NOVALURON (217)

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EXPLANATION

Novaluron is an insecticide of the diflubenzoylureas class of insect-growth regulators (IGR). IGRs kill insects through the disruption of the normal growth and development processes of immature insects. Novaluron acts as an insecticide mainly by ingestion, but has some contact activity. It was evaluated for the first time by JMPR in 2005 (T, R). The compound was listed for additional MRLs by 2010 JMPR at the Forty-first Session of the CCPR

The manufacturer has submitted supervised crop field trial studies to support additional MRLs for the following commodities: broccoli, cabbage, Swiss chard, mustard greens, tomato (increase MRL), cherry, peach, plum, blueberry, and sugar cane. The supervised crop field trials are supplemented by the relevant GAPs, analytical methods, storage stability data, processing studies, and a poultry feeding study.

The residue definition for compliance with MRLs and for estimation of dietary intake in plant and animal commodities is novaluron. The residue is fat soluble.

RESIDUE AND ANALYTICAL ASPECTS

Analytical methods

The analytical methods used in the supervised trials are based on the two methods previously included in the JMPR Evaluation in 2005: GC/ECD or HPLC with UV detection. A variation of the GC method uses a mass selective detector (MSD). A variation of the HPLC method uses LC/MS/MS. Descriptions of modifications to these methods for determination of novaluron in the crops of this submission are provided in Table 1.

Table 1 Summary of methods used for determination of novaluron in supervised field trials

RIM 258 Peach			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description:	After removal of the pit, the sample was homogenized with methanol: water, 70:30 and filtered. Sodium chloride solution and hexane were added to the aqueous phase. The mixture was centrifuged and the hexane layer cleaned up on an NH2 SPE cartridge, eluted with diethyl ether/ethyl acetate 50/50 and solvent evaporated under nitrogen. Novaluron residues were then determined by GC with ECD detection.		
RIM250 Cherry			
Analyte:	Novaluron	LC-MS-MS	LOQ = 0.05 mg/kg
Description	Novaluron residues were extracted from pitted cherry samples with methanol. The extracts were analysed using liquid chromatography with tandem mass spectrometric detection (LC-MS-MS)		
RIM 255 Plum			
Analyte:	Novaluron	LC-MS-MS	LOQ = 0.05 mg/kg
Description	Novaluron residues were extracted from pitted plum samples with methanol: water (70: 30, v:v) and filtered. The extracts were analysed using liquid chromatography with tandem mass spectrometric detection (LC-MS-MS)		
RIM 256 Blueberry; RIM 277 Strawberry			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	Residues of novaluron were extracted from samples by blending in methanol/water solution (70: 30, v:v) and after filtration, the extract was evaporated to remove all methanol. The analyte was partitioned into ethyl acetate followed by a solid phase extraction cleanup using a NH_2 column. Quantitation was achieved by GC with EC detection.		

RIM 193 Broccoli and Cabbage			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	The sample was homogenized with methanol: water (70:30, v:v) and filtered. Sodium chloride solution and hexane were added to the aqueous phase. The mixture was centrifuged and the hexane layer cleaned up on a NH_2 SPE cartridge, eluted with diethyl ether/ethyl acetate 50/50 and solvent evaporated. Novaluron residues are then determined by GC with ECD detection.		
RIM 249 Cucumber			
Analyte:	Novaluron	LC-MS-MS	LOQ = 0.05 mg/kg
Description	Novaluron residues were extracted from cucumber samples with methanol: water (70: 30, v:v) and filtered. The extracts were analysed using liquid chromatography with tandem mass spectrometric detection (LC-MS-MS).		
RIM 275 Cantaloupe and RIM 276 Summer Squash			
Analyte:	Novaluron		LOQ = 0.05 mg/kg
Description	Residues of novaluron were extracted from samples by blending in a methanol: water solution (70:30, v:v). After filtration, the extract was evaporated to remove all methanol. The analyte was partitioned into ethyl acetate followed by a solid phase extraction cleanup using a NH_2 column. Quantitation was achieved by GC with EC detection.		
RIM 273 Pepper			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	Residues of novaluron were extracted from the sample using methanol: water (70: 30, v: v) solution. After filtration, the extract was partitioned with hexane. The hexane extract was concentrated and then cleaned up by a solid phase extraction column (NH2-SPE). The final extract was concentrated to an appropriate volume and analysed by GC with EC detection.		
RIM 243 Tomato and Its Processed Commodities and RIM 257 Mustard Greens			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	Novaluron residues were extracted from tomato samples with methanol: water (70:30, v:v) and the extract filtered. After concentration under pressure, sodium chloride was added and the novaluron repeatedly partitioned into hexane. The hexane was roto-evaporated to reduce the volume and cleaned up using a preconditioned NH2-SPE cartridge, eluting the residues with diethyl ether: ethyl acetate (50:50, v:v) and acetone: hexane (50:50, v:v) solvents. Solvent was then evaporated and the residue reconstituted in ethyl acetate. The method for tomato samples was slightly revised for tomato paste by addition of celite into the sample during extraction to aid in the subsequent filtration Quantitation was achieved by GC with EC detection.		
RIM 280 Swiss Chard			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	Swiss chard samples were homogenized with methanol: water (70:30, v:v) and filtered. The extract was evaporated and partitioned with hexane three times. The extract was then concentrated and analysed by GC with ECD detection.		
RIM 278 Common Beans			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	Samples were homogenized with methanol: water (70: 30, v:v) and the mixture filtered. After reducing the extract volume, sodium chloride and hexane were added to the aqueous phase and shaken vigorously. The hexane layer was separated and evaporated to a volume of 2 to 4 mL and analysed for residues of novaluron by GC with EC detection.		
RIM 279 Dry Beans			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	Samples were extracted with methanol: water (70:30, v:v) and filtered. The extract was evaporated to aqueous portion and partitioned with hexane three times. The extract was cleaned up with a NH2-SPE cartridge and eluted with diethyl ether: ethyl acetate (50:50, v:v) followed by acetone: hexane (50:50, v:v). The extract was concentrated to dryness, redissolved with hexane and analysed by GC with ECD detection.		
RIM 282 Sugar cane			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg

Description	Sugar cane samples were extracted with methanol: water (70: 30, v: v) and after removal of the methanol, sodium chloride was added. Novaluron was repeatedly partitioned into hexane, where the extracts were combined and concentrated to dryness. The residue was reconstituted in hexane and the sample passed through an NH2-SPE cartridge for clean-up. The novaluron containing fraction was concentrated under vacuum and reconstituted in acetone for GC analysis using EC detection.		
RIM 282 Sugar cane			
Analyte:	Novaluron	GC-ECD	LOQ = 0.05 mg/kg
Description	Molasses and processed sugar were dissolved in sodium chloride solution before extraction with hexane. The hexane fraction was concentrated to a small volume and the sample cleaned up in an NH2-SPE cartridge. The novaluron containing fraction was concentrated under vacuum and reconstituted in ethyl acetate for analysis using GC with EC detection.		

A summary of the method validation and concurrent recoveries are provided in Table 2. Average method and concurrent recoveries were all within the range of 70–120%, with relative standard deviations (RSD) at or below 20%.

Table 2 Method validation recoveries and concurrent recoveries for commodities fortified with Novaluron

Commodity	Fortification mg/kg	n	Range Recovery (%)	Mean recovery (%)	% RSD	Method	Reference
METHOD VALIDATION							
Peach	0.05- 5.0	9	92-120	106	9.4	GC-ECD	RIM 258
Cherry	0.05- 5.0	9	92-116	104	7.0	LC-MS-MS	RIM 250
Plum	0.05- 5.0	9	89-102	95	4.5	LC-MS-MS	RIM-255
Blueberry	0.05- 5.0	9	98-113	103	6.0	GC-ECD	RIM 256
Strawberry	0.05- 5.0	7	86-116	103	9.2	GC-ECD	RIM 277
Broccoli	0.05- 25	6	73-103	86	14.2	GC-ECD	RIM 193
Cabbage	0.05- 25	6	73-103	86	14.2	GC-ECD	RIM 193
Cucumber	0.05- 25	9	93-108	97	4.6	LC-MS-MS	RIM 249
Cantaloupe	0.05- 5.0	9	99-120	109	6.6	GC-ECD	RIM 275
Squash, summer	0.05- 5.0	9	90-111	109	6.7	GC-ECD	RIM 276
Pepper	0.05- 5.0	9	77-113	95	13	GC-ECD	RIM 273
Tomato	0.05- 5.0	8	62-109	86	20	GC-ECD	RIM 243
Tomato puree	0.05-5.0	9	67-75	72	5.1	GC-ECD	RIM 243
Tomato paste	0.05-5.0	9	66-96	85	13.3	GC-ECD	RIM 243
Mustard greens	0.05-5.0	9	61-91	83	13.2	GC-ECD	RIM 257
Swiss chard	0.05-10	12	70-110	94	12.5	GC-ECD	RIM 280
Snap beans (pods)	0.05-5.0	9	68-104	83	16.9	GC-ECD	RIM 278
Snap beans (foliage)	0.05-5.0	9	80-112	96	12.6	GC-ECD	RIM 278
Dry beans	0.05-5.0	9	78-104	87	10.7	GC-ECD	RIM 279
Sugar cane	0.05-25	9	66-104	92	11.6	GC-ECD	RIM 228
Molasses	0.05-25	9	74-106	94	12.2	GC-ECD	RIM 228
Refined sugar	0.05-25	9	80-98	90	6.6	GC-ECD	RIM 228
CONCURRENT RECOVERIES							
Peach	0.05-5.0	19	80-116	97	8.7	GC-ECD	RIM 258
Plum	0.05-5.0	17	83-109	97	7.8	LC-MS-MS	RIM 255
Blueberry	0.05-5.0	9	94-119	109	7.4	GC-ECD	RIM 256
Strawberry	0.05-5.0	20	84-118	98	10.3	GC-ECD	RIM 277
Broccoli	0.05-1.0	16	76-100	90	9.4	GC-ECD	RIM 193
Cabbage	0.05-1.0	14	79-109	94	9.4	GC-ECD	RIM 193
Cucumber	0.05-25	6	71-106	89	13.3	LC-MS-MS	RIM 249
Cantaloupe	0.05-0.5	10	78-101	96	8.4	GC-ECD	RIM 275
Squash, summer	0.05	7	85-101	96	10.9	GC-ECD	RIM 276
Pepper	0.05	15	74-119	103	13.8	GC-ECD	RIM 273
Tomato	0.05-5.0	24	67-120	86	18.7	GC-ECD	RIM 243
Mustard greens	0.05-15	13	70-95	81	12.5	GC-ECD	RIM 257
Swiss chard	0.05-5.0	6	68-96	81	17.1	GC-ECD	RIM 280
Snap beans (pods)	0.05-0.5	17	70-110	83	12.1	GC-ECD	RIM 278
Snap beans (foliage)	0.05-30	17	72-114	88	12.7	GC-ECD	RIM 278
Dry beans	0.05-0.5	16	72-118	95	12.6	GC-ECD	RIM 279

Commodity	Fortification mg/kg	n	Range Recovery (%)	Mean recovery (%)	% RSD	Method	Reference
Sugar cane	0.05-0.5	10	70- 99	83	10.3	GC-ECD	RIM 228

Stability of residues in stored analytical samples

The JMPR Report (2005) listed the following intervals of stability for frozen commodity samples: apple, 12 months; pear, 158 days; apple juice, 99 days; potato, 12 months; cotton seed, 160 days; broccoli, 6 months; tomato, 12 month; orange processed fractions, 8 months. Minimum storage stability intervals of 12 months for high water content samples, 5 months for high oil content samples, 8 months for acidic commodities, and 12 months for high starch commodities are indicated.

In the crop field trial studies reported, except cherry, plum, broccoli, cabbage, cucumber, and sugar cane, a control sample was fortified and stored frozen with the treated field samples. The fortified control was analysed at the time of analysis of the field samples. However, no zero day or intermediate fortified samples were analysed. The percentages remaining were in the 71–118% range.

All crop field trial samples were analysed within periods of demonstrated frozen storage stability.

USE PATTERN

All supervised trials reported submitted to this Meeting were conducted in the United States and Canada. GAPs relevant to the supervised field trial studies are summarised in Table 3. No labels were provided for Canada. The trials were conducted with US: Rimon® 0.83 EC, an emulsifiable concentrate formulation containing 0.83 lbs/gallon or 100 g/L novaluron, (referred to in this document as 100 EC) or with Rimon® 10SC, a suspension concentrate formulation containing 0.83 lbs/gallon or 100 g./L novaluron (referred to in this document as 100 SC).

