

TEBUCONAZOLE (189)

First draft prepared by Professor Eloisa Dutra Caldas, University of Brasilia, Brazil

EXPLANATION

Tebuconazole, a triazole fungicide, was last evaluated for residues in 2011 within the periodic re-evaluation program. It was listed by the 46th Session of CCPR (2014) for the evaluation of 2015 JMPR for additional data on residues. Residue data were submitted on banana and cucumber by the government of China, on ginseng by the government of Korea, and on asparagus, sunflower, onion, bulb and onion, green by the Government of the United States. The government of Korea also submitted storage stability and processing studies on ginseng.

METHOD OF ANALYSIS

The analytical method used to analyse fresh ginseng and processed products (dried and red ginseng and ginseng extracts) involves extraction with acetone, partition with chloromethane, cleaned up in a glass florisil column and quantification by GC-NPD. The method was satisfactorily validated for fresh ginseng at a LOQ of 0.03 mg/kg up to 0.5 mg/kg, and for processed commodities at a LOQ of 0.06 mg/kg up to 1 mg/kg (n=5, recovery in the range of 80–120% and CV< 10%).

Storage stability under frozen conditions

Samples of fresh and processed ginseng fortified with tebuconazole were stored at -20 °C up to 156 days (Kyung, 2014). The results are shown in Table 1.

Table 1 Stability of tebuconazole in samples of ginseng, stored at -20 °C

Matrix	Fortification level, mg/kg	Period of storage, days	Mean % remaining; n=5	Coefficient variation, %
Fresh ginseng	0.3	42	88.7	2.1
		52	74.7	2.5
Dried ginseng	0.6	142	101	2.4
		41	80.0	1.3
Red ginseng	0.6	156	80.4	3.0
		32	91.6	3.6
Water extract of dried ginseng	0.6	121	89.4	6.9
		44	81.4	1.7
Water extract of red ginseng	0.6	96	90.6	1.4
		25	93.2	1.9

USE PATTERNS

Table 2 shows the critical registered uses of tebuconazole in China, Republic of Korea and USA for crops relevant to this submission.

Table 2 Use patterns of tebuconazole in China, Republic of Korea and USA

Crop	Country	Formulation	Application				PHI (days)	
			Method	Max. rate, kg ai/ha	kg ai/hL	Number		Interval, days
Asparagus*	USA		Foliar	0.2		3/season	14	100 ^a or 180
Banana	China	ME/WP/WG	Foliar	0.27	0.03	3		42
		EC	Foliar	0.28	0.031	3		35
		EW	Foliar, bagged	0.25	0.025	3		14
Cucumber	China	SC	foliar	0.12		3	7-10	5
Ginseng	Rep. Korea	SC	foliar	0.13		3		21
Onion (dry bulb) and garlic	USA		Over/in furrow at planting	0.65		1/season	---	---
			Foliar	0.2		4/season	10-14	7

Crop	Country	Formulation	Application				PHI (days)	
			Method	Max. rate, kg ai/ha	kg ai/hL	Number		Interval, days
			In furrow plus two foliar ^b	0.65 +0.2		3/season	In furrow then 10-14	7
Onion (green)	USA		Foliar	0.2		4/season	10-14	7
Sunflower	USA		Foliar	0.2		max 0.49 kg ai/ha	14	50

* Apply to the developing ferns after harvest of spears is completed;

^a in California;

^b If over/in furrow treatment used, then only two foliar applications are allowed. Otherwise four foliar treatments maybe used.

RESIDUES RESULTING FROM SUPERVISED TRIALS ON CROPS

A total of 77 foliar supervised trials were conducted in China, Republic of Korea and USA. Trials conducted in Republic of Korea were not at GLP, but the report provided information on the field conditions and analytical method used in the study. Unless indicated, concurrent determinations of residues in untreated crops gave residues <LOQ. Residues of tebuconazole within 25% of GAP are underlined and were considered for estimation of STMR, HR and maximum residue levels. When residues in samples harvested at a later stage were higher than that at the critical PHI, they will be selected for the estimations.

Banana

A total of 22 foliar residue trials were conducted in banana (bagged and unbagged) in China in 2013. The samples were analysed by LC-MS/MS and validated at a LOQ of 0.01 mg/kg. The results are shown in Table 3.

