HEXYTHIAZOX (176)

The first draft was prepared by Dr U Banasiak, Federal Institute for Risk Assessment, Berlin, Germany

EXPLANATION

Hexythiazox is a non-systemic insecticide and miticide first evaluated by the 1991 JMPR and a number of times subsequently. It was recently reviewed for toxicology by the 2008 JMPR within the periodic review program of the CCPR. An ADI of 0–0.03 mg/kg bw was established. An ARfD was not considered necessary by the Meeting. In the 2009 JMPR hexythiazox was scheduled for periodic review for the residue section. In 2011 additional GAP information, analytical method (hops only), processing information (hops only) and residue data for strawberries, hops and tea are considered by the Meeting.

METHODS OF RESIDUE ANALYSIS

Analytical methods

The Meeting received additional information on analytical methods for the determination of residues of hexythiazox in hops.

Reference: Weeren R.D., Hexyt_065
Commodities: Hops (dried cones)
Analytes: hexythiazox (determined as PT-1-3)
LOQ: 0.5 mg/kg
Determination: GC-ECD, confirmation by GC-MSD (quantitation: m/z 156, verification m/z 184 and m/z 227)
Description: Specimens were extracted with methanol. For liquid-liquid partition a first extraction step was done by n-hexane and sodium chloride. For a second step dichloromethane was used and after repeated mixing, excess water was separated. The evaporated residue of an aliquot of the organic phase was cleaned up by gel permeation chromatography using a mixture of ethyl acetate/cyclohexane (1/1, v/v) as eluent. The residue containing fraction was concentrated and after supplemental Florisil column chromatography analysed for residues of Hexythiazox by gas chromatography using ECD and confirming MSD. On GC injection, Hexythiazox is pyrolysed to its break down product PT-1-3, which is used as reference compound for the determination.

Table 1 Recoveries of hexythiazox in hops

Reference (Author, Year)	Fortification levels (mg/kg)	Mean recovery (%)	Relative standard deviation (%)	No.	Range of recoveries (%)		Remarks
					Low	High	
Hexyt_065 Weeren, R.D. 2001	0.5	150	8.5	5	143	163	External standard in solvent
	5	155	7.1	5	143	160	
	0.5	100	8.8	5	88	110	External standard in matrix
	5	115	3.0	5	110	118	

Stability of pesticides in stored analytical samples

Reference: Tilting N., 1998, Hexyt_066
Commodities: hops (fresh), hops (dried), spent hops and beer
Analytes: hexythiazox (determined as PT-1-3)
Material and Method: Per sample date and sample material, a set of 4 containers was filled with the amounts of 10 g green hops (whole umbels), 5 g dried hops (milled), 25 g spent hops and 50 g beer. Two containers were fortified with an amount of hexythiazox equivalent to 5 mg/kg for hops and 0.5 mg/kg for beer, the other two were used for control and procedural recovery.

Table 2 Freezer storage stability of hexythiazox residues in hops

Reference (Author, Year)	Storage interval (months)	Fortification level (mg/kg)	Residue analysed (mg/kg)	% remaining	Procedural recovery (%)	Matrix
Tilting N., 1998, Hexyt_066	0	5	4.5, 4.34 (4.42)	88	90	Green hops
	0.5	5	4.1, 3.84 (3.97)	79	82	
	1	5	3.92, 4.12 (4.02)	80	104	
	2	5	4.46, 4.56 (4.51)	90	100	
	4	5	3.25, 3.24 (3.25)	65	72	
	6	5	3.96, 3.89 (3.93)	79	80	
	12	5	3.61, 3.49 (3.55)	71	76	
	18	5	7.22[a], 5.49 (5.49)	110	108	
	24	5	4.88, 4.71 (4.8)	96	95	
	0	5	5.45, 4.98 (5.22)	104	90	Dried hops
	0.5	5	3.97, 4.1 (4.04)	81	86	
	1	5	5.38, 8.13[a] (5.38)	108	100	
	2	5	4.34, 3.93 (4.14)	83	91	
	4	5	3.84, 3.19 (3.52)	70	64	
	6	5	3.16, 3.03 (3.1)	62	67	
	12	5	3.62, 3.63 (3.63)	73	78	
	18	5	< 0.05[a], < 0.05[a]	-	133	
	24	5	4.3, 5.01 (4.66)	93	98	
	0	5	3.63, 3.14 (3.39)	68	64	Spent hops
	0.5	5	4.41, 5.02 (4.73)	95	93	
	1	5	4.37, 4.22 (4.3)	88	86	
	2	5	3.83, 3.09 (3.46)	69	83	
	4	5	3.71, 4.13 (3.92)	78	63	
	6	5	3.81, 3.69 (3.75)	75	72	
	12	5	3.25, < 0.05[a]	65	71	
	18	5	(3.25)	92	87	
	24	5	4.46, 4.91 (4.69)	108	107	
			5.22, 5.58 (5.4)			
	0	0.5	0.27, 0.28 (0.28)	56	60	Beer
	0.5	0.5	0.45, 0.48 (0.47)	94	92	
	1	0.5	0.37, 0.37 (0.37)	74	83	
	2	0.5	0.37, 0.33 (0.35)	70	74	
	4	0.5	0.52, 0.49 (0.51)	102	98	
	6	0.5	0.34, 0.36 (0.35)	70	81	
	12	0.5	0.27, 0.24 (0.26)	52	75	
	18	0.5	0.43, 0.32 (0.38)	76	92	
	25	0.5	0.19, 0.21 (0.2)	40	78	
	27	0.5	0.15, 0.22 (0.19)	38	107	