Table 3 Summary of USA GAPs (Labels) for Use of Novaluron on Food and Feed Crops [a]

Crop	Formulation (g ai/L)	Application						PHI (days)
		Method [b]	kg ai/ha	Water L/ha	kg ai/hL	No. or Max seasonal rate (kg ai/ha/Season)		
Beans, snap	100 EC	Foliar	0.044-0.087			3	0.26	1
Beans, dry	100 EC	Foliar	0.044-0.087			3	0.26	1
Bush berries, including: blueberry, currant, elderberry, gooseberry, and huckleberry)	100 EC	Foliar	0.245-0.218			3	0.65	8
Head and stem brassicas: broccoli, Chinese broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, Chinese mustard, kohlrabi	100 EC	Foliar	0.044-0.087	Min 94 ground; 19 aerial		3 (2 for certain pests)	0.17	7

Crop	Formulation (g ai/L)	Application						PHI (days)
		Method [b]	kg ai/ha	Water L/ha	kg ai/hL	No. or Max seasonal rate (kg ai/ha/Season)		
Fruiting vegetables – cucurbits: Balsam apple, balsam pear, chayote, edible gourd, Chinese waxgourd, Cantaloupe, cucumber, Chinese cucumber, gherkin, melon, musk melon, bittermelon, pumpkin, squash, summer squash, winter squash, watermelon	100 EC	Foliar	0.065-0.087	Min 94 ground; 19 ground		3	0.26	1
Fruiting vegetables other than cucurbits: Tomato (including bush and tree tomato and glass house), peppers, eggplant, ground cherry, tomatillo, pepino, okra, Goji berry, garden huckleberry, rosella, sunberry, cocona, martynia, naranjilla	100 EC; 10 SC	Foliar (field only, except tomato)	0.065-0.087	Min 94 ground; 19 aerial		3	0.26	1
Leafy brassica greens: broccoli raab, Chinese cabbage, collards, kale, mizuna, mustard greens, mustard spinach, rape greens	100 EC	Foliar	0.044-0.087	Min 94 ground; 19 aerial		3	0.26	7
Stone fruits: Apricots, cherry (sweet and tart), nectarines, peaches, plums, prune plums	100 EC	Foliar	0.145-0.363	Ground: min. 7 hl/ha for trees ≤ 3 m; 9.4 hl/ha for trees > 3m.		3	1.1	8
Strawberry	100 EC	Foliar (California only)	0.067-0.087			3	0.26	1
Sugar cane	100 EC	Foliar	0.065-0.087	Min 94 ground; 19 aerial		5	0.44	14
Swiss chard	100 EC	Foliar	0.065-0.087			3	0.26	1

[a] Includes only GAPs related to the supervised field trials reviewed herein,

[b] Airblast, ground boom, aerial, as appropriate.

RESIDUES RESULTING FROM SUPERVISED FIELD TRIALS

Supervised field trial reports were received for the following commodities:

Crop Group	Commodity	Table No.
Stone Fruits	Peach	4
	Plum	5

Crop Group	Commodity	Table No.
	Cherry	6
Berries and other small fruits	Blueberry	7
	Strawberry	8
Brassica	Broccoli	9
	Cabbage	10
Fruiting vegetables, Cucurbit	Cucumber	11
	Cantaloupe	12
	Summer Squash (Zucchini)	13
Fruiting vegetables, other than Cucurbits	Pepper	14
	Tomato	15
Leafy vegetables	Mustard Green	16
	Swiss Chard	17
Legume vegetables	Common Bean	18
Pulses	Beans (dry)	19
Grasses for sugar or syrup production	Sugar cane	20
Legume animal feeds	Bean forage (green)	21

The maximum residue from each trial judged to be within +/- 25% of maximum GAP is underlined and considered in the derivation of a maximum residue level, STMR, and/or highest residue estimate.

Stone Fruits

Peach (Samoil, 2007, RIM 258)

A total of sixteen supervised trials were conducted on peaches in the United States and Canada during the 2005 season, following the GAP in the US. Each field trial consisted of one untreated control and one treated plot. A different variety of peach was used in each trial. At each trial site, three foliar directed applications of an emulsifiable concentrate formulation containing 100 g/L novaluron were made, except in the Texas trial where the slow growth of peaches resulted in two additional applications for a total of five.

Table 4 Residues from the foliar application of novaluron to Peaches (IR-4 PR 09047)

PEACH Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA (Stone fruit)	*100 EC*	*0.145- 0.363*		*1.1*	*3*	*8*	
09047.05-CA139 Parlier, CA USA, 2005 (Flavorcrest)	100 EC	0.375-0.383	645-673	1.14	3	7	0.44, <u>0.66</u>
09047.05-CA140 Parlier, CA USA, 2005 (O'Henry)	100 EC	0.372-0.389	1029-1066	1.14	3	7	<u>0.41</u>, 0.38

PEACH Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
09047.05-CA141 Porterville, CA USA, 2005 (Fay Alberta)	100 EC	0.366-0.374	664-917	1.11	3	7	0.25, 0.20
09047.05-CA166 Madera, CA USA, 2005 (Last Chance)	100 EC	0.371-0.374	1076-1085	1.12	3	1 4 7 10	0.73, 0.77 0.62, 0.52 0.80, 0.51 0.92, 0.68
09047.05-NC23 Jackson Springs, NC, USA, 2005 (Contender)	100 EC	0.374-0.381	1010-1029	1.14	3	7	0.90, 0.72
09047.05-NC24 Jackson Springs, NC, USA, 2005 (Emery)	100 EC	0.374-0.382	1029-1048	1.13	3	6	2.1, 1.0
09047.05-NJ29 Bridgeton, NJ USA, 2005 (Dixie Red)	100 EC	0.368-0.372	698-879	1.11	3	7	0.42, 0.34
09047.05-NJ30 Bridgeton, NJ USA, 2005 (Suncrest)	100 EC	0.371-0.389	926-935	1.14	3	7	1.0, 0.98
09047.05-NY19 Sodus, NY USA, 2005 (Harcrest)	100 EC	0.373-0.379	935-954	1.13	3	7	1.0, 0.77
09047.05-TN12 Crossville, TN USA, 2005 (Reliance)	100 EC	0.368-0.381	692-730	1.13	3	7	0.20, 0.18
09047.05-TX31 Fredericksburg, TX, USA, 2005 (Hawthorne)	100 EC	0.372-0.373	514	1.86	5	6	2.4, 2.4
09047.05-BC06 Summerland, BC Canada, 2005 (Fairhaven)	100 EC	0.374-0.383	921-953	1.14	3	6	0.49, 0.58
09047.05-ON21 Jordan Station, ON, Canada, 2005 (Harrow Diamond)	100 EC	0.382-0.389	1025-1045	1.16	3	7	0.47, 0.49
09047.05-ON22 Jordan Station, ON, Canada, 2005 (Loring)	100 EC	0.361-0.368	967-987	1.10	3	7	0.52, 0.58
09047.05-ON23 Jordan Station, ON, Canada, 2005 (Harmony)	100 EC	0.387-0.390	1038-1047	1.17	3	7	0.42, 0.27
09047.05-ON24 Jordan Station, ON, Canada, 2005 (Babygold 5)	100 EC	0.368-0.375	987-1004	1.12	3	7	0.70, 0.38

Plum (Samoil, 2008, RIM 255)

Eleven supervised trials were conducted on plums in the United States and Canada during the 2006 season, following the GAP in the US for stone fruits. Each field trial consisted of one untreated

control and one treated plot. A different variety of plum was used in each trial. At each trial site, three foliar directed applications of an emulsifiable concentrate formulation containing 100 g/L novaluron were made, except in the CA18 trial where a fourth application was made because the fruits were not mature enough for harvest after 3 applications. Application rates ranged from at 0.371–0.380 kg ai/ha per application at 10- to 14-day intervals, for a total seasonal application rate of 1.12 to 1.15 kg ai/ha. The seasonal total for the CA18 trial was 1.51 kg ai/ha.

Table 5 Residues from the foliar application of novaluron to plums

PLUM Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA *(Stone fruit)*	*100 EC*	*0.145- 0.363*		*1.1*	*3*	*8*	
09048.06-CA14 Winters, CA USA, 2006 (French prune)	100 EC	0.380-0.382	963-991	1.14	3	8	0.47, 0.42
09048.06-CA15 Winters, CA USA, 2006 (French prune)	100 EC	0.372-0.376	926-945	1.12	3	8	0.19, 0.26
09048.06-CA16 Parlier, CA USA, 2006 (Friar)	100 EC	0.377-0.381	851-879	1.14	3	8	0.08, 0.08
09048.06-CA17 Parlier, CA USA, 2006 (French)	100 EC	0.375-0.380	542-552	1.13	3	8	0.35, 0.32
09048.06-CA18 [a] Madera, CA USA, 2006 (Red Beauty)	100 EC	0.374-0.386	945-973	1.51	4	7	0.11, 0.10
09048.06-OR28 Brooks, OR USA, 2006 (Brooks)	100 EC	0.372-0.375	636-645	1.12	3	6	0.09, 0.16
09048.06-BC06 Summerland, BC Canada, 2006 (Early Italian)	100 EC	0.371-0.373	730-739	1.12	3	6	0.80, 0.74
09048.06-NS05 Kentville, NS Canada, 2006 (Empress)	100 EC	0.381-0.383	812-817	1.15	3	8	0.79, 0.63
09048.06-ON10 Beamsville, ON Canada, 2006 (Shiro)	100 EC	0.376-0.384	905-924	1.14	3	1 4 7 10	0.58, 0.73 0.72, 0.76 0.62, 0.62 0.48, 0.52
09048.06-ON11 Vineland Station, ON, Canada, 2006 (Stanley)	100 EC	0.373	0.852-0.855	1.12	3	7	0.48, 0.41
09048.06-ON12 Vineland Station, ON, Canada, 2006 (Valor)	100 EC	0.374-0.379	854-866	1.13	3	7	0.33, 0.24

[a] Not included in the data used for estimation of the MRL because application was >125% of GAP and frozen storage period (507 days) was longer than that covered by stability data.

Cherries

A total of seven supervised trials were conducted on cherries in the United States and Canada during the 2006 season, following the GAP in the US (Willard, 2007, RIM 250). Three of the trials were conducted on sweet cherries (CA, MI, OR) and four on sour (tart) cherries (MI, NY, ON, WA). Each field trial consisted of one untreated control and one treated plot. At each trial site, three foliar directed applications of an emulsifiable concentrate formulation containing 100 g/L novaluron were made intervals of 10 to 14 days. Application rates ranged from at 0.372–0.391 kg ai/ha per application, for a total seasonal application rate of 1.12 to 1.15 kg ai/ha.

Residues of novaluron were determined by GC/ECD in pitted samples, following method 1585.00-00, based on procedures described in "Analytical Method for the Determination of Novaluron in Crop Matrices by LC/MS/MS".

Table 6 Residues from the foliar application of novaluron to Cherries

CHERRIES Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA (Stone fruit)	*100 EC*	*0.145- 0.363*		*1.1*	*3*	*8*	
Trial CA1 Plainview, CA USA, 2006 (Brooks- sweet)	100 EC	0.374-0.379	907-917	1.13	3	8	0.80, 0.97
Trial M11 Conklin, MI USA, 2006 (Napoleons – sweet)	100 EC	0.786-0.889	786-889	1.12	3	0 3 7 10 14	2.5, 2.3 2.7, 2.0 2.7, 2.1 2.3, 2.0 3.0, 2.4
Trial M12 Fremont, MI USA, 2006 (Montmorency- tart)	100 EC	0.375-0.376	720-804	1.13	3	7	2.2, 2.0
Trial NY1 Sodus, NYI USA, 2006 (Montmorency- tart)	100 EC	0.375-0.391	748-776	1.15	3	7	2.0, 1.4
Trial OR1 Parkdale, OR USA, 2006 (Skeena- sweet)	100 EC	0.372-0.376	776-786	1.12	3	7	0.76, 0.74
Trial WA1 Royal City, WA, USA, 2006 (Montmorency – tart)	100 EC	0.372-0.373	795	1.12	3	7	4.1, 3.3
Trial ON1 Arkona, ON, Canada, 2006 (Montmorency – tart)	100 EC	0.374-0.375	821-823	1.12	3	7	3.5, 3.9

Berries and other small fruits

Blueberries

Nine supervised trials were conducted on blueberries in the United States during the 2005 season, following the GAP in the US (Samoil, 2007, RIM 256). Each field trial consisted of one untreated control and one treated plot. At each trial, three foliar directed applications of an emulsifiable concentrate formulation containing 100 g/L novaluron were made to treated plots at intervals of 13 to

15 days. Application rates ranged from at 0.202–0.214 kg ai/ha per application, for a total seasonal application rate of 0.613–0.643 kg ai/ha.

Duplicate control and treated samples of mature berries were harvested from each plot 6–8 days after the last application. In addition, in one trial, duplicate samples were also collected 1, 4 and 10 days after the last application. Samples were immediately frozen and maintained frozen until analysis.

Residues of novaluron were determined by GC/ECD, following a method based on the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 7 Residues from the foliar application of novaluron to Blueberries

BLUEBERRIES Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA (Bush berries)	100 EC	0.145- 0.218		0.65	3	8	
Trial GA*14 Alapaha, GA USA, 2005 (Premier)	100 EC	0.209-0.213	393-402	0.635	3	6	1.0, 0.61
Trial ME02 Jonesboro, ME USA, 2005 (Low bush – no variety)	100 EC	0.208-0.211	374	0.628	3	7	2.9, 3.8
Trial MI25 Fennville, MI USA, 2005 (Rubel)	100 EC	0.204-0.220	458-486	0.636	3	1 4 7 10	2.1, 2.1 2.6, 3.1 3.2, 3.0 3.6, 2.8
Trial MI26 Fennville, MI USA, 2005 (Rubel)	100 EC	0.202-0.214	468-477	0.628	3	7	3.5, 3.0
Trial MI27 Fennville, MI USA, 2005 (Rubel)	100 EC	0.202-0.213	458-533	0.621	3	7	2.1, 1.6
Trial NC21 Castle Hayne, NC, USA, 2005 (Croatan)	100 EC	0.208-0.213	393-402	0.630	3	8	1.1, 0.63
Trial NJ26 Bridgeton, NJ, USA, 2005 (Blueray)	100 EC	0.206-0.222	421-440	0.646	3	7	1.4, 2.0
Trial NJ27 Chatsworth, NJ, USA, 2005 (Bluecrop)	100 EC	0.202-0.208	412-421	0.613	3	7	0.69, 0.99
Trial OR17 Aurora, OR USA, 2005 (Bluecrop)	100 EC	0.204-0.214	542-580	0.624	3	6	1.6, 2.3

Strawberry

Ten supervised trials on strawberries, eight in the US and two in Canada, were conducted during the 2007 growing season, following the GAP in the US (Samoil, 2008, RIM 277). Each field trial consisted of one untreated control and one treated plot. At each trial, three foliar directed applications of an emulsifiable concentrate formulation containing 100 g/L novaluron were made to treated plots at intervals of 7 to 10 days. Application rates ranged from at 0.086–0.094 kg ai/ha per application, for a total seasonal application rate of 0.266–0.281 kg ai/ha.