Table 3 Results of residue trials conducted with tebuconazole in/on banana in China in 2013 using 3 applications of an EW formulation

Location	Banana variety	Application			Residues			Trial No.
		Method	kg ai/ha	kg ai/hL	Portion analysed	DAT, days	mg/kg	
Guangzhou, Guangdong	Baxi	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.53</u>	212-FT-01
					Pulp	35	<u>0.07</u>	
					Whole fruit	42	0.31	
					pulp	42	0.05	
	Baxi	bagged	0.25	0.028	Whole fruit	14	<0.01	
					Pulp	14	<0.01	
					Whole fruit	21	<0.01	
					pulp	21	<0.01	
Gaoyao, Guangdong	818 banana	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.10</u>	212-FT-02
					Pulp	35	<u>0.05</u>	
					Whole fruit	42	0.07	
					pulp	42	0.05	
	818 banana	bagged	0.25	0.028	Whole fruit	14	<0.01	
					Pulp	14	<0.01	
					Whole fruit	21	<0.01	
					pulp	21	<0.01	
Nanning, Guangxi	Williams B6	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.21</u>	212-FT-03
					Pulp	35	<u>0.03</u>	
					Whole fruit	42	0.13	
					pulp	42	0.03	
	Williams B6	bagged	0.25	0.028	Whole fruit	14	<0.01	
					Pulp	14	<0.01	
					Whole fruit	21	<0.01	
					pulp	21	<0.01	

Location	Banana variety	Application			Residues			Trial No.
		Method	kg ai/ha	kg ai/hL	Portion analysed	DAT, days	mg/kg	
Fangcheng Guangxi	Williams B6	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.17</u>	212-FT-03
					Pulp	35	<u>0.07</u>	
					Whole fruit	42	0.13	
					pulp	42	0.05	
	Williams B6	bagged	0.25	0.028	Whole fruit	14	<u><0.01</u>	
					Pulp	14	<u><0.01</u>	
					Whole fruit	21	<0.01	
					pulp	21	<0.01	
Zhangzhou Fujian	Tinbao	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.37</u>	212-FT-05
					Pulp	35	<u>0.16</u>	
					Whole fruit	42	0.17	
					pulp	42	0.08	
	Tinbao	bagged	0.25	0.028	Whole fruit	14	<u>0.09</u>	
					Pulp	14	<u>0.04</u>	
					Whole fruit	21	0.07	
					pulp	21	0.06	
Kaiyuan, Yunnan	Williams	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.74</u>	212-FT-06
					Pulp	35	<u>0.15</u>	
					Whole fruit	42	0.30	
					pulp	42	0.09	
	Williams	bagged	0.25	0.028	Whole fruit	14	<u>0.42</u>	
					Pulp	14	<u>0.10</u>	
					Whole fruit	21	0.43	
					pulp	21	0.05	
Chengmai Hainan	Baxi	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.13</u>	212-FT-07
					Pulp	35	<u>0.06</u>	
					Whole fruit	42	0.11	
					pulp	42	0.10	
	Baxi	bagged	0.25	0.028	Whole fruit	14	<u>0.03</u>	
					Pulp	14	<u><0.01</u>	
					Whole fruit	21	0.01	
					pulp	21	<0.01	
Guangzhou, Guangdong	Baxi	Non-bagged	0.28	0.03	Whole fruit	35	<u>0.54</u>	213-FT-01
					Pulp	35	<u>0.09</u>	
					Whole fruit	42	0.47	
					pulp	42	0.11	
	Baxi	bagged	0.28	0.03	Whole fruit	14	<u>0.15</u>	
					Pulp	14	<u><0.01</u>	
					Whole fruit	21	0.01	
					pulp	21	<0.01	
Zhaoqing, Guangdong	818 banana	Non-bagged	0.25	0.028	Whole fruit	35	<u>0.20</u>	213-FT-02
					Pulp	35	<u>0.07</u>	
					Whole fruit	42	0.16	
					pulp	42	0.04	
	818 banana	bagged	0.25	0.028	Whole fruit	14	<u>0.01</u>	
					Pulp	14	<u><0.01</u>	
					Whole fruit	21	<0.01	
					pulp	21	<0.01	
Nanning, Guangxi	Williams B6	Non-bagged	0.28	0.03	Whole fruit	35	<u>0.13</u>	213-FT-03
					Pulp	35	<u>0.02</u>	
					Whole fruit	42	0.07	
					pulp	42	0.03	
	Williams B6	bagged	0.28	0.03	Whole fruit	14	<u><0.01</u>	
					Pulp	14	<u><0.01</u>	
					Whole fruit	21	0.01	
					pulp	21	<0.01	
Fangchenggang, Guangxi	Williams B6	Non-bagged	0.28	0.03	Whole fruit	35	<u>0.19</u>	213-FT-04
					Pulp	35	<u>0.07</u>	
					Whole fruit	42	0.15	
					pulp	42	0.10	