[a] value considered as invalid in study

USE PATTERN

Additional supervised trials residue data and GAP were submitted for strawberries, hops and tea. In the following table only GAP relevant for these commodities are presented either submitted in 2011 or for the periodic review in 2009.

Table 3 List of registered uses

Commodity	Country	Field (F), Indoor (I), Post-harvest (P)	Application	Form-ulation	kg ai/ha	kg ai/hL	No. of treatments	PHI (days)	Remarks
Hops	Germany	F	foliar	WP, 10%	0.15	0.0045	2	28	
Hops	USA	n.s.	foliar	DF, 50%	0.21	Min. 0.45	1	ns	treatment up to burr formation, 120 d label restriction on rotational crops
Hops	USA	n.s.	foliar	WP, 50%	0.21	Min. 0.45	1	ns	treatment up to burr formation, 120 d label restriction on rotational crops
Strawberries	Denmark	n.s.	foliar	WP, 10%	0.075		1	3	
Strawberries	Germany		foliar	WP, 10%	0.08		1	Not required	Before flowering, after harvest
Strawberries	Netherlands	F	foliar	WP, 10%	0.05	0.005	1	3	
Strawberries	Netherlands	I	foliar	WP, 10%	0.06	0.005	1	3	
Strawberries	USA	n.s.	foliar	DF, 50%	0.21	Min. 0.45	1	3	120 d label restriction on rotational crops
Strawberries	USA	n.s.	foliar	WP, 50%	0.21	Min. 0.45	1	3	120 d label restriction on rotational crops
Tea	India	F	foliar	EC, 5%	0.025		2	ns	

ns - Not stated

RESIDUES RESULTING FROM SUPERVISED TRIALS ON CROPS

Trials were generally well documented with laboratory and field report. Laboratory reports included method validation with procedural recoveries from spiking at residues levels similar to those occurring in samples from supervised trials. Dates of analyses or duration of residue sample storage were also provided. Although trials included control plots, no control data are recorded in the tables except where residues in control samples exceeded the LOQ. Residue data are recorded unadjusted for recovery.

In trials where duplicate field samples from an unreplicated plot were taken at each sampling time and analysed separately each figure is presented individually. When samples were analysed more than once all results are listed and the mean is presented in brackets.

When residues were not detected they are show as below the LOQ (e.g., < 0.01 mg/kg). Application rates and spray concentrations have generally been rounded to two significant figures. For residues above the LOQ results were rounded to two significant figures. Residue values from trials conducted according to maximum GAP have been used for the estimation of maximum residue levels. Those results included in the evaluation are underlined.

Conditions of the supervised residue trials were generally well reported in detailed field reports. Most trial designs used non-replicated plots. Most field reports provided data on the sprayers used, plot size, field sample size and sampling date.

Except specifically noted the residue data in the following tables represents the sum of hexythiazox and all metabolites hydrolysable to trans-5-(4-chlorophenyl)-4-methyl-2-oxothiazolidine (PT-1-3), expressed as hexythiazox.

Table 4 Hexythiazox - supervised residue trials

Commodity	Indoor/Outdoor	Treatment	Countries	Table
Strawberries	Outdoor	Foliar spray	Belgium, France, Italy, Netherlands, Spain	Table 5
Strawberries	Indoor	Foliar spray	Belgium, France, Italy, Netherlands, Spain, USA	Table 6
Hops	Outdoor	Foliar spray	Germany	Table 7
Tea	Outdoor	Foliar spray	India	Table 8

Table 5 Hexythiazox residues in strawberries (field use)