Duplicate control and treated samples of mature berries were harvested from each plot one day after the last application. In addition, in one trial, duplicate samples were also collected 0, 3, 5 and 8 days after the last application. Samples were immediately frozen and maintained frozen until analysis.

Residues of novaluron were determined by GC/ECD, following a method based on the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 8 Residues from the foliar application of novaluron to Strawberries

STRAWBERRY Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA	*100 EC*	*0.067-0.087*		*0.26*	*3*	*1*	
09782.07-CA72 Parlier, CA USA, 2007 (Seascape)	100 EC	0.091	758-786	0.273	3	1	< 0.05, 0.29
09782.07-CA*73 Salinas, CA USA, 2007 (Diamonte)	100 EC	0.090-0.092	561-898	0.274	3	1	0.07, 0.11
09782.07-CA*74 Salinas, CA USA, 2007 (Albion)	100 EC	0.086-0.094	879-1169	0.270	3	1	0.19, 0.22
09782.07-FL22 Wimauma, FL USA, 2007 (Festival)	100 EC	0.093-0.094	533-542	0.281	3	1	0.24, 0.26
09782.07-NJ28 Bridgeton, NJ USA, 2007 (Earliglow)	100 EC	0.087-0.091	468-505	0.266	3	1	0.07, < 0.05
09782.07-NY06 Freeville, NY USA, 2007 (Earliglow)	100 EC	0.087-0.091	561-571	0.268	3	1	0.07, 0.12
09782.07-OR12 Aurora, OR USA, 2007 (Totem)	100 EC	0.091-0.092	954-963	0.274	3	1	0.18, 0.12
09782.07-WI24 Arlington, WI USA, 2007 (Honeoye)	100 EC	0.088-0.090	496-514	0.268	3	1	0.10, 0.11
09782.07-ON25 Simcoe, ON Canada, 2007 (Jewel)	100 EC	0.087-0.092	488-514	0.267	3	0 1 3 5 8	0.19, 0.12 0.18, 0.17 0.09, 0.11 0.13, 0.17 0.11. 0.11
09782.07-QC07 Ste. Madeleine QC, Canada, 2007 (Kent)	100 EC	0.089-0.093	471-490	0.274	3	1	0.11, 0.09

Brassica (cole or cabbage) vegetables

Broccoli

Six supervised trials were conducted on broccoli in the US during 2002, following the GAP (Willard, 2004, RIM 193). Each trial consisted of one control and one treated plot. Novaluron 10EC, a commercial emulsifiable concentrate formulation containing 100 g/L novaluron was applied three times at the nominal rate of 0.056 kg ai/ha, at intervals of 5 to 8 days

Duplicate broccoli samples were collected at 7 to 8 days after the last application. In addition, in one trial, samples were also collected at 0, 3, 9, and 14 days after the last application. Samples were composed of the entire commercially harvested portion of at least 12 plants. Due to large sample size, broccoli samples were cut longitudinally into quarter pieces and one quarter taken for processing. A few smaller samples were processed in their entirety. All samples were kept in freezer storage until analysis.

Residues of novaluron were determined by GC/ECD, following a method based on the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 9 Residues from the foliar application of novaluron to Broccoli

BROCCOLI	Application					PHI	Novaluron
Location, year (variety)	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.	days	(mg/kg)
GAP, USA (Brassicas)	100 EC	0.044-0.087		0.17	3	7	
Trial CA2 Greenfield, CA USA, 2002 (Patriot)	100 EC	0.056	282-283	0.168	3	0 3 7 10 14	0.17, 0.13 0.11, 0.08 0.09, 0.06 0.07, 0.11 0.10, < 0.05
Trial CA3 Porterville, CA USA, 2002 (Liberty)	100 EC	0.056	285-290	0.168	3	7	0.10, 0.07
Trial CA4 Guadalupe, CA USA, 2002 (Bellstar)	100 EC	0.056-0.058	327-337	0.172	3	7	< 0.05, < 0.05
Trial CA5 Madera, CA USA, 2002 (Everest)	100 EC	0.056-0.059	327-337	0.172	3	7	0.12, 0.38
Trial OR1 Corvalis, OR USA, 2002 (Emerald Pride)	100 EC	0.056-0.057	290-337	0.168	3	8	< 0.05, < 0.05
Trial TX2 East Bernard, TX USA, 2003 (Marathon)	100 EC	0.056	309	0.168	3	7	0.14, 0.12

Cabbage

Six supervised trials were conducted on cabbage in the US during 2002, following the GAP for brassica vegetables (Willard, 2004, RIM 193). Each trial consisted of one control and one treated plot. Novaluron 10EC, a commercial emulsifiable concentrate formulation containing 100 g/L novaluron was applied three times at the nominal rate of 0.056 kg ai/ha, at intervals of 5 to 8 days.

Duplicate cabbage head samples were collected at 7 to 8 days after the last application. In addition, in one trial, samples were also collected at 0, 3, 10, and 14 days after the last application. Samples consisted of cabbage heads with wrapper leaves and cabbage heads with outer leaves removed. Cabbage head samples contained two quarters from each of 24 heads. All samples were kept in freezer storage until analysis.

Residues of novaluron were determined by GC/ECD, following a method based on the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 10 Residues from the foliar application of novaluron to Cabbage

CABBAGE Location, year (variety)	Application					PHI days	Novaluron (mg/kg)	
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.			
GAP, USA (Brassicas)	*100 EC*	*0.044-0.087*		*0.17*	*3*	*7*	*With wrapper leaves*	*No wrapper leaves*
Trial CA1 Porterville, CA USA, 2002 (Supreme Vantage)	100 EC	0.058-0.059	318-327	0.175	3	7	< 0.05, < 0.05	< 0.05, < 0.05
Trial FL1 Bunnell, FL USA, 2002 (Bravo)	100 EC	0.055-0.056	327-346	0.167	3	7	0.07, 0.08	< 0.05, < 0.05
Trial GA1 Chula, GA USA, 2002 (Bravo)	100 EC	0.055-0.056	309-327	0.167	3	7	0.19, 0.18	< 0.05, < 0.05
Trial IL1 Carlyle, IL USA, 2002 (Stonehead)	100 EC	0.057	299-309	0.171	3	0 3 7 10 14	< 0.05 < 0.05 < 0.05 < 0.05 < 0.05	< 0.05 < 0.05 < 0.05 < 0.05 < 0.05
Trial PA1 Germansville, PA USA, 2002 (Blue Lagoon)	100 EC	0.055-.057	318-337	0.169	3	7	< 0.05, < 0.05	0.05, < 0.05
Trial TX1 East Bernard, TX USA, 2002 (Early)	100 EC	0.054-0.057	309-327	0.167	3	8	0.43, 0.48	0.08, < 0.05

Fruiting vegetables, Cucurbits

Cucumber

Six supervised trials on cucumber were conducted in the United States during 2006, following the GAP for fruiting vegetables, cucurbits (Willard, 2007, RIM 249). Each trial consisted of one control and one treated plot. Novaluron 10EC, a commercial emulsifiable concentrate formulation containing 100 g/L novaluron was applied three times at the rate of 0.084 to 0.090 kg ai/ha, at intervals of 7 to 10 days, for a total seasonal rate of 0.257–0.265 kg ai/ha.

Duplicate samples were collected one day after the last application from each control and treated plot for the harvest trials In addition, in one decline trial, samples were also collected from treated plots at 0, 1, 3, 5 and 7 days after the last application with a control sample collected at 1 day after the last application. The samples contained at least 12 cucumber fruit and weighed at least 2 kg. All samples were kept in freezer storage until analysis.

Residues of novaluron were determined by LC-MS-MS, following a method described in "Determination of novaluron in crop matrices by LC/MS/MS" (Method METH1585.00-00". The method was validated with an LOQ of 0.05 mg/kg.

Table 11 Residues from the foliar application of novaluron to Cucumber

CUCUMBER Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA *Fruiting vegetables, cucurbits)*	*100 EC*	*0.065-0.087*		*0.26*	*3*	*1*	
Trial FL1 High Springs, FL USA, 2006 (Thunder	100 EC	0.086-0.089	196-216	0.261	3	1	< 0.05, < 0.05
Trial GA1 Chula, GA USA, 2006 (Tunder)	100 EC	0.086-0.087	212-224	0.262	3	0 1 3 5 7	< 0.05 < 0.05, < 0.05 < 0.05, < 0.05 < 0.05,< 0.05 < 0.05,< 0.05
Trial MI1 Conklin, MI USA, 2006 (Hybrid Macarthur Supreme)	100 EC	0.087	194-196	0.261	3	1	< 0.05, < 0.05
Trial NC1 Seven Springs, NC, USA, 2006 (National Pickling)	100 EC	0.084-0.087	202-267	0.257	3	1	< 0.05, < 0.05
Trial OH1 New Holland, OH USA, 2006 (Marketmore 86)	100 EC	0.087-0.090	196-201	0.265	3	1	< 0.05, < 0.05
Trial TX1 Raymondville, TX, USA, 2006 (Calypso)	100 EC	0.087-0.090	188-191	0.265	3	1	< 0.05, < 0.05

Cantaloupe

A total of eight supervised trials on cantaloupes were conducted in the United States during 2006, following the GAP for fruiting vegetables, cucurbits (Samoil, 2008, RIM 275). Each trial consisted of one control and one treated plot. At each treated plot, three foliar applications of a commercial emulsifiable concentrate formulation containing 100 g/L novaluron were applied at the rate of 0.088 to 0.092 kg ai/ha, at intervals of 13 to 16 days, for a total seasonal rate of 0.267–0.274 kg ai/ha. Duplicate samples were collected one day after the last application from each control and treated plot for the harvest trials. In addition, in one decline trial, samples were also collected from treated plots at 4, 8 and 9 days after the last application with a control sample collected at 1 day after the last application. Each sample consisted of 12 fruits.

All samples were kept in freezer storage until analysis. The maximum period of frozen storage until analysis was 162 days. Storage stability samples were fortified with novaluron at 0.5 mg/kg soon after receipt by the analytical laboratory and were held in frozen storage under similar conditions to the field generated samples. After 214 days in storage, the storage stability samples showed recoveries of 83–96%, with concurrent recovery of 91%.

Residues of novaluron were determined by GC/ED, following based on the method described in “Magnitude of the residue on novaluron in pome fruit raw agricultural and processed commodities (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg. No data were available on pulp only.

Table 12 Residues from the foliar application of novaluron to Cantaloupe

CANTALOUPE Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA Fruiting vegetables, cucurbits)	100 EC	0.065-0.087		0.26	3	1	
Trial CA23 Holtville, CA USA, 2006 (Esteem)	100 EC	0.090-0.092	374-393	0.274	3	1	0.09, 0.09
Trial CA24 Davis, CA USA, 2006 (Oro Rico)	100 EC	0.090-0.091	309-333	0.272	3	1 4 8 9	0.08, < 0.05 < 0.05, 0.06 < 0.05, 0.05 0.05, < 0.05
Trial CA25 Parlier, CA USA, 2006 (Top Mark)	100 EC	0.091-0.092	374	0.274	3	1	< 0.05, 0.07
Trial CA149 Five Point, CA USA, 2006 (Oration)	100 EC	0.088-0.091	365-383	0.270	3	1	< 0.05, < 0.05
Trial NC05 Clinton, NC USA, 2006 (Atena)	100 EC	0.091	309	0.273	3	1	< 0.05, < 0.05
Trial TX*06 Weslaco, TX USA, 2006 (Prino)	100 EC	0.090-0.091	309-318	0.271	3	1	< 0.05, < 0.05
Trial TX07 Weslaco, TX USA, 2006 (Cruizer F1)	100 EC	0.091-0.092	308-319	0.274	3	1	< 0.05, < 0.05
Trial WI05 Arlington, WI USA, 2006 (Jaipur)	100 EC	0.088-0.091	374	0.267	3	1	0.05, < 0.05

Summer Squash

A total of seven supervised trials on summer squash were conducted in the United States during 2006, following the GAP for fruiting vegetables, cucurbits (Samoil, 2008, RIM 276). Each trial consisted of one control and one treated plot. At each trial, three foliar applications of a commercial emulsifiable concentrate formulation containing 100 g/L novaluron were applied at the rate of 0.089 to 0.095 kg ai/ha, at intervals of 12 to 15 days, for a total seasonal rate of 0.270–0.279 kg ai/ha.

Duplicate samples were collected one day after the last application from each control and treated plot. Each sample consisted of 12 fruits. All samples were kept in freezer storage until analysis. The maximum period of frozen storage until analysis was 282 days. Storage stability samples were fortified with novaluron at 0.5 mg/kg soon after receipt by the analytical laboratory and were held in frozen storage under similar conditions to the field generated samples. After 286 days in storage, the storage stability samples showed recoveries of 97–116%, with concurrent recovery of 96%.

