Part I: Residues (by FAO)
Part II: Toxicology (by WHO)

For those interested in both aspects of pesticide evaluation, not only both parts but also the reports containing summaries of residue and toxicological considerations will be available. Special attention is drawn to Annex I containing updated ADIs, MRLs and temporary ADIs and MRLs, which also appears in full as part of the report of the Meeting.

Some of the compounds considered at this Meeting have been previously evaluated and reported on in earlier publications. In general only new information is summarized in the relevant monographs and reference is made to previously published evaluations, which should also be consulted. In the case of older compounds which are re-evaluated as part of the periodic review programme of the Codex Committee on Pesticide Residues (CCPR) however a comprehensive review of all available data, including data which may have previously been submitted, is carried out. Compounds evaluated for the first time are indicated by a single asterisk and those evaluated in the CCPR periodic review programme by a double asterisk in the Table of Contents.

The name of the compound appearing as the title of each monograph is followed by its Codex Classification Number in parentheses.

References to previous Reports and Evaluations of Joint Meetings are listed in Annex II.

Acknowledgements

The monographs in these Evaluations were prepared by the following participants in the 1992 JMPR for the FAO Panel of Experts on Pesticide Residues in Food and the Environment: Dr A. Ambrus, Dr. R. Greenhalgh, Mr D.J. Hamilton, Mr F. Ives, Dr J.-R. Lundehn, Mr A.F. Machin, Mr B. Murray, Mr K. Voldum-Clausen and Professor Wuji Zhuang.

Note: Any comments on residues in food and their evaluation should be addressed to the:

Pesticide Residue Specialist
Plant Protection Service
Plant Production and Protection Division
Food and Agriculture Organization
Via delle Terme di Caracalla
00100 Rome, Italy

CONTENTS

[1] * = first evaluation; ** = re-evaluation in CCPR periodic review programme

ABAMECTIN (177)

IDENTITY

ISO common name: abamectin

Chemical name: abamectin is a mixture of components, B_{1a} (≥80%) and B_{1b} (≤20%).

Component B_{1a}

IUPAC: (2a*E*,4*E*,8*E*)-
(5'*S*,6*S*,6'*R*,7*S*,11*R*,13*S*,15*S*,17a*R*,20*R*,20a*R*,20b*S*)-6'-[(*S*)-*sec*-butyl]-5',6,6',7,10,11,14,15,17a,20,20a,20b-dodecahydro-20,20b-dihydroxy-5',6,8,19-tetramethyl-17-oxospiro[11,15-methano-2*H*,13*H*,17*H*-furo[4,3,2-*pq*][2,6]benzodioxacyclooctadecin-13,2'-[2*H*]pyran]-7-yl 2,6-dideoxy-4-*O*-(2,6-dideoxy-3-*O*-methyl-α-L-*arabino*-hexopyranosyl)-3-*O*-methyl-α-L-*arabino*-hexopyranoside.