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha	water L/ha	No				
Southern Europe									
Italy, Volpedo 2002 (Maia)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	0.07 < 0.05 < 0.05 < 0.05	Perny A., 2003, Hexyt_068 A2063 IT1
Italy, Viguzzolo 2002 (Marmolada)	WP 10	Spray	0.1	1000	1	Fruits	3	< 0.05	Perny A., 2003, Hexyt_068 A2063 IT2
France (South), Les Barthes 2002 (Garriguette)	WP 10	Spray	0.1	1000	1	Fruits Fruits (RAC) Washed Canned Jam	3 3 3 3 3	0.07 0.14 0.05 0.05 0.07	Perny A., 2003, Hexyt_068 A2063 TL2
France (South), Cambes 2002 (Mara des bois)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	< 0.05 < 0.05 < 0.05 < 0.05	Perny A., 2003, Hexyt_068 A2063 DR1
France (South), Bonnut 2002 (Mara des bois)	WP 10	Spray	0.1	1000	1	Fruits	1 3	0.11 < 0.05	Perny A., 2003, Hexyt_068 A2063 SA1
Spain, Villarasa 2002 (Camarosa)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	0.06 < 0.05 < 0.05 < 0.05	Perny A., 2003, Hexyt_068 A2063 PA1
Northern Europe									
France (North), Huttendorf 2002 (Diamante)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	0.05 0.11 0.08 0.06	Perny A., 2003, Hexyt_068 A2063 AN1
	WP 10	Spray	1	1000	1	Fruits (RAC) Washed Canned Jam	3 3 3 3 3	3.18 1.51 3.14 2.5	

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha	water L/ha	No				
France (North), Thorée les pins 2002 (Maraline)	WP 10	Spray	0.1	1000	1	Fruits	1 3	0.09 0.08	Perny A., 2003, Hexyt_068 A2063 BM1
Netherlands, Neer 2002 (Elsanta)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	< 0.05 < 0.05 < 0.05 < 0.05	Perny A., 2003, Hexyt_068 A2063 NL1
Netherlands, Horst 2002 (Elsanta)	WP 10	Spray	0.1	1000	1	Fruits	3	< 0.05	Perny A., 2003, Hexyt_068 A2063 NL2
United Kingdom, East Peckham 2002 (Symphony)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	< 0.05 < 0.05 < 0.05 < 0.05	Perny A., 2003, Hexyt_068 A2063 UK1
United Kingdom, Peterborough 2002 (Elsanta)	WP 10	Spray	0.1	1000	1	Fruits	1 3	< 0.05 < 0.05	Perny A., 2003, Hexyt_068 A2063 UK2
Belgium, Heukelom 2002 (Elsanta)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	< 0.05 < 0.05 < 0.05 < 0.05	Perny A., 2003, Hexyt_068 A2063 BE1
Belgium, Hoeselt 2002 (Elsanta)	WP 10	Spray	0.1	1000	1	Fruits	3 3	< 0.05 0.06	Perny A., 2003, Hexyt_068 A2063 BE2
France (North), Entzheim 2003 (Darselect)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	< 0.05 < 0.05 < 0.05 < 0.05	Perny A., 2003, Hexyt_069 A3011 AN 1
France (North), Thorée les pins 2003 (Mara des Bois)	WP 10	Spray	0.1	1000	1	Fruits	1 3	0.12 0.07	Perny A., 2003, Hexyt_069 A3011 BM 1
USA									
USA (FL), Plant City 1985 (Pajaros)		Spray	0.07	1700	1	Fruits	1 3 7	0.24 0.18 0.11	McIntosh C., 1986, Hexyt_075
		Spray	0.14	1700	1	Fruits	1	0.36	
USA (CA), Irvine 1985 (not listed)	WP 50	Spray	0.14	2340	1	Fruits	1	0.18	McIntosh C., 1986, Hexyt_075
	WP 50	Spray	0.28	2340	1	Fruits	1	0.63	
USA (CA), Irvine 1985 (Douglas)		Spray	0.14	935	1	Fruits	3 5	0.16 0.14	McIntosh C., 1986, Hexyt_075
		Spray	0.28	935	1	Fruits	3 5	0.33 0.87	