Location	Banana variety	Application			Residues			Trial No.
		Method	kg ai/ha	kg ai/hL	Portion analysed	DAT, days	mg/kg	
	Williams B6	bagged	0.28	0.03	Whole fruit	14	0.03	
					Pulp	14	<0.01	
					Whole fruit	21	0.01	
					pulp	21	<0.01	

Onion (Dry Bulb)

Seventeen supervised residue trials were conducted in USA in 1999 and 2002. Samples were analysed by a GC-NPD validated method at a LOQ of 0.05 mg/kg. The results from analysis of treated samples are summarized in Table 4.

Table 4 Residues resulting from tebuconazole application to dry bulb onions in USA and Canada (Reports IR-4 PR)

Region, country	Onion variety	Application		DAT	Residue, mg/kg	Report No; trial
		No.	kg ai/ha			
New Jersey, USA	-	4 foliar	0.18	7	<0.05	07196; 07196.99-NJ10
Texas, USA	-	4 foliar	0.18	7	<0.05	07196; 07196.99-TX11
Ohio, USA	-	4 foliar	0.18	7	<0.05	07196; 07196.99-OH*02
Salinas, CA, USA	-	4 foliar	0.18	7	0.06	07196; 07196.99-CA*34
Holtville, CA, USA	-	4 foliar	0.18	6	0.08	07196; 07196.99-CA18
Washington, USA	-	4 foliar	0.18	7	<0.05	07196; 07196.99-WA03
Oregon, USA	-	4 foliar	0.18	7	0.09	07196; 07196.99-OR05
Colorado, USA	-	4 foliar	0.18	7	<0.05	07196; 07196.99-CO02
Texas, USA	Early White	1 furrow + 2 foliar	0.63 + 0.18	7	0.02, 0.03 (0.02)	08365; 08365.02-TX02
Colorado, USA	Vantage	1 furrow + 2 foliar	0.63 + 0.18	6	0.03, 0.04 (0.04)	08365; 08365.02-CO01
Salinas, CA, USA	Ruby	1 furrow + 2 foliar	2 + 0.19	6	0.02, 0.04	08365; 08365.02-CA*04
Holtville, CA, USA	Cebolla	1 furrow + 2 foliar	0.63 + 0.18	6	0.02, 0.10 (0.06)	08365; 08365.02-CA17
Washington, USA	Pinnacle	1 furrow + 2 foliar	0.63 + 0.18	7	<0.02 (2)	08365; 08365.02-WA*01
Lynden, Ontario, CAN	Yellow Sets	1 furrow + 2 foliar	0.63 + 0.21	7	0.03, 0.06 (0.04)	08365; 08365.02-ON05
Lynden, Ontario, CAN	Spanish Sets	1 furrow + 2 foliar	0.63 + 0.18	7	0.03 (2)	08365; 08365.02-ON06
St-Paul-d'Abbotsford, Quebec, CAN	Broedrebe	1 furrow + 2 foliar	0.63 + 0.18	5	0.02 (2)	08365; 08365.02-QC02
St-Paul-d'Abbotsford, Quebec, CAN	Stuttgart	1 furrow + 2 foliar	0.63 + 0.18	5	<0.02 (2)	08365.02-QC03

Onion (Green)

Three supervised residue trials were conducted in USA and Canada in 1999. Samples were analysed by a GC-NPD validated method at a LOQ of 0.05 mg/kg. The results from analysis of treated samples are summarized in Table 5.

Table 5 Residues resulting from tebuconazole application to green onions in USA and Canada (Report: IR-4 PR No. 07245)

Region, country	Application		DAT	Residue, mg/kg	Trial
	No.	kg ai/ha			
New Jersey, USA	4	0.19	8	<u>0.06</u>	07245.99-NJ11
Ontario, CA	4	0.19	7	<u>0.80</u>	07245.99-ON03
Oregon, USA	4	0.19	7	<u>0.10</u>	07245.99-OR11

Cucumber

Eleven residue trials were conducted in cucumber in China in 2014. The samples were analysed by LC-MS/MS and validated at a LOQ of 0.01 mg/kg, and the results are shown in Table 6.

