CYPRODINIL (207)

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EXPLANATION

Cyprodinil is a fungicide belonging to the anilinopyrimidine group of chemicals. It is a systemic fungicide with uptake through the leaves and translocation throughout the plant. It is used as a foliar fungicide for control of a range of fungal diseases in cereals, grapes, pome fruit, stone fruit, strawberries, vegetables, field crops and ornamentals, and as a seed dressing for barley.

Cyprodinil was evaluated by JMPR for the first time in 2003, when an ADI of 0–0.03 mg/kg bw/day was established. An ARfD was deemed to be unnecessary. A residue definition of cyprodinil was recommended for plant and animal commodities, for both compliance with MRLs and estimation of dietary intake. The residue is fat soluble.

At the Forty-fourth Session of the CCPR (2012), cyprodinil was scheduled for evaluation of additional use patterns by the 2013 JMPR.

The Meeting received residue data for avocadoes, dry beans, lima beans, common beans (snap beans), blueberries, Brassica vegetables (broccoli and cabbage), cane berries, cucurbit fruiting vegetables (cantaloupe, cucumber and squash), other fruiting vegetables (sweet and chilli pepper, and tomatoes), herbs (parsley, basil and chives), kiwifruit, leafy vegetables (mustard greens, lettuce and spinach), lemons (including processing data), lychees, pome fruit, root vegetables (carrot and radish), strawberry and watercress.

SPECIFICATIONS

Specifications for cyprodinil technical active constituent, emulsifiable concentrates and suspension concentrates were published by FAO in 2009.

Formulations

Two formulations were used in the residue trials submitted for evaluation by JMPR; both water-dispersible granular (WG) formulations, one containing 750 g/kg cyprodinil as the only active constituent, and the second containing 375 g/kg cyprodinil and 250 g/kg fludioxonil.

RESIDUE ANALYSIS

Plant matrices

Method number AG-631A/AG-631B

This method was used for determination of residues in pome fruit, dry beans, avocado, blueberry, broccoli, cabbage, mustard greens, raspberry, chilli and sweet pepper, tomato, basil, chives, kiwifruit, lettuce, spinach, lemon (including processed lemon commodities), lychee, parsley, carrot, radish, strawberry and watercress. Samples were extracted with methanol/water (80:20 v/v), then an aliquot of the extract was centrifuged, filtered and acidified with 1M hydrochloric acid. The extract was cleaned up using a strong cation exchange solid phase extraction cartridge. The cyprodinil residues were eluted with methanol/25% ammonia solution (95:5 v/v), before evaporation and reconstitution in a suitable solvent (e.g. 1:1 v/v methanol/water, 1:1 v/v acetonitrile/water). Samples were analysed by HPLC-UV (detection wavelength = 255 or 270 nm), or LC-MS/MS (quantification transition: 226.1 → 93.1). The calculated method LOQ was 0.01 mg/kg, although depending on the residue trial, the method was validated at various fortification levels, giving lowest limits of method validation (LLMVs) of 0.01–0.1 mg/kg.

Method number 2213-01

This method was used for determination of cyprodinil residues in cucurbit fruiting vegetables. Samples were extracted with methanol/water (80:20 v/v), then the extract was filtered and diluted to volume, before evaporation of the solvent from an aliquot of the sample and reconstitution in 0.1% aqueous ammonium acetate, and analysis by LC-MS (m/z=226). The method LOQ was 0.01 mg/kg.

The methods were validated for each matrix in conjunction with the analyses of the residue trial samples. Recovery data are tabulated below. The mean recoveries were acceptable, being within 70–120%, at fortification levels ranging from 0.01 to 115 mg/kg.