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha	water L/ha	No				
USA (CA), Watsonville 1985 (Heidi)		Spray	0.17	2340	1	Fruits	0 1 3	0.5 0.66 0.5	McIntosh C., 1986, Hexyt_075
USA (CA), Watsonville 1985 (Heidi)		Spray	0.34	2340	1	Fruits	0 1 2 3 5	0.25 0.3 0.31 0.29 0.19	McIntosh C., 1986, Hexyt_075
		Spray	0.34	2340	1	Fruits	0 1 2 3 5	0.31 0.43 0.33 0.43 0.24	
USA (FL), Bradenton 1984 (F.Belle)	WP 50	Spray	0.07	935	1	Fruits	0	0.13	McIntosh C., 1986, Hexyt_075
	WP 50	Spray	0.14	935	1	Fruits	0	0.65	
	WP 50	Spray	0.28	935	1	Fruits	0	0.7	
USA (FL), Bradenton 1984 (Dover)	WP 10	Spray	0.14	not stated	1	Fruits	3	0.88	McIntosh C., 1986, Hexyt_075
	WP 10	Spray	0.21	not stated	1	Fruits	3	1.8	
	WP 10	Spray	0.28	not stated	1	Fruits	3	1.9	
USA (FL), Bradenton 1984 (Dover)	WP 10	Spray	0.14	935	1	Fruits	3	0.55	
	WP 10	Spray	0.21	935	1	Fruits	3	1.4	
	WP 10	Spray	0.28	935	1	Fruits	3	2.0	
USA (FL), Bradenton 1984 (Dover)	WP 10	Spray	0.14	not stated	1	Fruits	4	0.6	
	WP 10	Spray	0.21	not stated	1	Fruits	4	0.89	
	WP 10	Spray	0.28	not stated	1	Fruits	4	1.4	
USA (MI), Niles 1985 (Sparkle)	WP 50	Spray	0.07	not stated	1	Fruits	1 3 7	1.5 1.2 1.3	McIntosh C., 1986, Hexyt_075
	WP 50	Spray	0.14	not stated	1	Fruits	1 3 7	2.5 2.4 1.6	
	WP 50	Spray	0.28	not stated	1	Fruits	1 3 7	6.0 5.5 3.7	
USA (LA), Baton Rouge 1985 (Tangi)		Spray	0.14	260	1	Fruits	0 3 7	0.12 0.19 0.14	McIntosh C., 1986, Hexyt_075
		Spray	0.14	260	1	Fruits	0 7	0.12 0.088	
		Spray	0.28	260	1	Fruits	0 3 7	0.6 0.36 0.32	
		Spray	0.28	260	1	Fruits	0 7	0.35 0.13	
USA (VA), Blacksburg 1985	WP 50	Spray	0.07	187	1	Fruits	0 0 0 0	0.036 0.056 0.059 0.037	McIntosh C., 1986, Hexyt_075

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha	water L/ha	No				
(Red Chief)	WP 50	Spray	0.14	187	1	Fruits	0 0	0.071 0.059	
	WP 50	Spray	0.28	187	1	Fruits	0 0	0.18 0.22	
	WP 50	Spray	0.07	187	1	Fruits	0 0	0.039 0.036	
	WP 50	Spray	0.14	187	1	Fruits	0 0 0 0	0.084 0.091 0.067 0.095	
	WP 50	Spray	0.28	187	1	Fruits	0 0	0.17 0.16	
USA, Yates (NY) 2001 (Honeoye)	WP 50	Spray	0.21	263	1	Fruits	3 3	0.13 0.11	TCI-01-001, TCI-01-001-01 Carringer, 2001, Hexyt_028 (submitted in 2009)
USA, Tulare (CA) 2001 (Seascape)	WP 50	Spray	0.21	350	1	Fruits	3 3 7 7 14 14 21 21 28 28	0.28 0.3 0.25 0.22 0.1 0.16 0.03 0.04 < 0.02 < 0.02	TCI-01-001, TCI-01-001-02 Carringer, 2001, Hexyt_028 (submitted in 2009)
USA, Washington (OR) 2001 (Puget Reliance)	WP 50	Spray	0.21	187	1	Fruits	3 3	0.17 0.16	TCI-01-001, TCI-01-001-03 Carringer, 2001, Hexyt_028 (submitted in 2009)

Table 6 Hexythiazox residues in strawberries (protected use)

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha	water L/ha	No				
Italy, Isola S. Antonio 2002 (Marmolada)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	0.07 < 0.05 < 0.05 < 0.05	Perny, A., 2003, Hexyt_067 A2062 IT1
Italy, Viguzzolo 2002 (Marmolada)	WP 10	Spray	0.1	1000	1	Fruits	3 3	0.07 0.06	Perny, A., 2003, Hexyt_067 A2062 IT2
France (South), Les Barthes 2002 (Garriguette)	WP 10	Spray	0.1	1000	1	Fruits	3 3	0.16 0.06	Perny, A., 2003, Hexyt_067 A2062 TL1
France (South), Monteton 2002 (Darselect)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	0.09 0.06 0.06 0.05	Perny, A., 2003, Hexyt_067 A2062 SA1

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha	water L/ha	No				
Netherlands, Roggel 2002 (Elsanta)	WP 10	Spray	0.1	1000	1	Fruits	0 1 3 7	0.25 0.12 0.13 0.10	Perny, A., 2003, Hexyt_067 A2062 NL1
Netherlands, Belfeld 2002 (Elsanta)	WP 10	Spray	0.1	1000	1	Fruits	3	0.19	Perny, A., 2003, Hexyt_067 A2062 NL2
Italy, Castellar Guidibono 2003 (Marmolada)	WP 10	Spray	1	1000	1	Fruits (RAC) Washed Cooked Canned Jam	3 3 3 3 3	0.69 0.36 0.33 0.36 0.37	Perny A., 2003, Hexyt_070 A3010 IT1
France (South), Roumagne 2003 (Garriguette)	WP 10	Spray	1	1000	1	Fruits (RAC) Washed Canned Jam	3 3 3 3	0.55 0.27 0.22 0.59	Perny A., 2003, Hexyt_070 A3010 DR1