Residues of novaluron were determined by GC/ECD, following based on the method described in "Magnitude of the residue on novaluron in pome fruit raw agricultural and processed commodities (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 13 Residues from the foliar application of novaluron to Summer squash

SUMMER SQUASH Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA Fruiting vegetables, cucurbits)	*100 EC*	*0.065-0.087*		*0.26*	*3*	*1*	
08989-06-CA145 Davis, CA USA, 2006 (Multipik F1)	100 EC	0.090-0.091	318-327	0.272	3	1	< 0.05, < 0.05
08989-06-FL13 Citra, FL USA, 2006 (Gentry)	100 EC	0.092-0.094	337-346	0.279	3	1	< 0.05, < 0.05
08989-06-NC06 Clinton, NC USA, 2006 (Enterprise)	100 EC	0.089-0.091	299-309	0.270	3	1	< 0.05, < 0.05
08989-06-NJ05 Bridgeton, NJ USA, 2006 (Prelude II)	100 EC	0.090-0.093	374-383	0.274	3	1	< 0.05, < 0.05
08989-06-TX09 Weslaco, TX USA, 2006 (Multipik F1)	100 EC	0.092-0.094	309-318	0.278	3	1	0.07, 0.07
08989-06-WA02 Prosser, WA USA, 2006 (Early summer crookneck)	100 EC	0.090	412-421	0.270	3	1	< 0.05, < 0.05
08989-06-WI06 Arlington, WI USA, 2006 (Lioness)	100 EC	0.092-0.095	365-383	0.279	3	1	< 0.05, < 0.05

ND = <LOD (0.015 mg/kg)

Fruiting vegetables other than cucurbits

Peppers

A total of 16 supervised trials on pepper, four on non-bell and 12 on bell peppers, were conducted in Canada and the United States during 2006, following the GAP for fruiting vegetables other than cucurbits (Samoil, 2008, RIM 273). Each trial consisted of one control and one treated plot. At each trial, three foliar applications of a commercial emulsifiable concentrate formulation containing 100 g/L novaluron were applied at the rate of 0.088 to 0.094 kg ai/ha, at intervals of 6–8 days, for a total seasonal rate of 0.260–0.275 kg ai/ha. In four of the bell pepper trials, a suspension concentrate formulation containing 100 g/L novaluron was applied to four separate plots in trials CA20, OH*03 ON08, and QC05.

Duplicate samples were collected one day after the last application from each control and treated plot, except in trial ON09 in which samples were collected 2 days after the last application. All samples were kept in freezer storage until analysis. The maximum period of frozen storage until analysis was 152 days. Storage stability samples (bell peppers) were fortified with novaluron at 0.53 mg/kg soon after receipt by the analytical laboratory and were held in frozen storage under similar conditions to the field generated samples. After 204 days in freezer storage, the storage stability samples showed recoveries of 109–115%, with concurrent recovery of 116%.

Residues of novaluron were determined by GC/ED, following a method based on the procedures described in "Magnitude of the residue on novaluron in pome fruit raw agricultural and processed commodities" (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 14 Residues from the foliar application of novaluron to Pepper

PEPPER Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA *Fruiting vegetables, non-cucurbits)*	*100 EC*	*0.065-0.087*		*0.26*	*3*	*1*	
BELL PEPPER							
08985.06-CA20 Irvine, CA USA, 2006 (Taurus)	100 EC	0.089-0.092	374-383	0.273	3	1	0.05, 0.05
	100 SC	0.090-0.093	383-394	0.274	3	1	< 0.05, < 0.05
08985.06-CA21 Holtville, CA USA, 2006 (Macabbi)	100 EC	0.090-0.092	449-477	0.272	3	1	0.13, 0.14
08985.06-FL14 Citra, FL USA, 2006 (Cameron X3R)	100 EC	0.089-0.093	327-337	0.264	3	1	0.07, 0.07
08985.06-GA*02 Tifton, GA USA, 2006 (Aristotle)	100 EC	0.090-0.091	449-458	0.272	3	1 4 8 11	0.29, 0.28 0.20, 0.23 0.28, 0.27 0.36, 0.38
08985.06-OH*03 Fremont, OH USA, 2006 (Aristotle X3R)	100 EC	0.090	449-477	0.270	3	1	0.07, 0.07
	100 SC	0.090	458-468	0.269	3	1	< 0.05, < 0.05
08985.06-TX08 Weslaco, TX USA, 2006 (Capistrano)	100 EC	0.090-0.091	318-327	0.271	3	1	0.22, 0.21
08985.06-TX08 Weslaco, TX USA, 2006 (Revolution)	100 EC	0.086-0.089	287-298	0.262	3	1	< 0.05, < 0.05
	100 SC	0.087-0.092	293-306	0.267	3	1	< 0.05, < 0.05
08985.06-ON09 Delhi, ON Canada, 2006 (Aristotle)	100 EC	0.087-0.091	390-405	0.267	3	2	0.05, < 0.05
08985.06-QC05 L'Acadie, QC Canada, 2006 (Aristotle)	100 EC	0.088-0.094	394-419	0.272	3	1	0.36, 0.37
	100 SC	0.086-0.092	385-405	0.269	3	1	0.28, 0.27
NON-BELL PEPPER							
08985.06-FL15 Citra, FL USA, 2006 (Mesilla)	100 EC	0.091-0.092	337	0.275	3	1	0.34, 0.36
08985.06-NM02 Las Cruces, NM USA, 2006 (Joe E Parker)	100 EC	0.090-0.091	327	0.271	3	1	< 0.05, < 0.05
08985.06-OH*02 Fremont, OH USA, 2006 (Sweet Spot X3R)	100 EC	0.090-0.091	468-477	0.271	3	1	< 0.05, < 0.05

PEPPER Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
08985.06-TX*05 Weslaco, TX USA, 2006 (Senora Anaheim)	100 EC	0.090	355-383	0.270	3	1	0.20, 0.20

Tomato

A total of 19 supervised trials on tomato, 15 field trials and four greenhouse trials, were conducted in the US during the 2004 growing season (Samoil, 2007, RIM 243). Each trial consisted of one untreated control and one treated plot, except for trials FL28, WI08, and CA62, which had a second treated plot. Trials CA62, CA65, FL27 and TX25 used small-fruited varieties. Trials CO04, NJ15, ON08, and TX25 were greenhouse trials.

At each trial, three foliar applications of an emulsifiable concentrate formulation containing 100 g/L novaluron were applied with crop oil concentrate at the rate of 0.085–0.095 kg ai/ha, at intervals of 6–9 days, for a total seasonal rate of 0.265–0.276 kg ai/ha. The additional treated plots in trials FL28, WI08, and CA62 were treated with a tank mix with no crop oil concentrate. The treated plots in the green house trials were treated with the SC formulation of novaluron at the rate of 0.090–0.096 kg ai/ha, for a total of 0.272–0.284 kg ai/ha.

Duplicate samples were collected 1 to 2 days after the last application. All samples were kept in freezer storage until analysis.

Residues of novaluron were determined by GC/ECD, following a method based on the procedures described in "Magnitude of the residue on novaluron in pome fruit raw agricultural and processed commodities" (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 15 Residues from the foliar application of novaluron to Tomato

TOMATO Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA Fruiting vegetables, non-cucurbits)	*100 EC*	*0.065-0.087*		*0.26*	*3*	*1*	
FIELD TRIALS							
08419.04-CA59 Madera, CA USA, 2004 (Ace 55)	100 EC	0.088-0.090	281	0.268	3	1	< 0.05, < 0.05
08419.04-CA60 Irvine, CA USA, 2004 (Merced)	100 EC	0.090-0.091	327-337	0.272	3	1	0.08, 0.07
08419.04-CA61 Winters, CA USA, 2004 (Orziettie 3155)	100 EC	0.090	234	0.270	3	2	< 0.05, 0.06
08419.04-CA62 Holtville, CA USA, 2004 (Jolly Elf)	100 EC	0.088-0.090	327-337	0.268	3	2	0.23, 0.19
	100 EC No adjuvant	0.088-0.091	327-337	0.267	3	2	0.20, 0.16
08419.04-CA63 Davis, CA USA, 2004 (Harris Moran 830)	100 EC	0.091-0.094	281-290	0.277	3	1	0.12, 0.13

TOMATO Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
08419.04-CA64 Davis, CA USA, 2004 (Shady Lady)	100 EC	0.092-0.094	290	0.278	3	1	0.05, 0.10
08419.04-CA65 Parlier, CA USA, 2004 (Cherry Grande	100 EC	0.090-0.091	234	0.272	3	1	0.26, 0.24
08419.04-CA66 Five Points, CA USA, 2004 (Heinz 8892)	100 EC	0.092	337-346	0.276	3	1	< 0.05, 0.06
08419.04-FL27 Citra, FL USA, 2004 (Cherry Grande)	100 EC	0.088-0.090	281	0.268	3	1	0.28, 0.27
08419.04-FL28 Citra, FL USA, 2004 (Florida 47)	100 EC	0.090-0.092	281-290	0.273	3	1	0.10, 0.06
	100 EC No adjuvant	0.090-0.092	281-290	0.273	3	1	0.06, 0.05
08419.04-NC13 Clinton, NC USA, 2004 (Mountain Spring)	100 EC	0.087-0.090	318-327	0.265	3	2	< 0.05, < 0.05
08419.04-NM04 Mesilla, NM USA, 2004 (Celebrity VFN)	100 EC	0.087-0.091	299-318	0.266	3	1	0.06, 0.08
08419.04-NM05 Mesilla, NM USA, 2004 (Celebrity VFN)	100 EC	0.088-0.091	234-281	0.269	3	1	0.06, 0.07
08419.04-NY09 Freeville, NY USA, 2004 (Hypeel 696)	100 EC	0.092	290	0.276	3	1	0.12, 0.13
08419.04-WI08 Arlington, WI USA, 2004 (Early Girl)	100 EC	0.085-0.092	224	0.265	3	1	< 0.05, < 0.05
	100 EC No adjuvant	0.087-0.093	224	0.271			< 0.05, < 0.05
GLASSHOUSE TRIALS							
08419.04-CO04 Fort Collins, CO USA, 2004 (Trust F1)	100 SC	0.093-0.094	290	0.282	3	1	< 0.05, < 0.05
08419.04-NJ15 Bridgeton, NJ USA, 2004 (Florida 47)	100 SC	0.093-0.096	290	0.284	3	1	0.20, 0.14
08419.04-ON08 Leamington, ON USA, 2004 (Macarena)	100 SC	0.090-0.091	931-939	0.272	3	2	< 0.05, 0.06
08419.04-TX25 Weslaco, TX USA, 2004 (Super Sweet 100)	100 SC	0.093	627	0.279	3	1	0.47, 0.26

Leafy vegetables (including Brassica Leafy)

Mustard greens

Eleven supervised trials were conducted on mustard greens in the US and Canada during 2004 (Samoil, 2007, RIM 257). Each trial consisted of one control and one treated plot, except for the CA*43, FL19, and NC07 trials which had a second treated plot. At each trial, a commercial emulsifiable concentrate formulation containing 100 g/L novaluron was applied three times at the rate of 0.087–0.095 kg ai/ha, at intervals of 6 to 8 days. All tank mixes used no adjuvants, except for trials CA*43, FL19, and NC07, where the second treated plot used a tank mix with crop oil concentrate.

Duplicate samples were collected 3 to 4 days after the last application. In addition, in one trial, samples were also collected at 7, 9 and 13 days after the last application. Leaves were cut about 5–8 cm from the ground. All samples were kept in freezer storage until analysis. The maximum period of frozen storage until analysis was 32 to 92 days, except for NC07 samples which had been initially analysed using a slightly different method from the other samples and were re-analysed 496 days after harvest using the appropriate method.

Residues of novaluron were determined by GC/ECD, following a method based on the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg

Table 16 Residues from the foliar application of novaluron to Mustard greens

MUSTARD GREENS Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA	*100 EC*	*0.044-0.087*		*0.26*	*3*	*7*	
08420.04-CA23 Holtville, CA USA, 2004 (Mizuna)	100 EC	0.089-0.093	318-327	0.274	3	4	3.2, 4.4
08420.04-CA*43 Salinas, CA USA, 2004 (Indian Red Giant)	100 EC	0.091-0.092	355-365	0.275	3	3	5.8, 3.3
	100 EC with oil	0.089-0.092	346-365	0.272	3	3	5.0, 4.5
08420.04-FL19 Citra, FL USA, 2004 (Florid Broadleaf)	100 EC	0.089-0.092	327	0.272	3	3	14.6, 7.5
	100 EC with oil	0.090	327	0.270	3	3	18.6, 18.1
08420.04-MD07 Salisbury, MD USA, 2004 (Southern Giant)	100 EC	0.087-0.088	206	0.263	3	4 7 9 13	14.2, 7.8 8.5, 10.1 8.0, 7.1 6.9, 7.0
08420.04-NC07 Clinton, NC USA, 2004 (Southern Giant Curled)	100 EC	0.089-0.091	281-290	0.266	3	3	2.6, 2.1
	100 EC with oil	0.087-0.092	281-290	0.269	3	3	2.0, 3.0
08420.04-NJ07 Bridgeton, NJ (Southern Giant Curled)	100 EC	0.089-0.092	196	0.272	3	4	2.1, 1.4
08420.04-TN03 Jackson, TN USA, 2004 (Florida Broadleaf)	100 EC	0.089-0.091	262	0.270	3	3	3.6, 3.0
08420.04-TX*14 Weslaco, TX USA, 2004 (Florida Broadleaf)	100 EC	0.090-0.091	290-318	0.272	3	4	2.0, 1.9
08420.04-BC08 Agassiz, BC Canada , 2004 (Giant Red)	100 EC	0.091-0.092	329-353	0.274	3	4	4.5, 5.2

MUSTARD GREENS Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
08420.04-ON09 Brachton, ON Canada, 2004 (Savanna)	100 EC	0.091-0.094	304-315	0.279	3	3	3.2, 2.8
08420.04-ON10 Branchton, ON Canada, 2004 (Florida Broadleaf)	100 EC	0.091-0095	305-320	0.281	3	3	2.4, 2.6

Swiss chard

Three supervised trials on Swiss chard were conducted in the US during 2007, following the GAP (Samoil, 2009, RIM 280). Each trial consisted of one control and one treated plot. At each trial, an emulsifiable concentrate formulation containing 100 g/L novaluron was applied three times at the rate of 0.089–0.092 kg ai/ha, at intervals of 6 to 8 days.