Table 6 Results of residue trials conducted with tebuconazole in/on cucumber in China in 2014 using 3 applications of a SC formulation

Location	Banana variety	Application			Residues		Trial No.
		Method	kg a.i./ha	kg a.i./hL	DAT, days	mg/kg	
Changchun, Jilin	Shengchun	field	0.116	0.013	1	0.03	RP006-13Teb-01
					3	0.03	
					5	<u>0.02</u>	
					7	0.02	
	Shengchun	greenhouse	0.116	0.013	1	0.03	RP006-13Teb-02
					3	0.03	
					5	<u>0.03</u>	
					7	0.02	
Qingdao, Shandong	Huhuang	field	0.116	0.013	1	0.08	RP006-13Teb-04
					3	0.03	
					5	0.03	
					7	0.04	
	Budaojuncheng	greenhouse	0.116	0.013	1	0.06	RP006-13Teb-05
					3	0.07	
					5	<u>0.04</u>	
					7	0.02	
Hangzhou, Zhejiang	Zhexiu 302	field	0.116	0.013	1	0.08	RP006-13Teb-06
					3	0.06	
					5	<u>0.03</u>	
					7	0.02	
Changsha, Hunan	Shuyan 5	field	0.116	0.013	1	0.06	RP006-13Teb-07
					3	0.03	
					5	<u>0.02</u>	
					7	0.02	
Chongming, Yunnan	Bonei 2	field	0.116	0.013	1	0.06	RP006-13Teb-08
					3	0.04	
					5	<u>0.03</u>	
					7	0.02	
Guangzhou, Guangdong	Dadiao	field	0.116	0.013	1	0.17	RP006-13Teb-09
					3	0.12	
					5	<u>0.07</u>	
					7	0.03	
Zhangzhou, Fujian	Jinyou 48	field	0.116	0.013	1	0.21	RP006-13Teb-10
					3	0.19	
					5	<u>0.09</u>	
					7	0.03	
	Jinyou 10	greenhouse	0.116	0.013	1	0.12	RP006-13Teb-11
					3	0.07	
					5	<u>0.06</u>	
					7	0.03	
Hefei, Anhui	Jinyou 1	field	0.116	0.013	1	0.41	RP006-13Teb-13
					3	0.13	

Location	Banana variety	Application			Residues		Trial No.
		Method	kg a.i./ha	kg a.i./hL	DAT, days	mg/kg	
					5	0.11	
					7	0.04	

Ginseng

Nine supervised trials were conducted in Republic of Korea in ginseng in 2013 and 2014. Fresh harvested ginseng was rinsed with tap water to remove soil particle, ground and stored at -20 °C until analysis. The results are shown in Table 7.

Table 7 Residues of tebuconazole resulting from supervised trials on fresh ginseng conducted in Korea using SC formulation (Kyung, 2014)

Location, year	Application			PHI, days	Residues, mg/kg*
	Number	Rate, kg ai/ha	Water (L/ha)		
Yeongju, 2013	3	0.13	1900-2000	21	0.06 (3)
Geumsan, 2013	3	0.13	1900-2000	21	0.08 (3)
Jeungpyeong, 2013	3	0.13	1900-2000	21	0.06 (3)
Yeongju, 2014	3	0.13	1900-2000	21	0.03 (3)
Geumsan, 2014	3	0.13	1900-2000	21	0.04 (3)
Jeungpyeong, 2014	3	0.13	1900-2000	21	0.03 (3)
Yeongju, 2013-2014	6	0.13	1900-2000	21	0.03 (3)
Geumsan, 2013-2014	6	0.13	1900-2000	21	0.04 (3)
Jeungpyeong, 2013-2014	6	0.13	1900-2000	21	0.03 (3)

*Three replicate plots in each field. All samples were analysed in triplicates.

Asparagus

Eight supervised residue trials were conducted in USA in 2001. Tebuconazole was applied to the developing ferns after harvest of spears is completed. Samples were analysed by a LC-MS/MS validated method at a LOQ of 0.02 mg/kg. The results from analysis of treated samples are summarized in Table 8.