Table 7 Hexythiazox residues in hops

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha (kg ai/hL)	water L/ha	No				
Germany, Huell-Wolznach 1993 (Perle)	WP 10	Spray	0.22 (0.0045)	4549	1	Leaves and cones Cones, fresh Cones, dried	0 21 27 35 27	5.2 0.11 0.18 < 0.1 <u>0.79</u>	Beck J., 1994, Hexyt_071 D07/82/93
Germany, Osterwaal 1993 (Perle)	WP 10	Spray	0.17 (0.0045)	3493	1	Leaves and cones Cones, fresh Cones, dried	0 21 27 35 27	5.8 < 0.1 0.12 0.12 <u>0.71</u>	Beck J., 1994, Hexyt_071 D07/83/93
Germany, Larsbach 1993 (Northern Brewer)	WP 10	Spray	0.19 (0.0045)	3937	1	Leaves and cones Cones, fresh Cones, dried	0 21 27 35 27	5.5 < 0.1 0.10 0.13 <u>0.64</u>	Beck J., 1994, Hexyt_071 D07/84/93
Germany, Rohrbach 1993 (Northern Brewer)	WP 10	Spray	0.16 (0.0045)	3393	1	Leaves and cones Cones, fresh Cones, dried	0 20 27 34 27	6.4 0.27 0.29 0.13 <u>0.79</u>	Beck J., 1994, Hexyt_071 D07/85/93

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha (kg ai/hL)	water L/ha	No				
Germany, Nierderlauterbach 1993 (Magnum)	WP 10	Spray	0.18 (0.0045)	3731	1	Leaves and cones Cones, fresh Cones, dried	0 20 27 34 27	5.8 0.23 0.13 < 0.1 <u>0.61</u>	Beck J., 1994, Hexyt_071 D07/86/93
Germany, Niederumelsdorf 1992 (Perle)	WP 10	Spray	0.16 (0.0045)	3421	1	Cones, fresh Cones, dried (RAC) Beer[a] Spent hops Brewers yeast Dregs	0 21 28 35 28 28 28 28 28	2.8 0.95 0.48 0.14 <u>0.93</u> < 0.05 0.15 < 0.05 0.08	Beck J., 1994, Hexyt_072
Germany, Osterwaal 1992 (Perle)	WP 10	Spray	0.15 (0.0045)	3333	1	Cones, fresh Cones, dried (RAC) Beer[1] Spent hops Brewers yeast Dregs	0 21 28 35 28 28 28 28 28	3.3 1.6 0.96 0.35 <u>1.5</u> < 0.05 0.18 < 0.05 0.28	Beck J., 1994, Hexyt_072
Germany, Niederlauterbach 1992 (Perle)	WP 10	Spray	0.16 (0.0045)	3387	1	Cones, fresh Cones, dried (RAC) Beer[1] Spent hops Brewers yeast Dregs	0 21 28 35 28 28 28 28 28	3.6 0.93 0.53 0.47 <u>1.3</u> < 0.05 0.18 < 0.05 0.14	Beck J., 1994, Hexyt_072

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha (kg ai/hL)	water L/ha	No				
Germany, Huell-Wolznach 1992 (Perle)	WP 10	Spray	0.15 (0.0045)	3333	1	Cones, fresh	0 21 28 35 28	3.1 1.1 0.23 0.34 <u>0.88</u>	Beck J., 1994, Hexyt_072
						Cones, dried (RAC) Beer[1] Spent hops Brewers yeast Dregs	28 28 28 28	< 0.05 0.11 < 0.05 < 0.05	

[a] beer samples stored for 2 months

Note: processing not conducted under GLP

Table 8 Hexythiazox residues in tea

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha (kg ai/hL)	water L/ha	No				
India, Darjeeling 2008 (CPI, AV2 & Tukdah 135)	EC 5	Spray	0.025 (0.003)	765	2	Green tea	0 3 7 14	<u>4.9</u> 1.3 0.29 < 0.01	Sathiyanarayanan S., 2009, Hexyt_073
						Green tea infusion	0 3 7 14	0.14 0.05 < 0.01 < 0.01	
						Fermented tea	0 3 7 14	4.0 0.66 0.12 < 0.01	
						Fermented tea infusion	0 3 7 14	0.12 0.02 < 0.01 < 0.01	
India, Darjeeling 2009 (CPI, AV2 & Tukdah 135)	EC 5	Spray	0.025 (0.003)	765	2	Green tea, dry	0 3 7 14	<u>4.5</u> 1.3 0.1 < 0.01	Sathiyanarayanan S., 2009, Hexyt_074
						Green tea infusion	0 3 7 14	0.12 0.05 < 0.01 < 0.01	
						Fermented tea, dry	0 3 7 14	4.3 1.5 0.12 < 0.01	
						Fermented tea infusion	0 3 7 14	0.15 0.03 < 0.01 < 0.01	