Table 1 Cyprodinil recovery data for method number AG-631B and 2213-01

Matrix	Fortification level (mg/kg)	n	Mean recovery (%)	RSD (%)	Reference (Author, Year)
Avocado	0.02	8	84	3.5	Barney, 2005
	0.2	4	79	3.3	
	2	3	80	2.2	
Beans (dry)	0.02	7	93	5.9	Chen, 2003
	0.1	9	90	4.1	
	1	5	87	3.3	
Blueberry	0.02	3	103	3.4	Thompson, 2001
	0.2	4	80	2.7	
	2	8	95	16	
Broccoli	0.025	7	98	10	Arsenovic, 2002
	0.25	1	114	–	
	0.5	1	104	–	
	0.6	3	101	5.0	
	10	5	109	5.3	
Cabbage	0.02	6	99	16	Arsenovic, 2002
	0.4	7	85	15	
	10	1	82	–	
	20	3	86	6.8	
Mustard greens	0.05	7	85	12	Arsenovic, 2002
	0.5	8	87	8.4	
	1	2	97	–	
	10	2	82	–	
	20	3	88	4.0	
Raspberry	0.02	3	98	7.7	Starner, 2001
	0.2	3	77	4.6	
	2	9	92	11	
	10	3	83	10	
Cantaloupe	0.01	9	81	10	Oakes, 2007
	0.02	1	84	–	
	0.05	2	85	–	
	0.1	2	86	–	
	0.5	3	111	3.6	
Cucumber	0.01	9	80	5.8	
	0.02	1	79	–	
	0.05	5	86	12	
	0.1	3	100	15	
	0.5	1	101	–	
Squash	0.01	8	87	–7	
	0.02	1	83	–	
	0.05	2	82	–	
	0.1	2	98	–	
	0.5	2	97	–	
	1	1	106	–	
Chilli and	0.01	9	89	12	Lennon, 2011

Matrix	Fortification level (mg/kg)	n	Mean recovery (%)	RSD (%)	Reference (Author, Year)
sweet					
	0.1	2	78	–	
	0.2	3	81	7.7	
	0.5	8	83	9.5	
	1	3	81	6.3	
	2	3	81	4.0	
Tomato (fruit)	0.01	22	94	9.0	Thompson, 2005
	0.1	1	82	–	
	0.2	20	90	8.9	
	1	1	83	–	
	2	4	87	6.9	
Tomato (puree)	0.01	6	96	18	
	0.2	4	92	2.8	
	1	1	85	–	
	2	3	90	4.0	
Tomato (paste)	0.01	6	86	11	
	0.2	4	88	6.1	
	1	1	101	–	
	2	3	85	7.7	
Basil (fresh)	0.05	3	83	3.6	Chen, 2002
	0.1	1	90	–	
	0.5	3	81	3.1	
	1	3	86	3.1	
	10	2	80	–	
Basil (dried)	0.1	3	82	7.5	
	0.5	3	73	5.2	
	1	3	96	2.6	
	10	3	82	6.5	
Chives (fresh)	0.05	9	94	9.5	Chen, 2002
	0.2	3	87	0	
	1	7	82	4.1	
Chives (dried)	0.05	3	75	2.0	
	0.2	3	81	2.8	
	5	3	81	2.5	
Kiwifruit	0.01	6	91	16	Thompson, 2007
	0.5	7	79	8.4	
	1	1	90	–	
	5	3	83	6.0	
Lettuce	0.02	6	108	3.5	Chen, 2003
	1	16	87	4.7	
	10	4	91	3.3	
	30	3	86	4.1	
Spinach	0.02	7	93	13	Thompson, 2011
	0.2	3	79	7.6	
	1	4	88	13	
	2	4	92	17	
	10	4	85	11	
	15	2	78	–	
	25	1	86	–	
	50	4	88	11	
Lemon	0.02	7	99	13	Thompson, 2007
	0.2	5	87	6.6	
	0.5	3	82	4.2	
	1	1	90	–	
	2	3	91	2.3	

Matrix	Fortification level (mg/kg)	n	Mean recovery (%)	RSD (%)	Reference (Author, Year)
Lemon	0.02	1	82	–	Barney, 2010
	0.2	1	73	–	
Lemon dried pulp	0.01	5	80	10	
	0.02	3	107	1.9	
	0.2	3	84	6.6	
	2	3	79	0.7	
Lemon juice	0.01	5	96	3.0	
	0.02	1	84	–	
	0.2	4	77	6.6	
	2	3	75	7.4	
Lemon oil	0.02	6	99	11	
	0.2	3	105	1.6	
	2	4	96	9.8	
	50	3	88	15	
Lychee (whole)	0.02	3	92	13	Chen, 2002
	0.5	3	93	8.8	
	1	4	77	10	
	5	3	88	8.8	
Lychee (peeled fruit)	1	1	75	–	
Lychee (peel)	1	1	71	–	
Parsley (fresh)	0.05	7	103	13	Barney, 2006
	1	4	82	6.5	
	30	6	89	8.4	
Parsley (dried)	0.1	7	83	6.9	
	1	5	86	6.9	
	30	6	85	13	
	115	4	81	2.5	
Carrot	0.02	4	91	16	Chen, 2002
	0.1	4	85	6.3	
	0.4	6	80	9.0	
	1	5	99	11	
	0.02	7	87	14	Barney, 2006
	0.8	5	78	10	
Radish tops	0.01	10	90	15	Barney, 2007
	0.5	7	85	12	
	1	1	93	–	
	2	3	89	7.4	
Radish roots	0.01	7	94	12	
	0.025	3	81	10	
	0.5	9	80	7.7	
	1	1	85	–	
	2	3	76	3.5	
Strawberry	0.02	9	92	8.8	Chen, 2004
	0.2	3	82	5.3	
	2	8	82	6.3	
Watercress	0.05	3	109	7.1	Starner, 2001
	0.5	4	80	9.7	
	2	1	73	–	
	5	3	76	2.6	
	20	3	93	11	
Apple	0.01	9	100	15	Mazlo, 2010
	0.1	6	95	7.6	
	1	3	70	6.8	
	2	2	76	–	