Duplicate samples were collected one day after the last application. At least twelve plants were collected for each sample by cutting them off at the soil line or pulling them from the ground and cutting off the roots. Loose dirt was removed by shaking the plants and lightly brushing them off. The plants were cut longitudinally into quarters, retaining at least one quarter for the sample. All samples were kept in freezer storage until analysis.

Residues of novaluron were determined by GC/ECD using a method based on the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 17 Residues from the foliar application of novaluron to Swiss chard

SWISS CHARD Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA	*100 EC*	*0.065-0.087*		*0.26*	*3*	*1*	
09745.07-CA*69 Salinas, CA USA, 2007 (Magenta Sunset)	100 EC	0.089	374-542	0.267	3	1	2.2, 2.3
09745.07-CA70 Riverside, CA USA, 2007 (Virgo)	100 EC	0.090-0.092	374-383	0.272	3	1	6.4, 6.6
09745.07-TX30 Weslaco, TX USA, 2007 (Silverado)	100 EC	0.091	206-217	0.273	3	1	4.0, 3.6

Legume vegetables

Snap beans (Common Bean)

A total of fourteen supervised trials on snap beans were conducted in Canada and the US during 2006, following the GAP (Samoil, 2009, RIM 278). Each trial consisted of one control and one treated plot. At each trial, an emulsifiable concentrate formulation containing 100 g/L novaluron was applied three times at the rate of 0.086-0.094 kg ai/ha, at intervals of 6 to 8 days.

Duplicate samples of pods with seeds were collected 2 or 3 day after the last application. In one trial, additional samples of pods with seeds and foliage were collected 1, 8 and 9 days after the last application.

All samples were kept in freezer storage until analysis. The maximum period of frozen storage until analysis was 228 days. Storage stability samples were fortified with novaluron at 0.50 mg/kg soon after receipt by the analytical laboratory and were held in frozen storage under similar conditions to the field generated samples. After 263-264 days in freezer storage, the storage stability samples showed recoveries of 88-96% for pods with seeds and 84-92% for foliage.

Residues of novaluron were determined by GC/ECD using the working method "Residue Analysis of Novaluron on Snap Bean (Pods with seed and foliage)", which is based on procedures used in the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 18 Residues from the foliar application of novaluron to Common bean

SNAP BEANS Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA	*100 EC*	*0.044-0.087*		*0.26*	*3*	*1*	
08128.06-CA19 Irvine, CA USA, 2006 (Jade)	100 EC	0.088-0.092	365-383	0.271	3	3	0.40, 0.46
08128.06-FL11 Cittra, FL USA, 2006 (Leon)	100 EC	0.090	327	0.270	3	2	0.16, 0.09
08128.06-FL12 Cittra, FL USA, 2006 (Dusky)	100 EC	0.090-0.092	327-337	0.273	3	2	0.17, 0.16
08128.06-ID04 Kimberly. ID USA, 2006 (Idelite)	100 EC	0.091-0.093	327-337	0.273	3	3	0.18, 0.16
08128.06-MD04 Salisbury, MD USA, 2006 (Slenderette)	100 EC	0.091-0.092	318-327	0.273	3	2	0.12, 0.10
08128.06-NC04 Clinton, NC USA, 2006 (Ambra)	100 EC	0.089-0.090	337	0.269	3	1 3 8 9	0.26, 0.28 0.24, 0.40 0.28, 0.22 0.28, 0.36
08128.06-NJ04 Bridgeton, NJ USA, 2006 (Blue Lake 274)	100 EC	0.091-0.092	374-383	0.274	3	2	0.31, 0.32
08128.06-TN04 Crossville, TN USA, 2006 (Roma II Bush Bean)	100 EC	0.090	327	0.270	3	3	< 0.05, < 0.05
08128.06-WI04 Arlington, WI USA, 2006 (Hystyle)	100 EC	0.089-0.090	355-365	0.268	3	3	0.10, 0.16
08128.06-NS04 Kentville, NS Canada, 2006 (Ambra)	100 EC	0.098-0.099	434-441	0.295	3	2	0.12, 0.09
08128.06-ON06 Leamington, ON Canada, 2006 (Slenderpak)	100 EC	0.096-0.097	321-325	0.289	3	2	0.17, 0.18
08128.06-ON07 Leamington, ON Canada, 2006 (Hialeah)	100 EC	0.087-0.094	291-315	0.272	3	2	0.16, 0.18

SNAP BEANS Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
08128.06-QC03 L'Acadie, QC Canada, 2006 (Goldrush)	100 EC	0.089-0.091	397-399	0.270	3	2	0.14, 0.14
08128.06-QC04 L'Acadie, QC Canada, 2006 (Sunburst)	100 EC	0.086-0.091	381-404	0.265	3	2	0.09, 0.10

Pulses

Dry beans

A total of thirteen supervised trials on various varieties of beans were conducted in the US and Canada during 2007 to generate residue data on dry beans (Samoil, 2009, RIM 279). The trials followed the US GAP. Each trial consisted of one control and one treated plot. At each trial, an emulsifiable concentrate formulation containing 100 g/L novaluron was applied three times at the rate of 0.088–0.101 kg ai/ha, at intervals of 7 to 8 days, for a total seasonal application of 0.270–0.280 kg ai/ha.

Duplicate samples of beans were harvested one day after the last application. Where it was deemed necessary by the field personnel, the beans were left to dry in the field or in a greenhouse for additional time after harvest prior to sample collection.

All samples were kept in freezer storage until analysis. The maximum period of frozen storage for field-treated samples was 142 days. Storage stability samples were fortified with novaluron at 0.50 mg/kg soon after receipt by the analytical laboratory and were held in frozen storage under similar conditions to the field generated samples. After 150–151 days in freezer storage, the storage stability samples showed recoveries of 100–118%.

Residues of novaluron were determined by GC/ECD using the working method "Residue Analysis of Novaluron on Beans (Dry)", which is based on procedures used in the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 19 Residues from the foliar application of novaluron to Dry bean

DRY BEANS Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA	*100 EC*	*0.044-0.087*		*0.26*	*3*	*1*	
09781.07-CA71 Riverside, CA USA, 2007 (CB46-DF blackeye pea)	100 EC	0.088-0.092	318-337	0.271	3	1	< 0.05, < 0.05
09781.07-CO14 Fort Collins, CO USA, 2007 (Vision)	100 EC	0.091-0.095	186-196	0.277	3	1	< 0.05, < 0.05
09781.07-CO15 Fruita, CO USA, 2007 (Othello pinto beans)	100 EC	0.089-0.093	187-196	0.274	3	1	< 0.05, < 0.05
09781.07-ID12 Kimberly, ID USA, 2007 (UI 537)	100 EC	0.091-0.095	186-196	0.277	3	1	< 0.05, 0.08

DRY BEANS Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
09781.07-MI18 Holt, MI USA, 2007 (Jaguar black bean)	100 EC	0.091-0.092	187-196	0.274	3	1	< 0.05, < 0.05
09781.07-ND08 Velva, ND USA, 2007 (Maverick)	100 EC	0.090-0.091	187	0.272	3	1	0.05, 0.06
09781.07-ND09 Minot, ND USA, 2007 (La Paz pinto beans)	100 EC	0.091-0.095	94	0.277	3	2	0.36, 0.08 [a]
09781.07-NY08 Freeville, NY USA, 2007 (Cabernet)	100 EC	0.089	421	0.267	3	1	< 0.05, < 0.05
09781.07-OH*13 Freemont, OH USA, 2007 (French horticultural)	100 EC	0.090-0.091	355-393	0.452	3	1	< 0.05, < 0.05
09781.07-OH*14 Freemont, OH USA, 2007 (Great Northern)	100 EC	0.089-0.101	365-393	0.280	3	1	< 0.05, < 0.05
09781.07-SD05 Aurora, SD USA, 2007 (Maverick pinto beans)	100 EC	0.090-0.092	187-196	0.273	3	1	< 0.05, < 0.05
09781.07-WA*21 Moxee, WA USA, 2007 (Othello pinto beans)	100 EC	0.088-0.091	299-309	0.270	3	1`	< 0.05, < 0.05
09781.07-WI22 Arlington, WI USA, 2007 (Othello pinto beans)	100 EC	0.088-0.091	234-243	0.270	3	1	< 0.05, < 0.05

[a] One result excluded as result of possible sample collection/analysis error.

Grasses for sugar or syrup production

Sugar cane

Eight supervised trials were conducted on sugar cane in 2005 following the GAP in the US (Willard, 2008, RIM 228). One of the trials in Florida (Trial FL3) was destroyed by Hurricane Wilma.

The application regime consisted of five applications of Novaluron 10EC at a nominal rate of 0.087 kg ai/ha for a total target seasonal application of 0.435 kg ai/ha. Applications were made at 8 to 12-day intervals, incorporating a commercially available spreader/sticker adjuvant at 0.25% v/v. Applications were made using ground over-the-top broadcast application equipment and were within 96 to 106% of the target rate.

Samples of cane pieces were collected from treated and control plots 14 days after the last application, except for Trials FL1 and FL2, where samples had to be re-harvested 10 days after the last application in order to avoid damage from the hurricane. In one decline trial, samples were also collected from the treated plot at 0, 7, 14, 21 and 28 days after the last application, with a control sample collected only at 14 days after last application. The samples contained portions of 12 different sugar cane stems (canes). Single samples were taken from the control plot and duplicate samples from each treated plot at each sampling period. All samples were kept frozen until analysis.

Residues of novaluron were determined by GC/ECD using a method based on procedures used in the determination of novaluron in pome fruit (previously reviewed by the 2005 JMPR). The method was validated with an LOQ of 0.05 mg/kg.

Table 20 Residues from the foliar application of novaluron to Sugar cane

SUGAR CANE Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA	*100 EC*	*0.065-0.087*		*0.44*	*5*	*14*	
Trial FL1 Belle Glade, FL USA, 2005 (CP-1762 Kt)	100 EC	0.085-0.092	290-318	0.444	5	10	0.27, 0.31
Trial FL2 Belle Glade, FL USA, 2005 (CP89-2143)	100 EC	0.086-0.092	290-327	0.440	5	10	0.21, 0.29
Trial HI1 Spreckelsville, HI USA, 2005 (65-7052)	100 EC	0.087	337	0.435	5	14	0.08, 0.07
Trial LA1 Washington, LA USA, 2005 (LCP85-384)	100 EC	0.086-0.088	327-337	0.437	5	14	0.07, < 0.05
Trial LA2 Church Point, LA USA, 2005 (LCP85-384)	100 EC	0.086-0.091	196-206	0.441	5	0 7 14 21 28	0.06, 0.10 < 0.05, < 0.05 0.07, 0.06 0.06, < 0.05 < 0.05, < 0.05
Trial LA3 Cheneyville, LA USA, 2005 (LCP85-384)	100 EC	0.085-0.090	187-196	0.436	5	14	< 0.05, < 0.05
Trial TX1 Raymondville, TX USA, 2005 (3388)	100 EC	0.088-0.090	187-196	0.448	5	14	0.08, 0.10

Animal feed commodities

Bean forage (green)

Bean foliage samples were collected from each common bean trial site (see Table 18). At some trial sites the entire plant (except root) was retained with residual pod samples, while at other locations all pods were removed.

Table 21 Residues on forage from the foliar application of novaluron to Common bean

BEAN FORAGE Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
GAP, USA *Snap beans*	*100 EC*	*0.044-0.087*		*0.26*	*3*	*1*	
08128.06-CA19 Irvine, CA USA, 2006 (Jade)	100 EC	0.088-0.092	365-383	0.271	3	3	8.6, 8.0
08128.06-FL11 Cittra, FL USA, 2006 (Leon)	100 EC	0.090	327	0.270	3	2	5.8, 5.8

BEAN FORAGE Location, year (variety)	Application					PHI days	Novaluron (mg/kg)
	Form. g ai/L	per applic kg ai/ha	Water (L/ha)	Season total kg ai/ha	no.		
08128.06-FL12 Cittra, FL USA, 2006 (Dusky)	100 EC	0.090-0.092	327-337	0.273	3	2	6.0, 6.8
08128.06-ID04 Kimberly. ID USA, 2006 (Idelite)	100 EC	0.091-0.093	327-337	0.273	3	3	5.3, 4.1
08128.06-MD04 Salisbury, MD USA, 2006 (Slenderette)	100 EC	0.091-0.092	318-327	0.273	3	2	7.8, 6.4
08128.06-NC04 Clinton, NC USA, 2006 (Ambra)	100 EC	0.089-0.090	337	0.269	3	1 3 8 9	13, 12 13, 11 12, 10 9.2, 13
08128.06-NJ04 Bridgeton, NJ USA, 2006 (Blue Lake 274)	100 EC	0.091-0.092	374-383	0.274	3	2	10, 9.4
08128.06-TN04 Crossville, TN USA, 2006 (Roma II Bush Bean)	100 EC	0.090	327	0.270	3	3	10, 8.1
08128.06-WI04 Arlington, WI USA, 2006 (Hystyle)	100 EC	0.089-0.090	355-365	0.268	3	3	3.1, 3.0
08128.06-NS04 Kentville, NS Canada, 2006 (Ambra)	100 EC	0.098-0.099	434-441	0.295	3	2	8.7, 8.8
08128.06-ON06 Leamington, ON Canada, 2006 (Slenderpak)	100 EC	0.096-0.097	321-325	0.289	3	2	15, 18
08128.06-ON07 Leamington, ON Canada, 2006 (Hialeah)	100 EC	0.087-0.094	291-315	0.272	3	2	7.4, 7.2
08128.06-QC03 L'Acadie, QC Canada, 2006 (Goldrush)	100 EC	0.089-0.091	397-399	0.270	3	2	6.6, 5.3
08128.06-QC04 L'Acadie, QC Canada, 2006 (Sunburst)	100 EC	0.086-0.091	381-404	0.265	3	2	5.8, 5.5

Livestock feeding studies

The Meeting received a poultry feeding study report (Rodgers, 2006, MAK/0900).