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha (kg ai/hL)	water L/ha	No				
India, Jalpaiguri 2008 (Assam hybrid)	EC 5	Spray	0.025 (0.003)	765	2	Green tea, dry	0 3 7 14	4.8 1.8 0.23 < 0.01	Sathiyanarayanan S., 2009, Hexyt_073
						Green tea infusion	0 3 7 14	0.09 0.03 < 0.01 < 0.01	
						Fermented tea, dry	0 3 7 14	3.7 0.56 0.18 < 0.01	
						Fermented tea infusion	0 3 7 14	0.09 0.02 < 0.01 < 0.01	
India, Jalpaiguri 2009 (Assam hybrid)	EC 5	Spray	0.025 (0.003)	765	2	Green tea, dry	0 3 7 14	3.1 0.89 0.13 < 0.01	Sathiyanarayanan S., 2009, Hexyt_074
						Green tea infusion	0 3 7 14	0.12 0.05 < 0.01 < 0.01	
						Fermented tea, dry	0 3 7 14	3.7 1.1 0.17 < 0.01	
						Fermented tea infusion	0 3 7 14	0.1 0.06 < 0.01 < 0.01	
India, Palampur 2008 (China hybrid)	EC 5	Spray	0.025 (0.003)	765	2	Green tea, dry	0 3 7 14	4.1 0.78 0.04 < 0.01	Sathiyanarayanan S., 2009, Hexyt_073
						Green tea infusion	0 3 7 14	0.12 0.04 < 0.01 < 0.01	
						Fermented tea, dry	0 3 7 14	3.1 0.37 0.03 < 0.01	
						Fermented tea infusion	0 3 7 14	0.11 0.02 < 0.01 < 0.01	

Location, Year (variety)	Application					Sample material	PHI, days	Residues, mg/kg	Author, Year, Code, Trial-No.
	Form	Method	kg ai/ha (kg ai/hL)	water L/ha	No				
India, Palampur 2009 (China hybrid)	EC 5	Spray	0.025 (0.003)	765	2	Green tea, dry	0 3 7 14	5.2 1.3 0.1 < 0.01	Sathiyanarayanan S., 2009, Hexyt_074
						Green tea infusion	0 3 7 14	0.19 0.08 < 0.01 < 0.01	
						Fermented tea, dry	0 3 7 14	4.1 1.6 0.09 < 0.01	
						Fermented tea infusion	0 3 7 14	0.18 0.06 < 0.01 < 0.01	
India, Munnar 2008 (Camellia sinensis)	EC 5	Spray	0.025 (0.003)	765	2	Green tea, dry	0 3 7 14	4.6 1.5 0.15 < 0.01	Sathiyanarayanan S., 2009, Hexyt_073
						Green tea infusion	0 3 7 14	0.11 0.05 < 0.01 < 0.01	
						Fermented tea, dry	0 3 7 14	3.5 0.87 0.1 < 0.01	
						Fermented tea infusion	0 3 7 14	0.1 0.03 < 0.01 < 0.01	
India, Munnar 2009 (Camellia sinensis)	EC 5	Spray	0.025 (0.003)	765	2	Green tea, dry	0 3 7 14	3.1 1.2 0.11 < 0.01	Sathiyanarayanan S., 2009, Hexyt_074
						Green tea infusion	0 3 7 14	0.14 0.04 < 0.01 < 0.01	
						Fermented tea, dry	0 3 7 14	3.2 1.1 0.1 < 0.01	
						Fermented tea infusion	0 3 7 14	0.17 0.04 < 0.01 < 0.01	

FATE OF RESIDUES IN STORAGE AND PROCESSING

In processing

The Meeting received additional information on the processing of strawberries, hops and tea. The respective field trials are presented in Tables 5 to 8.

For the processing of strawberries the fruits were washed with pure water. Canned fruits included removal of the crown and stem, followed by pasteurisation at 95 °C for 3min under addition of water and sugar (17–20% sugar in the syrup). Strawberry jam was processed by mixing fruits without crown and stem with an equal amount of sugar. The mixture was cooked at 55–60°C and finally sterilized at 120 °C for 10min.

The processing of hops was conducted according to the normal commercial procedure of brewing. Wort and dried hops were boiled and filtered. The extract was used in the fermentation, giving brewers yeast, young beer and beer. The processing of hops was not conducted according to GLP principles due to the limitation of commercial practice on laboratory scale.

For tea green the leaves were first air dried for 45 minutes and subsequently segregated into fine and needle shapes leaves. After the separation the leaves were dried at changing temperatures between 50 °C to 150 °C, until the final moisture level was less than 3%.

Fermented tea leaves were first withered for 15 hours, followed by cutting, rolling, and additional fermentation of 45 minutes and finally drying as described for green tea.

The preparation of tea infusion (green and fermented) was performed by adding 10 g dried tea to 100ml of boiling water. After 2 minutes the mixture was filtered and the infusion sampled for analysis.

Processing factors have been calculated for hexythiazox residues and are presented below in Table 9.