Table 8 Residues resulting from tebuconazole application to asparagus in USA (IR-4 PR No. 07991)

Region	Asparagus variety	Application			Residue, mg/kg	Trial
		No.	kg ai/ha	DAT		
Gonzales, CA	UC157	3	0.19	125	<0.02 (2)	07991.01-CA*54
Soledade, CA	UC157	3	0.19	125	<0.02 (2)	07991.01-CA*90
Stockton, CA	UC157	3	0.19	100	<0.02 (2)	07991.01-CA102
Holt, MI	Jersey Knight	3	0.19	184	<0.02 (2)	07991.01-MI14
East Lansing, MI	Jersey Giant	3	0.19	184	<0.02 (2)	07991.01-MI15
New Jersey	Jersey Giant	3	0.19	186	<0.02 (2)	07991.01-NJ16
Prosser, WA	Jersey Giant	3	0.19	199	<0.02 (2)	07991.01-WA23
Prosser, WA	Jersey Giant	3	0.19	197	<0.02 (2)	07991.01-WA24

Sunflower

Seven supervised residue trials were conducted in USA in 1997 and 1998. Samples were analysed by a GC-NPD validated method at a LOQ of 0.04 mg/kg. The results from analysis of treated samples are summarized in Table 9.

Table 9 Residues resulting from tebuconazole application to sunflowers in USA (IR-4 PR No. 06414)

Region, year	Application			Residue, mg/kg	Trial
	No.	kg ai/ha	DAT		
Courtland, KS 1997	2	0.25	55	<0.04 (2)	06414.97-KS01
	2	1.3	55	<0.04, 0.04	
Prosper, ND 1997	2	0.25	58	<0.04 (2)	06414.97-ND08
	2	1.3	58	0.06 (2)	
Amenia, ND 1998	2	0.25	57	<0.04 (2)	06414.98-ND19
	2	1.3	57	0.04, 0.06	
Carrington, ND 1998	2	0.25	48	<0.04 (2)	06414.98-ND20
	2	1.3	48	<0.04 (2)	
Minot ND 1998	2	0.25	56	<0.04, 0.04 (0.04)	06414.98-ND21
	2	1.3	56	0.05, 0.09	
Scandia, KS 1998	2	0.25	55	<0.04 (2)	06414.98-KS01
	2	1.3	55	0.09, 0.10	
Belleville, KS	2	0.25	55	<0.04	06414.98-KS02
	2	1.3	55	0.125, 0.128	

Processing studies

After rinsing with tap water, fresh ginseng was dried in hot air at 60 °C reaching a moisture content under 14% to yield dried ginseng. Washed fresh ginseng was steamed for 3 hours at 98 °C, dried at 65 °C to a moisture content of 50~55% and ground to yield red ginseng. Dried ginseng or red ginseng was cut into about 1 cm length and extracted three times in a refluxing extractor with water at 85 °C for about 18 hours. The water was evaporated reaching 72 °Brix to yield water extract of dried or red ginseng (Kyung, 2014). Residues in fresh and processed ginseng and the respective processing factors are shown in Table 10.

Table 10 Residues of tebuconazole in ginseng processed commodities and calculated processed factors

Matrix	Residues, mg/kg*	Processing factors	Residues, mg/kg*	Processing factors	Residues, mg/kg*	PF	Processing factors, best estimate underlined
Fresh ginseng	0.06 0.08 0.06	-	0.03 0.04 0.03	-	0.03 0.04 0.03	-	
Dried ginseng	0.12 0.15 0.12	2 1.88 2	0.08 0.10 0.09	2.67 2.5 3	0.08 0.10 0.07	2.67 2.5 2.33	1.88, 2 (2), 2.33, <u>2.5</u> (2), 2.67 (2) and 3
Red ginseng	<0.06 0.08 <0.06	<1 1 <1	<0.06 <0.06 <0.06	<2 <2 <2	<0.06 <0.06 <0.06	<2 <1.5 <2	<1 (2), <u>1</u> , <1.5 and <2 (5)
Water extract of dried ginseng	0.20 0.26 0.19	3.33 3.35 3.17	0.12 0.15 0.10	4 3.75 3.33	0.13 0.16 0.11	4.3 4 3.7	3.17, 3.33 (3), <u>3.35</u> , 3.7, 3.75, 4 and 4.3
Water extract of red ginseng	0.08 0.15 0.06	1.33 1.87 1	0.08 0.06 <0.06	2.67 1.5 <2	0.08 0.09 <0.06	2.67 2.25 <2	1, 1.33, 1.5, <u>1.87</u> , 2.25, 2.67 (2), <2 (2)

*Three replicate plots in each field. All samples were analysed in triplicates.