Four treatment groups of twelve laying hens each were dosed with novaluron at 0, 0.12, 0.36, and 1.2 ppm in the feed for 56/57 consecutive days. Following withdrawal of test diet after 56/57 days, three satellite groups of 12 birds each were returned to the control diet for 14, 42, or 70 days, to measure the kinetics of depuration. Composite egg samples were collected on Days -1, 3, 7, 9, 15, 19, 23, 27, 30, 33, 37, 40, 44, 47, 51, and 54 for all four groups. Additional composite egg sampling was conducted on Days 1, 5, and 12 for the 1.2 ppm group (Group 4). Hens were sacrificed within 24

hours after the treatment, and composite samples of muscle, liver, kidney, skin (with attached fat), and abdominal fat were collected.

Novaluron was extracted from eggs and tissue using acetonitrile (ACN). Clean-up was by liquid-liquid partition, using hexane. Quantitation was performed using liquid chromatography with mass-spectrometric detection (LC/MSD). The method was validated with the analysis of egg and tissue samples fortified at 0.01–1.0 ppm. Concurrent method recoveries were also analysed for egg and tissue samples fortified at 0.01–3.0 ppm. The validated limit of quantitation (LOQ) was 0.01 ppm in chicken egg and tissues. The limit of detection (LOD) was 0.5 ng/mL (equivalent to 0.0025 ppm in all matrix types).

The results are summarised in Tables 22 and 23.

Table 22 Novaluron (mg/kg) in eggs and tissues after dosing laying hens for 56 Days at 0.12, 0.36, and 1.2 ppm

Matrix	Collection Time	Group Residues (ppm)						
		#1 (control)	#2 (0.12)	#3 (0.36)	#4a (1.2)	#4b (1.2)	#4c (1.2)	#4d (1.2)
Eggs	Day -1	ND ND ND	ND ND ND	ND ND ND	ND ND ND	ND ND ND	ND ND ND	ND ND ND
	Day 1	NA NA NA	NA NA NA	NA NA NA	ND ND ND	ND ND ND	ND ND ND	ND ND ND
	Day 3	ND ND ND	< 0.01 < 0.01 < 0.01	0.011 0.014 < 0.01	0.023 0.022 0.031	0.016 0.043 0.046	0.042 0.026 0.020	0.023 0.018 0.013
	Day 5	NA NA NA	NA NA NA	NA NA NA	0.063 0.074 0.068	0.085 0.060 0.126	0.087 0.117 0.123	0.068 0.051 0.041
	Day 7	ND ND ND	0.016 0.020 0.019	0.066 0.036 0.092	0.109 0.163 0.210	0.195 0.204 0.192	0.214 0.169 0.205	0.206 0.209 0.246
	Day 9	ND ND ND	0.022 0.024 0.024	0.087 0.095 0.073	0.252 0.218 0.234	0.297 0.208 0.267	0.212 0.224 0.248	0.251 0.211 0.199
	Day 12	NA NA NA	NA NA NA	NA NA NA	0.222 0.288 0.284	0.272 0.382 0.239	0.273 0.250 0.271	0.322 0.298 0.301
	Day 15	ND ND ND	0.041 0.054 0.039	0.084 0.124 0.114	0.407 0.398 0.282	0.442 0.322 0.373	0.460 0.327 0.389	0.328 0.236 0.456
	Day 19	ND ND ND	0.052 0.056 0.045	0.155 0.192 0.217	0.624 0.719 0.598	0.589 0.394 0.329	0.533 0.501 0.551	0.471 0.508 0.459
	Day 23	ND ND ND	0.060 0.054 0.049	0.160 0.174 0.187	0.595 0.549 0.596	0.584 0.527 0.483	0.584 0.448 0.525	0.483 0.547 0.502
	Day 27	ND ND ND	0.036 0.044 0.045	0.179 0.112 0.125	0.486 0.318 0.358	0.435 0.387 0.388	0.397 0.372 0.379	0.362 0.500 0.542
	Day 30	ND ND ND	0.045 0.040 0.046	0.121 0.114 0.120	0.582 0.479 0.626	0.492 0.455 0.509	0.349 0.458 0.533	0.517 0.409 0.478
	Day 33	ND ND ND	0.051 0.055 0.047	0.106 0.256 0.152	0.508 0.501 0.503	0.943 0.495 0.463	0.368 0.559 0.338	0.421 0.339 0.450

Matrix	Collection Time	Group Residues (ppm)						
		#1 (control)	#2 (0.12)	#3 (0.36)	#4a (1.2)	#4b (1.2)	#4c (1.2)	#4d (1.2)
	Day 37	ND ND ND	0.037 0.029 0.042	0.111 0.108 0.123	0.379 0.452 0.429	0.332 0.437 0.373	0.288 0.471 0.328	0.324 0.325 0.449
	Day 40	ND ND ND	0.030 0.046 0.037	0.102 0.152 0.152	0.356 0.856 0.575	0.505 0.544 0.407	0.750 0.641 0.400	0.761 0.522 0.571
	Day 44	ND ND ND	0.053 0.049 0.062	0.160 0.135 0.173	0.585 0.706 0.606	0.662 0.564 0.690	0.431 0.579 0.669	0.473 0.500 0.571
	Day 47	ND ND ND	0.067 0.064 0.080	0.180 0.167 0.175	0.486 0.559 0.726	0.547 0.796 0.496	0.563 0.579 0.602	0.599 0.504 0.326
	Day 51	ND ND ND	0.035 0.040 0.034	0.117 0.103 0.117	0.336 0.343 0.629	0.374 0.437 0.340	0.395 0.524 0.439	0.379 0.357 0.491
	Day 54	ND ND ND	0.041 0.063 0.050	0.122 0.181 0.180	0.702 0.612 0.471	0.613 0.660 0.591	0.492 0.532 0.368	0.359 0.431 0.475
Muscle	Sacrifice	ND ND ND	0.01 0.012 0.014	0.031 0.031 0.024	0.101 0.16 0.089	NA	NA	NA
Liver	Sacrifice	ND ND ND	0.03 0.034 0.034	0.094 0.096 0.087	0.312 0.364 0.273	NA	NA	NA
Kidney	Sacrifice	ND ND ND	0.037 0.039 0.031	0.08 0.088 0.089	0.284 0.368 0.25	NA	NA	NA
Skin + attached fat	Sacrifice	ND ND ND	0.125 0.144 0.161	0.462 0.436 0.423	1.665 1.842 1.331	NA	NA	NA
Abdominal fat	Sacrifice	ND ND ND	0.278 0.323 0.321	0.897 0.988 0.807	2.882 3.011 2.307	NA	NA	NA

Table 23 Novaluron Residues in Eggs and Tissues of Poultry from the Depuration Study (1.2 ppm dosing group).

Matrix	Study Day	Group Residues (ppm)	Mean ± std dev
Eggs	54	0.359, 0.368, 0.431, 0.471, 0.475, 0.492, 0.532, 0.591, 0.612, 0.613, 0.660, 0.702	0.53 ± 0.11
	59	0.518, 0.521, 0.541, 0.597, 0.606, 0.631, 0.681, 0.702, 0.76	0.62 ± 0.085
	61	0.156, 0.339, 0.409, 0.449, 0.451, 0.519, 0.532, 0.6, 0.645	0.46 ± 0.147
	65	0.313, 0.332, 0.346, 0.354, 0.382, 0.401, 0.407, 0.428, 0.431	0.38 ± 0.043
	68	0.252, 0.256, 0.278, 0.286, 0.289, 0.32, 0.323, 0.35, 0.351	0.30 ± 0.037
	75	0.081, 0.085, 0.118, 0.18, 0.203, 0.209	0.15 ± 0.058
	82	0.074, 0.082, 0.083, 0.094, 0.101, 0.134	0.09 ± 0.025
	89	0.034, 0.035, 0.045, 0.062, 0.077, 0.077	0.06 ± 0.020
	96	0.019, 0.028, 0.048, 0.05, 0.051, 0.057	0.04 ± 0.015
	103	0.013, 0.014, 0.019	0.02 ± 0.003
	110	< LOQ, < LOQ, 0.013	< LOQ
	117	< LOQ, < LOQ, < LOQ	< LOQ
	124	< LOQ, < LOQ, < LOQ	< LOQ

Matrix	Study Day	Group Residues (ppm)	Mean ± std dev
Muscle	57	0.089, 0.101, 0.160	0.12 ± 0.038
	71	0.034, 0.4, 0.46	0.04 ± 0.006
	99	< LOQ, < LOQ, < LOQ	< LOQ
	127	ND, ND, < LOQ	< LOQ
Liver	57	0.273, 0.312, 0.364	0.32 ± 0.046
	71	0.065, 0.078, 0.081	0.075 ± 0.009
	99	< LOQ, < LOQ, 0.023	0.011 ± 0.01
	127	< LOQ, < LOQ, < LOQ	< LOQ
Kidney	57	0.250, 0.284, 0.368	0.30 ± 0.061
	71	0.08, 0.089, 0.116	0.095 ± 0.019
	99	< LOQ, < LOQ, 0.03	0.013 ± 0.014
	127	< LOQ, < LOQ, < LOQ	< LOQ
Skin/Fat	57	1.331, 1.665, 1.842	1.61 ± 0.259
	71	0.332, 0.505, 0.694	0.51 ± 0.181
	99	0.043, 0.072, 0.16	0.092 ± 0.061
	127	< LOQ, < LOQ, 0.01	< LOQ
Abdominal Fat	57	2.307, 2.882, 3.011	2.733 ± 0.375
	71	1.121, 1.181, 1.258	1.187 ± 0.069
	99	0.143, 0.17, 0.341	0.218 ± 0.107
	127	0.01, 0.018, 0.023	0.017 ± 0.007

FATE OF RESIDUES IN PROCESSING

The Meeting received processing study reports for plums, tomatoes and sugar cane.

Processing plums to dried plums/prunes

Two trials (CA14 and CA17) were conducted in California, USA in 2006 together with the field trials on plums, where samples were collected for production of dried plums (Samoil, 2008, RIM 255). The trials were carried out according to the GAP in the US for stone fruits, which recommends three foliar applications at a nominal rate of 0.363 kg ai/ha of an emulsifiable concentrate formulation containing 100 g/L novaluron for a total of 1.1 kg ai/ha/season and a PHI of 8 days. Mature fruits were collected 8 days after the last application, by hand-picking. After removal of the pits, samples were placed on Teflon-coated pizza trays in a forced-air dryer. Dried plum samples were collected after the weight of the plums had declined by a factor of approximately 2.8 (fresh weight/2.8).

Residues of novaluron were determined by LC-MS-MS, using the method number STM1585.01, "Analytical Method for the Determination of Novaluron in Crop Matrices by LC/MS/MS", which had been previously validated with an LOQ of 0.05 mg/kg.

Table 24 Residues of novaluron in dried plums/prunes

Processed Fractions	Residues mg/kg	Processing factor
Plum (RAC)	0.41	-
Dried plum/prunes	1.39	3.4
Plum (RAC)	0.32	-
Dried plum/prunes	< 0.05 (0.88)	<2.8

Processing tomatoes to paste and puree

Two processing trials (Trials CA66 and NY09) were conducted in the US in 2004 together with the field trials on tomatoes (Samoil, 2007, RIM 243). Each trial received three applications of 10EC Novaluron at the rate of 0.092 kg ai/ha for a total seasonal rate of 0.276 kg ai/ha. Applications were made 6 to 9 days apart, with the last application made one day prior to harvest. For each processing sample, approximately 100 lbs of mature tomatoes were collected from more than 12 plants per sample. Samples were then shipped to the processing facility where they were processed into tomato paste and puree following commercial practices.

Upon arrival in the facility, RAC samples were taken and frozen for future analysis. Whole tomato, tomato paste and tomato puree samples were analysed for residues of novaluron by GC-ECD, following a method based on the determination of novaluron on pome fruit raw agricultural and processed commodities, which had been previously validated with an LOQ of 0.05 mg/kg.

Results for the processing studies are summarised in Table 25 below. In some samples estimated concentrates below the LOQ are indicated in parentheses. These estimated values were not used in the calculation of processing (or transfer) factors.

Table 25 Residues of novaluron in processed tomato fractions

Matrix	Residues mg/kg	Processing factor
Tomato (RAC)	< 0.05 (0.028)	-
Tomato puree	< 0.05 (0.020)	-
Tomato paste	0.054	-
Tomato (RAC)	0.068	-
Tomato puree	< 0.05 (0.032)	< 0.73
Tomato paste	0.075	1.1

Processing sugar cane into molasses and refined sugar

The magnitude of the residues of novaluron in field samples followed an application regime which consisted of five applications of Novaluron 10EC at the nominal rate of 0.087 kg ai/ha for a total seasonal application of 0.44 kg ai/ha (Willard, 2006; Everich, 2008, RIM 228; RIM 282). Applications were made at 8 to 12-day intervals, ending at 10 to 14 days prior to normal harvest. In addition to the above application regime, at the LA1 trial a second plot was treated with approximately 2× the application rate (0.175–0.183 kg ai/ha) at the same intervals described above resulting in a total application rate of 0.887 kg ai/ha (Ref: RIM 282). Bulk samples of sugar cane pieces were collected 14 days after the last application and sent to the processing facility, where they were processed into molasses and refined sugar simulating commercial practices as close as possible.