Table 9 Summary of processing factors for hexythiazox in strawberries, hops and tea

Raw agricultural commodity (RAC)	Processed commodity	Calculated processing factors	Median or best estimate
Strawberries	Washed fruits	0.36, 0.48, 0.49, 0.52	0.485
	Canned fruits	0.36, 0.4, 0.52, 0.99	0.46
	Jam	0.5, 0.54, 0.79, 1.1	0.665
	Cooked fruits	0.49	0.49
Hops	Beer	< 0.03, < 0.04, < 0.05, < 0.06	< 0.045
	Spent hops	0.12, 0.13, 0.14, 0.16	0.135
	Brewers yeast	< 0.03, < 0.04, < 0.05, < 0.06	< 0.045
	Dregs	< 0.06, 0.09, 0.11, 0.19	0.1
Tea	Green tea infusion	0.02(3), < 0.03, 0.03(5), < 0.04, 0.04(4), 0.05, 0.05, 0.06, 0.06, < 0.07, < 0.08, < 0.09, < 0.1, < 0.1, < 0.25	0.04
	Fermented tea infusion	0.01, 0.02(6), 0.03(6), < 0.04, 0.05, 0.05, < 0.07, 0.07, < 0.08, < 0.09, < 0.1, < 0.1, < 0.25, 0.34	0.03

APPRAISAL

Hexythiazox is a non-systemic insecticide and miticide first evaluated by the JMPR in 1991 and a number of times subsequently. It was recently reviewed for toxicology by the 2008 JMPR within the

periodic review program of the CCPR. An ADI of 0–0.03 mg/kg bw was established. An ARfD was not considered necessary by the Meeting. It was then reviewed for residues by the 2009 JMPR as part of the periodic review program. Additional GAP information, analytical method (hops only), residue data and processing information for strawberries, hops and tea were submitted for evaluation by the present Meeting.

Analytical methods

The 2011 Meeting received additional information on the analysis of hexythiazox in hops.

The method submitted involves analysis of hexythiazox in combination with the metabolite trans-5-(4-chlorophenyl)-4-methyl-2-oxothiazolidine (PT-1-3) using gas chromatography and either ECD or MSD detection. The data indicated a very high recovery (> 150%), when external standard in solvent is used. Matrix based external standard gave acceptable recoveries of 110% up to 115%. The LOQ for this method was validated at 0.5 mg/kg.

Stability of pesticide residues in stored analytical samples

The 2011 Meeting received additional information on the storage stability in hops and beer.

Although the procedural recoveries gave some variation during the whole storage period, the Meeting concluded that hexythiazox residues in hops (fresh and dry) and spent hops are stable for at least 24 months.

In beer a significant degradation was observed after 12 months or more. The Meeting concluded that hexythiazox in beer is stable for a period of up to 6 months only, still providing more than 70% of the initial residue remaining.

Results of supervised trials on crops

New data were submitted for strawberries, hops and tea.

The OECD calculator was used as a tool in the estimation of the maximum residue level from the selected residue data set obtained from trials conducted according to GAP. As a first step, the Meeting reviewed all relevant factors related to each data set in arriving at a best estimate of the maximum residue level using expert judgement. Then, the OECD calculator was employed. If the statistical calculation spreadsheet suggested a different value from that recommended by the JMPR, a brief explanation of the deviation was provided.

Strawberries

In the USA hexythiazox is approved for use on strawberries with one spray application at 0.21 kg ai/ha and a PHI of 3 days. Various supervised field trials were submitted involving treatment of strawberries at lower and higher application rates. At a PHI of 3 days, hexythiazox residues in fruit were:

- for 0.07 kg ai/ha: 0.18 mg/kg
- for 0.14 kg ai/ha: 0.19 mg/kg
- for 0.17 kg ai/ha: 0.50 mg/kg
- for 0.21 kg ai/ha: 0.13, 0.17, 0.3, 1.8 mg/kg
- for 0.28 kg ai/ha: 0.87, 5.5 mg/kg.

However, the five data points matching the US GAP (± 25%: application rates 0.17–0.21 kg ai/ha) are not sufficient to estimate a maximum residue level. Applying the principle of proportionality to the US data set, the residues in strawberries following scaling were:

- for 0.07 kg ai/ha (scaling factor 3) 0.07➔0.21 kg ai/ha: 0.54 mg/kg
- for 0.14 kg ai/ha (scaling factor 1.5) 0.14➔0.21 kg ai/ha: 0.29 mg/kg

- for 0.17 kg ai/ha (scaling factor 1.23) 0.17➔0.21 kg ai/ha: 0.62 mg/kg
- for 0.21 kg ai/ha (no scaling): 0.13, 0.17, 0.3, 1.8 mg/kg
- for 0.28 kg ai/ha (scaling factor 0.75) 0.28➔0.21 kg ai/ha: 0.65, 4.1 mg/kg.