CAS: 5-*O*-demethylavermectin A_{1a}

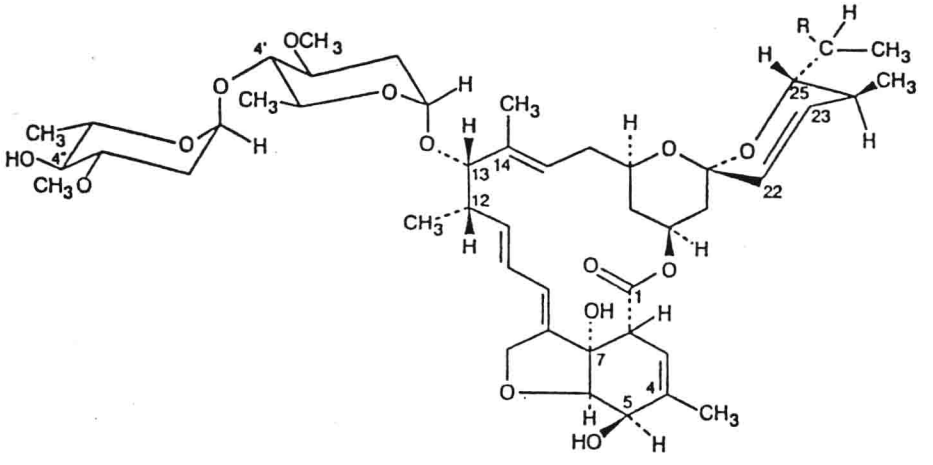
Component B_{1b}

IUPAC: (2a*E*,4*E*,8*E*)-
(5'*S*,6*S*,6'*R*,7*S*,11*R*,13*S*,15*S*,17a*R*,20*R*,20a*R*,20b*S*)-5',6,6',7,10,11,14,15,17a,20,20a,20b-dodecahydro-20,20b-dihydroxy-6'-isopropyl-5',6,8,19-tetramethyl-17-oxospiro[11,15-methano-2*H*,13*H*,17*H*-furo[4,3,2-*pq*][2,6]benzodioxacyclooctadecin-13,2'-[2*H*]pyran]-7-yl 2,6-dideoxy-4-*O*-(2,6-dideoxy-3-*O*-methyl-α-L-*arabino*-hexopyranosyl)-3-*O*-methyl-α-L-*arabino*-hexopyranoside.

CAS: 5-*O*-demethyl-25-de(1-methylpropyl)-25-(1-methylethyl)avermectin A_{1a}

CAS Registry No:	Component B_{1a}	65195-55-3
	Component B_{1b}	65195-56-4
Synonyms:	Avermectin B_1, MK-936	
Molecular formula:	Component B_{1a}	$C_{48}H_{72}O_{14}$
	Component B_{1b}	$C_{47}H_{70}O_{14}$
Molecular weight:	Component B_{1a}	873.11
	Component B_{1b}	859.08

Structural formula:



Physical and chemical properties of abamectin

Physical state:	odourless white to yellowish-white crystalline powder.
Melting point:	155-157°C (with decomposition)
Density:	1.16
Vapour pressure:	<0.0004 mPa
Octanol/water partition coefficient:	log P_{ow} 3.96
Solubility at 21°C:	

Water	10 µg/l
Acetone	>10 g/kg
Chloroform	>25 g/kg
Dichloromethane	>10 g/kg
Ethanol	>10 g/kg
Isopropanol	>10 g/kg
Methanol	>10 g/kg

Hydrolysis: stable to hydrolysis at pH 5, 7 and 9 at 25°C in the dark.

Formulation. Abamectin is formulated in an 18 g ai/l EC formulation as an acaricide/insecticide for use on agricultural, horticultural and ornamental crops. An abamectin injectable formulation is also registered as an endo- and ecto-parasiticide in cattle, and abamectin bait formulations are used for the control of household pests.

A monograph (Campbell, ed, 1989) has been published on the chemistry, production, toxicology, metabolism, uses and analytical methods for ivermectin and abamectin.

USE PATTERN

Abamectin is a macrocyclic lactone product derived from the soil micro-organism *Streptomyces avermitilis*, which controls a number of plant-feeding mites and insects on agricultural and horticultural crops. It is most effective as an ingestion toxicant, but also has some contact activity. It is active against motile mites and insect larvae, but has no ovicidal activity. Surface residues dissipate rapidly. Use in combination with a paraffin crop oil increases foliar penetration, so extending residual activity against mites and pear psylla.

Registered and proposed registered uses of abamectin on agricultural and horticultural crops are shown in Table 1. Recommendations for citrus and pears include the addition of a spray oil, usually at 0.25% of the spray volume.

Table 1. Registered uses and proposed registered uses of abamectin.

Crop	Country 1/	Application 2/			PHI, days
		No	Rate per applic. kg ai/ha	Spray conc. kg ai/hl	
Almond	USA (p)		0.013-0.026		21
Cabbage	Malaysia			0.0016-0.0024	7
	Philippines (p)		0.018		7
Celery	Italy (p)		0.005-0.022	0.0011	7
	Peru		0.009-0.011		7
	Spain	1-4	0.005-0.022	0.0011	10
	USA (p)		0.011-0.021		7
Chinese cabbage	Malaysia			0.0016-0.0024	7
Citrus	Argentina		0.011-0.027	0.00027-0.00036	7
	Brazil		0.005-0.011	0.00036-0.0005	7
	Colombia		0.005-0.011		7
	Israel		0.011-0.015		7
	Italy (p)		0.009-0.027	0.0005	7
	Mexico		0.007-0.027		7
	Peru		0.010-0.027		7
	Thailand			0.0009	
	USA		0.013-0.026	0.00014-0.0028	7
Cotton	Argentina		0.005-0.011		20
	Brazil		0.005-0.011		21
	Colombia		0.005-0.011		20
	Israel		0.005		7
	Italy (p)		0.009-0.018		20
	Mexico		0.009-0.022		20
	Peru		0.005-0.011		20
	South Africa		0.005-0.011		21
	Spain	1-2	0.009-0.018	0.0018	3
	USA		0.011-0.021		20
Cruciferous crops	Philippines (p)		0.018		7
	Thailand			0.0018-0.0023	7
Cucumber	France	1-6	0.010-0.022	0.0009	3
	Netherlands (p)		0.009-0.023	0.0005-0.0009	3
	Switzerland	1-6	0.009 (g)	0.0005-0.0009	3
Cucurbits	Italy (p)		0.005-0.022	0.0011	3
Eggplant	France	1-6	0.022	0.0005-0.0009	3
Endive	Netherlands (p)		0.009-0.023	0.0009	14
Gherkin	Netherlands (p)		0.009-0.023	0.0005-0.0009	3
Kale	Malaysia			0.0016-0.0024	7