Residues of novaluron in the processed sugar cane fractions were determined using the same method used for sugar cane samples. The only modification was that molasses and sugar were first dissolved in sodium chloride solution before extraction with hexane. The method was validated with an LOQ of 0.05 mg/kg.

Results for the processing studies are summarised in Table 26 below. Note that actual residue value estimates below the LOQ are listed in parentheses but are not used in the calculation of the processing (or transfer) factor.

Table 26 Residues of novaluron in processed sugar cane fractions

Matrix	Residues mg/kg	Processing factor
Sugar cane (RAC)	< 0.05 (0.0289)	-
Molasses	< 0.05 (0.0079)	-

Matrix	Residues mg/kg	Processing factor
Refined sugar	ND	<1
Sugar cane (RAC)	< 0.05 (0.0409)	-
Molasses	< 0.05 (0.0082)	-
Refined sugar	ND	<1

ND = no instrument response.

APPRAISAL

Novaluron is an insecticide of the class diflubenzoylureas. It was evaluated for the first time by JMPR in 2005 (T, R). The compound was listed for additional MRLs by 2010 JMPR at the Forty-first Session of the CCPR.

The manufacturer has submitted supervised crop field trial studies to support additional MRLs for the following commodities: broccoli, cabbage, mustard greens, Swiss chard, tomato (increase MRL), cherry, peach, plum, blueberry, snap bean (common bean), dry bean, and sugar cane. The supervised crop field trials are supplemented by the relevant GAPs, analytical methods, storage stability data, processing studies, and a poultry feeding study.

Methods of analysis

The analytical methods used in the supervised trials are based on the two methods previously included in the JMPR Evaluation in 2005: GC/ECD or HPLC with UV detection. A variation of the GC method uses a mass selective detector (MSD). A variation of the HPLC method uses LC/MS/MS. Adequate method validation at 0.05 mg/kg was reported with each crop field trial study. Average method and concurrent recoveries were all within the range of 70–120%, with relative standard deviations (RSD) at or below 20%.

Stability of residues in stored analytical samples

From the JMPR Report (2005) it can be concluded that minimum storage stability intervals of 12 months for high water content samples, 5 months for high oil content samples, 8 months for acidic commodities, and 12 months for high starch commodities are indicated. Additionally, in some of the crop field trial studies reported a control sample was fortified and stored frozen with the treated field samples. The fortified control was analysed at the time of analysis of the field samples. The percentages remaining were in the 71–118% range. All crop field trial samples were analysed within periods of demonstrated frozen storage stability.

Results of supervised trials on crops

Stone fruits

In all trials, determinations were made on the fruit without pit and no data on pit weights were available to express results on a fruit with pit basis. The absence of pit would be anticipated to yield slightly exaggerated residue values.

Peaches

A report on peach supervised field trials from the US was available. The US GAP is 3 applications at 0.36 kg ai/ha of an EC formulation with an 8 day PHI. The ranked order of residues on peaches (without pit) (n = 15) at the maximum GAP were: 0.20, 0.25, 0.41, 0.42 (2), 0.49, 0.58 (2), 0.66, 0.70, 0.90, 0.92, 1.0 (2), 2.1 mg/kg

Plums

A report on plum supervised field trials form the US was available. The US GAP is 3 applications at 0.36 kg ai/ha with an EC formulation with an 8 day PHI. The ranked order of residues on plums (without pits) (n = 10) at the maximum GAP were: 0.08, 0.16, 0.26, 0.33, 0.35, 0.47, 0.48, 0.62, 0.79, 0.80 mg/kg.

Cherries

A report on cherry supervised field trials form the US was available. The US GAP is 3 applications at 0.36 kg ai/ha with an EC formulation with an 8 day PHI. The ranked order of residues on cherries (without pits) (n = 7) at the maximum GAP were: 0.76, 0.97, 2.0, 2.2, 3.0, 3.9, 4.1 mg/kg.

The Meeting noted that the GAPs are identical for cherry, peach, and nectarine and that the US label specifies use on stone fruit. The Meeting decided to use the cherry supervised field trial data to estimate a maximum residue level of 7 mg/kg for stone fruit and an STMR of 2.2 mg/kg.

The value derived from use of the NAFTA calculator was 10 mg/kg based on a maximum residue level estimate for cherries (Lognormal 95/99 rule, 99th). However, small data sets may not produce reliable estimates via statistical procedures.

Berries and other small fruits

Blueberries

A report on blueberry supervised field trials in the US was received, where the GAP is 3 applications of an EC formulation at a maximum rate of 0.22 kg ai/ha/application and a PHI of 8 days. Nine trials complied with GAP, and the results in ranked order are: 0.99, 1.0, 1.1, 2.0, 2.1, 2.3, 3.5, 3.6, 3.8 mg/kg.

The Meeting estimated an STMR and maximum residue level of 2.1 and 7 mg/kg, respectively.

Use of the NAFTA statistical procedure yielded a maximum residue level estimate of 8, based on the 99th percentile of a log normal distribution. The mean plus 3 standard deviations was 6 mg/kg. The statistical calculation has limited utility with small data sets (n = 9).

Strawberry

A report on strawberry supervised field trials in the US and Canada was received, where the GAP 3 applications of an EC formulation with a maximum application rate of 0.087 kg ai/ha/application and a PHI of 1 day. Using the GAP of the US for both Canadian and US trials, 10 trials complied with GAP, and the results in ranked order are: 0.07, 0.11 (3), 0.12, 0.18 (2), 0.22, 0.26, 0.29 mg/kg. The Meeting estimated an STMR and maximum residue level of 0.15 and 0.5 mg/kg, respectively.

Use of the NAFTA statistical procedure yielded a maximum residue level estimate of 0.45 mg/kg (0.5 mg/kg rounded up), based on the 99th percentile of a log normal distribution. The mean plus three standard deviations is 0.4 mg/kg.

Brassica (cole or cabbage) vegetables

Broccoli

A report on supervised field trials on broccoli in the US was received. The US GAP is for a maximum of 3 applications of an EC formulation at 0.044–0.087 kg ai/ha/application with a seasonal rate maximum of 0.17 kg ai/ha and a PHI of 7 days. The trials were conducted as 3 applications at 0.056 kg ai/ha, which matches the seasonal maximum rate but is only 64% of the single application rate, i.e., 0.087 mg/kg. The retreatment interval was 5 to 8 days. The broccoli residue decline study indicates a slow loss of residue with a half-life of about 14 days. Therefore, an accumulation effect from the 3 applications can be anticipated and, as the trials match the seasonal maximum application rate, they

may be considered as complying with maximum GAP. Six trials complied with GAP, and the residues in ranked order are: < 0.05 (2), 0.10, 0.11, 0.14, 0.38 mg/kg.

Cabbage

A report on supervised field trials on cabbage in the US was received. The US GAP is 3 applications of an EC formulation at 0.087 kg ai/ha/application and a PHI of 7 days. The trials were conducted as 3 applications at 0.056 kg ai/ha, which matches the seasonal maximum rate but is only 64% of the single application rate, i.e., 0.087 mg/kg. The retreatment interval was 5 to 8 days. The cabbage residue decline study indicates residues < LOQ at all time intervals. Based on the broccoli decline study, a slow loss of residue with a half-life of about 14 days might be expected. Therefore, an accumulation effect from the 3 applications can be anticipated and, as the trials match the seasonal maximum application rate, they may be considered as complying with maximum GAP. Six trials complied with GAP, and the residues in ranked order are: < 0.05 (3), 0.08, 0.19, 0.48 mg/kg.

The Meeting used the broccoli and cabbage data as mutual support for a brassica vegetable maximum residue estimate of 0.7 mg/kg (broccoli or cabbage) and an STMR estimate of 0.105 mg/kg (broccoli).

The NAFTA statistical procedure produced for broccoli a maximum residue level estimate of 0.6 mg/kg, based on the 99th percentile of a log normal distribution. The NAFTA statistical procedure produced for cabbage a maximum residue level estimate of 0.6 mg/kg, based on the UCL median 95th. Statistical procedures have limited utility with very small data sets (n = 6 each).

Fruiting vegetables, Cucurbits

Cucumber

A report on supervised field trials on cucumbers in the US was received, where the GAP for all cucurbits is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Six trials complied with GAP, and the results in ranked order are: < 0.05 (6) mg/kg.

Melons

A report on supervised field trials on cantaloupe melons in the US was received, where the GAP for all cucurbits is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Eight trials complied with GAP, and the results in ranked order are: < 0.05 (4), 0.05, 0.07, 0.08, 0.09 mg/kg.

Summer squash (zucchini)

A report on supervised field trials on summer squash in the US was received, where the GAP for all cucurbits is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Seven trials complied with GAP, and the results in ranked order are: < 0.05 (6), 0.07 mg/kg.

The Meeting noted that residue levels from the same GAP are similar on cucumber, cantaloupe, and summer squash and decided to estimate an STMR of 0.05 and a maximum residue level of 0.2 mg/kg, respectively, for fruiting vegetables cucurbits.

The NAFTA statistical calculation procedure is not reliable for highly censored data sets. Using the data set with the lowest percentage of censored data (melons), a maximum residue level estimate of 0.11 mg/kg based on the mean plus 3×SD is suggested.

Fruiting vegetables, other than Cucurbits

Peppers

A report on supervised field trials on peppers in Canada and the US was received. The US GAP for all fruiting vegetables (non-cucurbit) is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Twelve bell pepper trials and 4 non-bell pepper trials complied with the US GAP. The non-bell (< 0.05 (2), 0.20, 0.36 mg/kg) results were not from a different population than the bell pepper

results, and the combined results (n = 16) in ranked order are: < 0.05 (5), 0.05 (2), 0.07 (2), 0.14, 0.20, 0.22, 0.28, 0.36, 0.37, 0.38 mg/kg.

Tomato

A report on supervised field trials on tomatoes in Canada and the US was received. The US GAP for all fruiting vegetables (non-cucurbit) is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. The use for fruiting vegetables non-cucurbit is for fields (outside) only except tomato, where glasshouse use is also specified.

Four glasshouse trials complied with GAP, and the trial results in ranked order are: < 0.05, 0.06, 0.20, 0.47 mg/kg. Fourteen field trials in Canada and the US complied with the US GAP, and the trial results in ranked order are: < 0.05 (3), 0.06 (2), 0.08 (2), 0.10 (2), 0.13 (2), 0.23, 0.26, 0.28 mg/kg.

The glasshouse and field trial results do not appear to be from different populations and may be combined (n = 18) to yield in ranked order: < 0.05 (4), 0.06 (3), 0.08 (2), 0.10 (2), 0.13 (2), 0.20, 0.23, 0.26, 0.28, 0.47 mg/kg.

The Meeting noted that the GAP is identical for pepper and tomato and that the tomato and pepper residue data sets are not from different populations. The Meeting used the data sets for mutual support and based upon the tomato data set (with the highest residue) estimated an STMR of 0.10 and a maximum residue level of 0.7 mg/kg for fruiting vegetables other than cucurbits to replace the existing Codex MRL of 0.02 (*) mg/kg for tomato.

The NAFTA statistical procedure estimated a maximum residue level of 0.6 mg/kg for pepper based on the mean plus 3 standard deviations and a maximum residue level of 0.6 mg/kg for tomato, based on the 99th percentile of a log normal distribution. The mean plus 3 standard deviations was 0.6 mg/kg for pepper and 0.5 mg/kg for tomato. The Meeting considered 0.7 mg/kg a better estimate, given a highest residue of 0.48 mg/kg in a set of 18 values.

Leafy vegetables (including Brassica leafy)

Mustard greens

A report on supervised field trials on mustard greens in Canada and the US was received. The US GAP for all Brassica leafy vegetables is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 7 days. Eleven trials complied with the US GAP, and the results in ranked order are: 2.0, 2.1, 2.6, 3.0, 3.2, 3.6, 4.4, 5.0, 5.2, 10, 19 mg/kg. The Meeting estimates an STMR of 3.6 and a maximum residue level of 25 mg/kg, respectively.

The NAFTA statistical procedure yielded a maximum residue level estimate of 25 mg/kg, based on the 99th percentile of a log normal distribution. The mean plus 3 standard deviations is also 25 mg/kg.

Swiss chard

A report on supervised field trials on Swiss chard in the US was received. The US GAP for Swiss chard is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Three trials complied with the US GAP, and residues in ranked order are: 2.3, 4.0, and 6.6 mg/kg.

The Meeting estimated an STMR of 4 and a maximum residue level of 15 mg/kg for Swiss chard. The Meeting noted that the number of trials was marginally acceptable, given that Swiss chard is not generally a major crop in production or in consumption.

The NAFTA statistical procedure yields a maximum residue estimate of 14 mg/kg, based on the 99th percentile of a log normal distribution. The mean plus 3 standard deviations is 11 mg/kg. Statistical procedures have no utility for very small data sets.

Legume vegetables

Common bean

A report on supervised field trials on snap beans (common bean, green bean) in Canada and the US was received. The US GAP for common bean is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Fourteen trials complied with the US GAP, and the results in ranked order are: < 0.05, 0.10, 0.12 (2), 0.14, 0.16 (2), 0.17, 0.18 (3), 0.32, 0.40, 0.46 mg/kg.

The Meeting estimated an STMR of 0.165 and a maximum residue level of 0.7 kg/mg, respectively.

The NAFTA statistical procedure estimated a maximum residue level of 0.7 mg/kg, based on the 99th percentile of a log normal distribution. The mean plus 3 standard deviations is 0.60 mg/kg.

Pulses

Bean (dry)

A report on supervised field trials on dry beans in the US was received. The US GAP for dry bean is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Thirteen trials complied with the US GAP, and the results in ranked order are: < 0.05 (10), 0.06, 0.08 (2) mg/kg.