APPRAISAL

Tebuconazole a triazole fungicide was last evaluated for residues in 2011 within the periodic re-review programme. It was listed by the Forty-sixth Session of CCPR (2014) for the evaluation in the 2015 JMPR for additional data on residues. Data was submitted for banana, cucumber, ginseng, asparagus, sunflower, onion bulb; and onion, green. The residue definition for plant commodities for enforcement and risk assessment purposes is tebuconazole. The ADI for tebuconazole is 0-0.03 mg/kg bw and the ARfD is 0.3 mg/kg bw.

Method of analysis and stability of residues

A GC-NPD analytical method was satisfactorily validated for the analysis of tebuconazole in fresh ginseng at a LOQ of 0.03 mg/kg up to 0.5 mg/kg and for processed commodities at a LOQ of 0.06 mg/kg up to 1 mg/kg.

Tebuconazole residues were shown to be stable under frozen conditions (at -20 °C) in fresh ginseng for at least 52 days; in dried ginseng for at least 142 days; in red ginseng for at least 96 days; and in ginseng water extracts for at least 121 days.

The sample storage period used in the trials for ginseng and other commodities evaluated by the present Meeting was within the storage period that guaranteed that the residues in the samples were not degraded.

Residues resulting from supervised trials

Banana

In China, the critical GAPs for tebuconazole in banana is 3 × 0.28 kg ai/ha and 35 days PHI for unbagged banana and 3 × 0.25 kg ai/ha and 14 days PHI for bagged banana.

In eleven trials conducted with unbagged banana in China according to GAP, residues in the whole fruit were 0.10, 0.13 (2), 0.17, 0.19, 0.20, 0.21, 0.37, 0.53, 0.54 and 0.74 mg/kg. Residues in the pulp were 0.02, 0.03, 0.05, 0.06, 0.07 (4), 0.09, 0.15 and 0.16 mg/kg.

In eleven trials conducted with bagged banana according to GAP, residues in the whole fruit were < 0.01 (5), 0.01, 0.03 (2), 0.09, 0.15 and 0.42 mg/kg. Residues in the pulp were < 0.01 (9), 0.04 and 0.10 mg/kg.

Residues from trials conducted with unbagged banana gave the highest residues. The Meeting estimated a maximum residue level of 1.5 mg/kg, a STMR of 0.07 mg/kg and a HR of 0.16 mg/kg for tebuconazole in banana. These estimates replace the previous recommendations for tebuconazole in banana.

Onion, bulb and shallots

In the USA tebuconazole can be applied in onion and shallots at 4 foliar applications at 0.19 kg ai/ha or one furrow at 0.65 kg ai/ha plus 2 foliar at 0.19 kg ai/ha. The PHI is 7 days for both. In eight trials conducted in USA at the foliar GAP, residues were < 0.05 (5). 0.06. 0.08 and 0.09 mg/kg. In five trials conducted using furrow plus foliar application, residues were < 0.02, 0.02, 0.04 (2), and 0.06 mg/kg.

The Meeting agreed that the foliar only trials gave the highest residues and estimated a maximum residue level of 0.15 mg/kg, an STMR of 0.055 mg/kg and an HR of 0.09 mg/kg for tebuconazole in onion, bulb. These estimates replace the previous recommendation for tebuconazole in onion bulb.

The Meeting agreed to extrapolate this estimate to shallots.

Spring onion (Onion, green)

In the USA, tebuconazole can be applied in onions, green with 4 foliar applications at 0.19 kg ai/ha and a 7 day PHI. In three trials conducted in the USA and Canada in 1999 at GAP, residues were 0.06, 0.10 and 0.80 mg/kg.

The Meeting estimated a maximum residue level of 2 mg/kg, a STMR of 0.10 mg/kg and an HR of 0.8 mg/kg for tebuconazole in spring onion.

Cucumber

GAP for tebuconazole in cucumber in China is 3×0.12 kg ai/ha and 5 days PHI. In eight field trials conducted in the country according to GAP, residues were 0.02 (2), 0.03, 0.04, 0.06, 0.07, 0.09 and 0.11 mg/kg. In three protected trials residues were 0.03, 0.04 and 0.06 mg/kg.