The total range of residues in strawberry fruits (n = 9) was: 0.13, 0.17, 0.29, 0.30, 0.54, 0.62, 0.65, 1.8 and 4.1 mg/kg.

The application of proportionality resulted in nine data points being available to estimate a maximum residue level. Based on the total dataset, according to the US GAP, the Meeting estimated a maximum residue level of 6 mg/kg for hexythiazox in strawberries and an STMR of 0.54 mg/kg.

Hops, dry

In Germany hexythiazox is approved for use on hops as a single application at 0.0045 kg ai/hL with a PHI of 28 days. In corresponding supervised field trials conducted in Germany residues in dried hops were (n = 9): 0.61, 0.64, 0.71, 0.79, 0.79, 0.88, 0.93, 1.3 and 1.5 mg/kg.

The Meeting estimated a maximum residue level of 3 mg/kg for hexythiazox in hops (dried cones) and an STMR of 0.79 mg/kg.

Tea

For tea a GAP from India was reported involving two treatments at 0.025 kg ai/ha each with no specified PHI. Eight Indian supervised field trials carried out in 2008 and 2009 corresponding to this GAP were submitted.

The residue in dry tea green or black, fermented) after 0 days were (n = 8): 3.2, 3.7, 4.1, 4.5, 4.6, 4.8, 4.9 and 5.2 mg/kg.

The Meeting estimated a maximum residue level of 15 mg/kg for hexythiazox in tea (green or black, fermented) and an STMR of 4.55 mg/kg.

Fate of residues during processing

The Meeting received information on the fate of hexythiazox residues during the processing of strawberries to canned fruits and jam, of hops to beer and of tea to tea infusions. The processing factors and the derived STMR-P values are summarized as follows:

RAC	Processed commodity	Calculated processing factors	PF (median or best estimate)	RAC STMR, mg/kg	STMR-P mg/kg
Strawberry	Canned fruit	0.36, 0.4, 0.52, 0.99	0.46	0.54	0.248
	Jam	0.5, 0.54, 0.79, 1.1	0.665	0.54	0.359
Hops	Beer	< 0.03, < 0.04, < 0.05, < 0.06	< 0.045	0.79	0.036
Tea	Infusion, green tea	0.02(3), < 0.03, 0.03(5), < 0.04, 0.04(4), 0.05, 0.05, 0.06, 0.06, < 0.07, < 0.08, < 0.09, < 0.1, < 0.1, < 0.25	0.04	4.55	0.182
	Infusion, fermented tea	0.01, 0.02(6), 0.03(6), < 0.04, 0.05, 0.05, < 0.07, 0.07, < 0.08, < 0.09, < 0.1, < 0.1, < 0.25, 0.34	0.03	4.55	0.137

Residues in animal commodities

Since strawberries, hops or tea are not potential animal feed items, the recommendations for animal commodities as made by the 2009 Meeting are still valid.

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 and for IEDI assessment.

Definition of the residue (for compliance with MRL) for plant commodities: *hexythiazox*

Definition of the residue (for estimation of dietary intake) for plant commodities: *sum of hexythiazox and all metabolites containing the trans-5-(4-chlorophenyl)-4-methyl-2-oxothiazolidine-moiety (PT-1-3), expressed as hexythiazox*

Definition of the residue (for compliance with MRL and for estimation of dietary intake) for animal commodities: *sum of hexythiazox and all metabolites containing the trans-5-(4-chlorophenyl)-4-methyl-2-oxothiazolidine-moiety (PT-1-3), expressed as hexythiazox*

The residue is fat-soluble.

CCN	Commodity	MRL, mg/kg		STMR or STMR-P, mg/kg
		New	Previous	
DH 1100	Hops, dry	3	2 [a]	0.79
FB 0275	Strawberry	6	0.5 [a]	0.54
DT 1114	Tea, Green, Black (black, fermented and dried)	15		4.55
	Beer			0.036
	Green tea infusion			0.182
	Fermented tea infusion			0.137
	Strawberry, canned			0.248
	Strawberry jam			0.359

[a] The Codex MRL was retained under the four year rule awaiting the evaluation of data by the 2011 Meeting of the JMPR

DIETARY RISK ASSESSMENT

Long-term intake

The International Estimated Dietary Intakes (IEDIs) of hexythiazox were calculated for the 13 GEMS/Food cluster diets using STMRs and STMR-Ps estimated by the JMPR in 2009 and the current Meeting. The ADI is 0–0.03 mg/kg bw and the calculated IEDIs were 0–3 % of the maximum ADI. The results are shown in Annex 3 of the JMPR 2011 Report. The Meeting concluded that the long-term intakes of residues of hexythiazox, resulting from the uses considered by the JMPR, are unlikely to present a public health concern.

Short-term intake

The 2008 Meeting decided that an ARfD for hexythiazox is unnecessary and concluded that the short-term intake of residues resulting from the use of hexythiazox is unlikely to present a public health concern.

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