The Meeting estimated an STMR and maximum residue level of 0.05 and 0.1 mg/kg, respectively.

Use of the NAFTA statistical procedure yielded a maximum residue level estimate of 0.15 mg/kg, based on the 99th percentile of a log normal distribution. MLE was used to fill-in the < LOQ values. The mean plus 3 standard deviations is also 0.15 mg/kg. Statistical procedures are not reliable for highly censored data sets, and attributing log normal behaviour to the LOQ data may not be appropriate.

Grasses for sugar or syrup production

Sugar cane

A report on supervised field trials on sugar cane in the US was received. The US GAP for sugar cane is 5 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 14 days. Seven trials comply with the US GAP, and the results in ranked order are: < 0.05, 0.07 (2), 0.08, 0.10, 0.29, 0.31 mg/kg.

The Meeting estimated an STMR of 0.08 and a maximum residue level of 0.5 mg/kg.

The NAFTA statistical procedure yielded a maximum residue level estimate of 0.6 mg/kg, based on the 99th percentile of a log normal distribution. The mean plus 3 standard deviations is 0.5 mg/kg. Statistical procedures are unreliable for small data sets.

Animal feed commodities

Bean forage (green)

A report on supervised field trials on snap beans (common bean, green bean) in Canada and the US was received. The US GAP for common bean is 3 applications of an EC formulation at 0.087 kg ai/ha with a PHI of 1 day. Two types of vine samples were collected at different locations, vine only and vine plus residual pods. Fourteen trials comply with the US GAP, and residue results in ranked order are: 3.1, 5.3, 5.8 (2), 6.6, 6.8, 7.4, 7.8, 8.6, 8.8, 10 (2), 13, 18 mg/kg.

The Meeting estimated an STMR of 8.2 and a highest residue of 18 mg/kg.

Processing studies

Processing studies were provided for plum, tomato, and sugar cane. However, no residues were found in either the sugar cane or processed commodities. The processing factors (transfer factors) and related STMR-Ps are summarised as follows:

Commodity	Number of Studies (n)	Median Novaluron Transfer Factors	Novaluron RAC-STMR (mg/kg)	Novaluron STMR-P (mg/kg)
Plum - dried	2	3.1	0.41	1.27
Tomato - puree	1	< 0.73	0.10	0.073
Tomato - paste	1	1.1	0.10	0.11

The Meeting calculated a maximum residue level of 7 mg/kg for dried plums based on a highest residue of 2.2 mg/kg for stone fruit and a processing factor of 3.1 for plums (2.2 mg/kg × 3.1 = 6.8 mg/kg). This estimate is not needed as the mrl estimate for stone fruit is 7 mg/kg, and 7 mg/kg is equal to or greater than the dried plum estimate.

Farm animal feeding studies

The 2005 JMPR evaluated a ruminant feeding study and derived maximum residue estimates for livestock commodities based on the feeding study, a poultry metabolism study, and the livestock feeding tables then in use. New livestock feeding tables have been adopted, based on the OECD work.

The new uses under consideration by the present JMPR have several livestock feed items: bean vines (green), sugar cane molasses and bagasse, bean seed, and cabbage heads.

The Meeting estimated the dietary burden of novaluron in farm animals on the basis of the diets listed in Appendix IX of the FAO Manual (2009 Edition). Calculation from highest residues, STMR (some bulk blended commodities), and STMR-P values provides the levels in feed suitable for estimating MRLs, while calculation from STMR and STMR-P values for feed is suitable for estimating STMR values for animal commodities. The percentage dry matter is assumed to be 100% when the highest residue levels and STMRs are expressed on a dry weight basis.

Estimated maximum and mean dietary burdens of farm animals

Dietary burden calculations for beef cattle, dairy cattle, chicken broilers, and laying poultry are provided in Annex 6 of the 2010 JMPR Report. The calculations were made according to the animal diets from the US/CAN, EU, and Australia in Appendix IX of the FAO Manual (2009 Edition). Bean forage makes a considerable contribution to the diet of cattle in Australia and to a lesser extent in Europe. Preliminary IEDI calculations with bean forage included in the diets of Australian and European cattle indicate that the ADI may be exceeded in at least one region. Therefore a tiered approach was adopted, and bean forage (green) was not included in the livestock diet for Australia or the European Union because novaluron is not registered for use on beans in Australia or in European Union member states, and forages are not generally in international trade (JMPR Report 2009, General Consideration 2.2). Thus, no residue of novaluron is anticipated on bean forage in Australia or in European Union member states.

Commodity	Level	Animal Dietary Burden, Novaluron, ppm of dry matter diet.			
		US/CAN	EU	Australia	Japan
Beef cattle	Max	1.54	3.03 [a]	2.44	0.0
	Mean	0.44	2.53 [c]	2.44	0.0
Dairy cattle	Max	1.20	1.86 [b]	1.27	0.0
	Mean	1.20	1.36 [d]	1.27	0.0
Poultry – broiler	Max	0.0092	0.174 [e]	0.044	0.0
	Mean	0.0092	0.049 [f]	0.044	0.0
Poultry – layer	Max	0.0092	0.014	0.044 [g]	0.0
	Mean	0.0092	0.014	0.044 [h]	0.0

[a] Highest maximum beef or dairy cattle dietary burden suitable for MRL estimates for mammalian tissues

[b] Highest maximum dairy cattle dietary burden suitable for MRL estimates for mammalian milk

[c] Highest mean beef or dairy cattle dietary burden suitable for STMR estimates for mammalian tissues.

[d] Highest mean dairy cattle dietary burden suitable for STMR estimates for milk.

[e] Highest maximum poultry dietary burden suitable for MRL estimates for poultry tissues.

[f] Highest mean poultry dietary burden suitable for STMR estimates for poultry tissues.

[g] Highest maximum poultry dietary burden suitable for MRL estimates for poultry eggs.

[h] Highest mean poultry dietary burden suitable for STMR estimates for poultry eggs.

A cow feeding study was reviewed by the 2005 JMPR. In the table below, dietary burdens are shown in round brackets (), feeding levels and residue concentrations from the feeding study are shown in square brackets [], and estimated concentrations related to the dietary burdens are shown without brackets.

Cattle Dietary Burden (ppm)						
Feeding Level [ppm]	Cream	Milk	Muscle	Liver	Kidney	Fat
MAXIMUM RESIDUE LEVEL	Mean	Mean	Highest	Highest	Highest	Highest
MAXIMUM RESIDUE LEVEL beef cattle (3.03) [2.6]			0.10 [0.09]	0.16 [0.14]	0.16 [0.14]	2.6 [2.25]
MAXIMUM RESIDUE LEVEL dairy cattle (1.86) [2.6]	2.0 [2.8]	0.093 [0.13]	0.064 [0.09]	0.10 [0.14]	0.10 [0.14]	1.6 [2.25]
STMR	Mean	Mean	Mean	Mean	Mean	Mean
STMR beef cattle (2.53) [2.6]			0.078 [0.08]	0.13 [0.13]	0.13 [0.13]	1.7 [1.73]
STMR dairy Cattle (1.36) [0.35/2.6]	2.6 [0.68/2.80]	0.13 [0.04/0.13]	0.08 [0.04/0.08]	0.13 [0.05/0.13]	0.13 [0.04/0.13]	1.7 [0.45/1.73]

The data from the lactating dairy cow feeding study were used to support mammalian (except marine) milk and meat maximum residue levels.

The Meeting estimated the following STMR values: milk 0.13; cream, 2.6 mg/kg; muscle 0.08; edible offal 0.13; fat 1.7 mg/kg. These levels replace previous estimates.

The Meeting estimated the following maximum residue levels for mammalian commodities (except marine): milk 0.2 mg/kg; milk fat 5 mg/kg; meat (fat) 3 mg/kg; edible offal 0.2 mg/kg. The milk fat estimate assumes that cream contains 50% milk fat. However, as these estimates are lower than previous recommendations, which are now CXLs, the Meeting confirmed the previous recommendations: milk 0.4 mg/kg; milk fat 7 mg/kg; meat (fat) 10 mg/kg; edible offal 0.7 mg/kg. The Meeting noted that the decrease in estimates results from the new OECD animal dietary burden diets adopted by the JMPR. For example consumption of cotton gin trash has dropped from 20% to 5%, and consumption of wet apple pomace has dropped from 40% to 20%.

A poultry feeding study was made available to the Meeting. Groups of laying hens were orally dosed with novaluron at levels of 0, 0.12, 0.36, and 1.2 mg/kg for 56 days. Maximum residues at the 0.12 ppm feeding level were 0.080 mg/kg in eggs (day 47), 0.014 mg/kg in muscle, 0.034 mg/kg in liver, 0.039 mg/kg in kidney, and 0.323 mg/kg in fat (abdominal). Average residues were 0.070 mg/kg in eggs (day 47), 0.012 mg/kg in muscle, 0.033 mg/kg in liver, 0.036 mg/kg in kidney,

and 0.307 mg/kg in fat (abdominal). At the 0.36 ppm feeding level, the maximum and average residues in egg were 0.18 mg/kg and 0.174 mg/kg (day 47), respectively.

In the table below, dietary burdens are shown in round brackets (), feeding levels and residue concentrations from the feeding study are shown in square brackets [], and estimated concentrations related to the dietary burdens are shown without brackets.

Poultry Dietary Burden (ppm)					
Feeding Level [ppm]	Egg	Muscle	Liver	Kidney	Fat
MAXIMUM RESIDUE LEVEL	Mean	Highest	Highest		Highest
MAXIMUM RESIDUE LEVEL Broiler (0.044) [0.12]		0.0044 [0.012]	0.012 [0.033]	0.013 [0.036]	0.11 [0.307]
MAXIMUM RESIDUE LEVEL Laying (0.174) [0.12]	0.10 [0.0703]	0.021 [0.014]	0.049 [0.034]	0.056 [0.039]	0.47 [0.323]
STMR	Mean	Mean	Mean		Mean
STMR Broiler (0.044) [0.12]		0.0044 [0.012]	0.012 [0.033]	0.013 [0.036]	0.11 [0.307]
STMR Laying (0.049) [0.12]	0.029 [0.0703]	0.0048 [0.012]	0.013 [0.033]	0.015 [0.036]	0.13 [0.307]

The data from the laying hen feeding study were used to support poultry egg and meat maximum residue levels.

The Meeting estimated the following STMR values: eggs, 0.029 mg/kg; fat, 0.13 mg/kg; muscle, 0.005 mg/kg; edible offal, 0.015 mg/kg. These replace previous STMR estimates.

The Meeting estimated the following maximum residue levels for poultry commodities: eggs, 0.1 mg/kg; meat (fat), 0.5 mg/kg; edible offal, 0.1 mg/kg. These estimates replace previous recommendations: eggs 0.01 (*) mg/kg; poultry meat (fat) 0.01 (*) mg/kg; poultry, edible offal of 0.01 (*) mg/kg.

RECOMMENDATIONS

On the basis of data from supervised trials, the Meeting concluded that the residue levels listed in the table below are suitable for establishing MRLs and for dietary risk assessment.

Definition of the residue for compliance with MRLs and for estimation of dietary intake for plant and livestock commodities: Novaluron. Novaluron is fat soluble.

Commodity		Maximum residue level recommendation, mg/kg	Previous MRL, mg/kg	STMR or STMR-P, mg/kg
CCN	Name			
VD 0071	Beans (dry)	0.1		0.05
FB 0020	Blueberries	7	-	2.1
VB 0040	Brassica (cole or cabbage) vegetables, Head cabbages, Flowerhead brassica	0.7	-	0.105

Commodity		Maximum residue level recommendation, mg/kg	Previous MRL, mg/kg	STMR or STMR-P, mg/kg
CCN	Name			
VP 0526	Common Bean (pods and/or immature seeds)	0.7		0.165
MO 0105	Edible offal (mammalian)	0.7	0.7	0.13
PE 0112	Eggs	0.1	0.01 (*)	0.029
VC 0045	Fruiting vegetables, Cucurbits	0.2	-	0.05
VO 0050	Fruiting vegetables, other than Cucurbits	0.7	-	0.10
MM 0095	Meat (from mammals other than marine mammals)	10 (fat)	10 (fat)	0.08 muscle 1.7 fat
ML 0106	Milks	0.4	0.4	0.13
FM 0183	Milk fats	7	7	2.6 cream
VL 0485	Mustard Greens	25	-	3.6
PM 0110	Poultry meat	0.5 (fat)	0.01 (fat) (*)	0.005 muscle 0.13 fat
PO 0111	Poultry, edible offal of	0.1	0.01 (*)	0.015
DF 0014	Prunes (plums dry)	3		1.27
FS 0012	Stone fruits	7	-	2.2
FB 0275	Strawberry	0.5		0.15
GS 0659	Sugar cane	0.5		0.08
VL 0464	Swiss Chard	15		4.0
VO 0448	Tomato	W	0.02 (*)	
-	Tomato puree			0.073
VW 0448	Tomato paste			0.11

DIETARY RISK ASSESSMENT

Long-term intake

The International Estimated Daily Intakes (IEDIs) of novaluron were calculated for the 13 GEMS/Food Consumption Cluster Diets using STMRs and STMR-Ps estimated by the current Meeting (see Annex 3 of 2010 JMPR Report). The ADI is 0–0.01mg/kg bw and the calculated IEDIs were 7–50% of the maximum ADI. The Meeting concluded that the long-term intake of residues of novaluron resulting from the uses considered by the current JMPR is unlikely to present a public health concern.

Short-term intake

The2005 JMPR decided that an ARfD was unnecessary. The Meeting therefore concluded that the short-term intake of novaluron residues is unlikely to present a public health concern.

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Author(s)	Year	Study Title	Code Number
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