Based on the residue data from field trials, the Meeting estimated a maximum residue level of 0.2 mg/kg, an STMR of 0.05 mg/kg and an HR of 0.11 mg/kg for tebuconazole in cucumber. These estimates replace the previous recommendations for tebuconazole in cucumber.

Ginseng

Six trials were conducted with tebuconazole in ginseng in Korea according to GAP (3×0.13 kg ai/ha; 21 days PHI). giving residues in fresh ginseng of 0.03 (2), 0.04, 0.06 (2) and 0.08 mg/kg. Three other trials conducted with 6 applications gave similar results.

The Meeting estimated a maximum residue level of 0.15 mg/kg, an STMR of 0.05 mg/kg and an HR of 0.08 mg/kg for tebuconazole in ginseng.

Asparagus

In the USA the critical GAP for tebuconazole in asparagus is to apply up to 3×0.19 kg ai/ha to the developing ferns after harvest of spears is completed; the PHI is 100 days. In three trials conducted in USA at GAP gave residues of $< \underline{0.02}$ (3) mg/kg.

The Meeting estimated a maximum residue level of 0.02* mg/kg and an STMR and HR of 0.02 mg/kg for tebuconazole in asparagus.

Sunflower

In the USA tebuconazole can be applied to sunflowers at a maximum rate of 0.49 kg ai/ha with a 50 day PHI. In seven trials conducted in the USA at GAP residues were < 0.04 (6) and 0.04 mg/kg.

The Meeting estimated a maximum residue level of 0.1 mg/kg and an STMR of 0.04 mg/kg for tebuconazole in sunflower seed.

Fate of residues in processing

Nine processing studies were conducted with ginseng yielding dried ginseng ($\leq 14\%$ water content), red ginseng (50–55% water content) and water extracts of dried and red ginseng. Median processing factors were 2.5 for dried ginseng, 1.0 for red ginseng, 3.35 for dried ginseng extract and 1.87 for red ginseng extract.

Using the estimated maximum residue level and STMR for ginseng (0.15 and 0.05 mg/kg, respectively) and the processing factor for dried ginseng (2.5), the Meeting estimated a maximum residue level of 0.4 mg/kg and an STMR of 0.125 mg/kg for ginseng, dried including red ginseng.

Using the processing factor for water extract of dried ginseng (3.35), the Meeting estimated a maximum residue level of 0.5 mg/kg and an STMR of 0.17 mg/kg for ginseng extracts.

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 dietary intake assessment.

CCN	Commodity	Recommended Maximum residue level (mg/kg)		STMR or STMR-P mg/kg	HR or HR-P mg/kg
		New	Previous		
VS 0621	Asparagus	0.02*		0.02	0.02
FI 0327	Banana	1.5	0.05	0.07	0.16
VC 0424	Cucumber	0.2	0.15	0.05	0.11
VR 0604	Ginseng	0.15		0.05	0.08
DM 0604	Ginseng, extracts	0.5		0.17	
DV 0604	Ginseng, dried including red ginseng	0.4		0.125	
VA 0385	Onion, Bulb	0.15	0.1	0.055	0.09
VA 0388	Shallot	0.15		0.055	0.09
VA 389	Spring onion	2		0.1	0.8
SO 0702	Sunflower seed	0.1		0.04	

DIETARY RISK ASSESSMENT

Long-term intake

The IEDI of tebuconazole based on the STMRs estimated by this and previous Meetings for the 17 GEMS/Food regional diets were 2–9% of the maximum ADI of 0.03 mg/kg bw (see Annex 3 of the 2015 Report). The Meeting concluded that the long-term dietary intake of residues of tebuconazole is unlikely to present a public health concern.

Short-term intake

An ARfD for tebuconazole is 0.3 mg/kg bw. The Meeting estimated the International Estimated Short-Term Intake (IESTI) of propiconazole for the commodities for which STMR, HR and maximum residue levels were estimated by the current Meeting. The results are shown in Annex 4. The IESTI represented a maximum of 5% of the ARfD. The Meeting concluded that the short-term intake of tebuconazole residues from uses considered by the current Meeting was unlikely to present a public health concern.