Crop	Country 1/	Application 2/			PHI, days
		No	Rate per applic. kg ai/ha	Spray conc. kg ai/hl	
Lettuce	Netherlands (p)		0.0090-0.023	0.0009	14
	USA (p)		0.011-0.021		7
Lettuce, iceberg	Netherlands (p)		0.0090-0.023	0.0009	14
Melons	Netherlands (p)		0.0090-0.023	0.0005-0.0009	3
Mustard	Malaysia			0.0016-0.0024	7
Pear	Argentina		0.011-0.027	0.0007-0.0009	14
	France	1-2	0.014-0.027	0.0013	15
	Italy (p)		0.014-0.027	0.0013	14
	Portugal	1-2	0.014-0.020	0.0013	14
	South Africa		0.014-0.027	0.0006	7
	Spain	1-2	0.014-0.027	0.0013	10
	USA (p)		0.013-0.026	0.0003-0.0028	21
Peppers	France	1-6	0.022	0.0009	3
	Italy (p)		0.005-0.022	0.0011	3
	Netherlands (p)		0.009-0.023	0.0005-0.0009	3
Strawberry	Italy (p)		0.009-0.022	0.0018	3
	USA (p)		0.026		3
Tomato	Argentina		0.009-0.022	0.0009-0.0013	3
	Brazil (p)		0.007-0.022	0.0013-0.0018	3
	France	1-6	0.009-0.023	0.0009	3
	Italy (p)		0.005-0.022	0.0011	3
	Mexico		0.005-0.022	0.0011-0.0018	3
	Netherlands (p)		0.009-0.023	0.0005-0.0009	3
	Peru		0.009-0.011		3
	Portugal		0.005-0.022	0.0011	3
	South Africa		0.005-0.022	0.0011	3
	Spain	1-4	0.005-0.022	0.0011	3
	Spain	1-4	0.005-0.022 (g)	0.0011	7
	Switzerland	1-6	0.009 (g)	0.0005-0.0009	3
	USA (p)		0.011-0.021		3
Walnut	USA (p)		0.013-0.026		21
Zucchini	Netherlands (p)		0.009-0.023	0.0005-0.0009	3

1/ (p) proposed registered use 2/ (g) glasshouse

RESIDUES RESULTING FROM SUPERVISED TRIALS

Residue data from supervised trials on horticultural and agricultural crops are summarised in tables 2 to 20. The data in the tables are not corrected for analytical recovery.

Table 2. Oranges, lemons, tangelos, grapefruit. Argentina (1990), USA (1986).

Table 3. Oranges. Brazil (1983, 1984, 1985).

Citrus

Abamectin was applied to crops of lemons and oranges in supervised trials in Argentina in 1989-90 (Table 2). There were 4 applications of an EC formulation (18 g/l) together with an added spraying oil, at intervals of 55-77 days. Samples from 4 replicates were composited into a single sample for analysis.

Residue data from supervised trials on oranges in the principal citrus growing areas of Brazil (Sao Paulo and Minas Gerais) in 1982-83 and 1983-84 are summarized in Table 3. There were 2 or 4 applications of an EC formulation (18 g/l) at intervals of 60 days. In the second season a spraying oil was included. Peel and pulp were analysed separately, with residues detected in pulp on only one occasion.

Supervised trials on citrus (orange, grapefruit, lemon and tangelo) were conducted in the major citrus growing areas of the USA in 1983, 1984 and 1986 (Tables 2 and 4). An EC formulation (18 g/l) was applied in association with a spraying oil up to 4 times, with intervals between applications of 17 to 92 days. Plot size was 4 to 32 trees comprising in each case replicate sub-plots to provide 3 or 4 samples for analysis at each sampling date.

The method used in 1983 and 1984 gave poor recovery of the Δ-8,9 isomer, which forms a minor part of the residue, and does not affect the