REFERENCES

Author, year	Study or trial number	Study
Corley, J. 2006		Tebuconazole: Magnitude of the Residue on Asparagus; Author: Johannes Corley, IR-4 Project HQ, Rutgers, The State University of New Jersey, Princeton, NJ 08540; dated: 6 February 2006. GLP, not published
Dong, F., 2014	RP006-13Teb-01, RP006-13Teb-02	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Shuangliao and Changchun, Jilin Province, P.R. China. Institute of Plant Protection, Chinese Academy Agricultural Sciences GLP, not published
Dong, F., 2014	RP006-13Teb-04, RP006-13Teb-05	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Jimo, Qingdao, Shandong Province, P.R. China. Institute of Plant Protection, Chinese Academy Agricultural Sciences. GLP, not published
Dong, F., 2014	RP006-13Teb-06	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Hangzhou, Zhejiang Province, P.R. China Institute of Plant Protection, Chinese Academy Agricultural Sciences. GLP, not published
Dong, F., 2014	. RP006-13Teb-07	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Changsha, Hunan Province, P.R. China Institute of Plant Protection, Chinese Academy Agricultural Sciences. GLP, not published
Dong, F., 2014	RP006-13Teb-08	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Chongming, Yunnan Province, P.R. China. Institute of Plant Protection, Chinese Academy Agricultural Science. GLP, not published

Dong, F., 2014	RP006-13Teb-09	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Guangzhou, Guangdong Province, P.R. China.. Institute of Plant Protection, Chinese Academy Agricultural Sciences. GLP, not published
Dong, F., 2014	RP006-13Teb-10, RP006-13Teb-11	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Zhangzhou, Fujian Province, P.R. China. Institute of Plant Protection, Chinese Academy Agricultural Sciences. GLP, not published
Dong, F., 2014	RP006-13Teb-13	Determination of the residues of tebuconazole on cucumber after spraying of 430g/L tebuconazole SC in Hefei, Anhui Province, P.R. China. Institute of Plant Protection, Chinese Academy Agricultural Sciences. GLP, not published
Kyung, K. S., 2014	MFDS 2013- 17889	Magnitude of tebuconazole residues in ginseng and its processing products in Korea. Chungbuk National University. Non - GLP. Unpublished
Liu, Y, 2013	212-FT-01	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EW in Panyu, Guangzhou, Guangdong Province, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China.. GLP, not published
Liu, Y, 2013	212-FT-02	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EW in Gaoyao, Zhaoqing, Guangdong Province, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	212-FT-03	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EW in Nanning, Guangxi, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	212-FT-04.	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EW in Fangchenggang, Guangxi, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	212-FT-05.	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EW in Zhangzhou in Fujian Province, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	212-FT-06	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EW in Kaiyuan, Yunnan, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	212-FT-07	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EW Chengmai, Hainan, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	213-FT-01	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EC in Panyu, Guangzhou, Guangdong Province, P.R. China.. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	213-FT-02	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EC in Gaoyao, Zhaoqing, Guangdong Province, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	213-FT-03	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EC in Nanning, Guangxi, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Liu, Y, 2013	213-FT-04	Determination of the residues of tebuconazole on banana after spraying of 250g/L tebuconazole EC in Fangchenggang, Guangxi, P.R. China. Institute for Control of Agrochemicals, Ministry of Agriculture. P. R. China. GLP, not published
Thompson, D., 2005		Tebuconazole: Magnitude of the Residue on Onion (Dry); Author: David Thompson, IR-4 Project HQ, Rutgers, The State University of New Jersey, Princeton, NJ 08540; dated: 28 April 2005. GLP, not published
Thompson, D., 2006		Tebuconazole: Magnitude of the Residue on Onion (Dry); Author: David Thompson, IR-4 Project HQ, Rutgers, The State University of New Jersey, Princeton, NJ 08540; dated: 15 February 2006 GLP, not published
Thompson, D., 2006		Tebuconazole: Magnitude of the Residue on Onion (Green); Author: David Thompson, IR-4 Project HQ, Rutgers, The State University of New Jersey, Princeton, NJ 08540; dated: 19 July 2006. GLP, not published
Corley, J., 2000		Tebuconazole: Magnitude of the Residue on Sunflower; Author: Johannes Corley, IR-4 Project HQ, Rutgers, The State University of New Jersey, Princeton, NJ 08540; dated: 17 April 2000. GLP, not published