Matrix	Fortification level (mg/kg)	n	Mean recovery (%)	RSD (%)	Reference (Author, Year)
Pear	0.01	3	102	3.4	Mazlo, 2010
	0.1	3	98	7.4	
	1	3	87	21	

Stability of pesticide residues in stored analytical samples

Plant matrices

Storage stability data was determined concurrently with sample storage as part of the analytical phase of the residue trials submitted to the Meeting. The storage intervals for the plant matrices in the residue trials are tabulated below, together with storage stability data.

Table 2 Storage stability data for cyprodinil residues in frozen plant matrices

Matrix	Sample storage interval (days)	Test storage interval (days)	Fortification level (mg/kg)	Stored recoveries (%)	Procedural recoveries (%)	Reference (Author, Year)
Avocado	103	229	1	64, 64, 64	90	Barney, 2005
Beans (dry)	164	164	1	89, 90, 94	90	Chen, 2003
Blueberry	329	335	2	95, 98, 110	95 (mean)	Thompson, 2001
Broccoli	180	183	10	84, 95, 90	105	Arsenovic, 2002
Cabbage	219	360	10	96, 102, 103	82	Arsenovic, 2002
Mustard greens	581	601	10	77, 84, 85	82 (mean)	Arsenovic, 2002
Raspberry	234	234	2	87, 94, 95	96	Starner, 2001
Cantaloupe	613	–	–	–	–	Oakes, 2007
Cucumber	596	–	–	–	–	
Squash	598	–	–	–	–	
Peppers	258	–	–	–	–	Lennon, 2011
Tomato (fruit)	221	292	1	89, 107, 108	83	Thompson, 2005
Tomato (puree)	90	123	1	78, 80, 86	85	
Tomato (paste)	65	126	1	89, 92, 93	101	
Basil (fresh)	416	428	1	83, 87, 97	75	Chen, 2002
Chives (fresh)	493	489	1	87, 88, 90	85	Chen, 2002
Kiwifruit	118	123	1	80, 83, 89	90	Thompson, 2007
Lettuce	182	207	1	87, 89, 89	89	Chen, 2003
Spinach	670	–	–	–	–	Thompson, 2011
Lemon	118	125	1	80, 86, 99	90	Thompson, 2007
Lemon	97	–	–	–	–	Barney, 2010
Lemon dried pulp	146	–	–	–	–	
Lemon juice	169	–	–	–	–	
Lemon oil	313	–	–	–	–	
Lychee	107	125	1	67, 71, 74	73	Chen, 2002
Parsley (fresh)	113	181	30	71, 79, 81	78	Barney, 2006
Parsley (dried)	101	180	30	80, 94, 95	83	
Carrot	256	439	1	73, 75, 80	85, 89	Chen, 2002
	80	–	–	–	–	Barney, 2006
Radish top	153	178	1	86, 95, 97	93	Barney, 2007
Radish roots	190	181	1	82, 91, 94	85, 93	
Strawberry	149	–	–	–	–	Chen, 2004
Watercress	303	308	2	63, 65, 73	73	Starner, 2001

Matrix	Sample storage interval (days)	Test storage interval (days)	Fortification level (mg/kg)	Stored recoveries (%)	Procedural recoveries (%)	Reference (Author, Year)
Apple	357	–	–	–	–	Mazlo, 2010
Pear	356	–	–	–	–	Mazlo, 2010

Further storage stability data was evaluated by JMPR for the 2003 evaluation of cyprodinil. A study by Kissling (1995) evaluated the stability (at –18 °C) of incurred cyprodinil residues in grapes, apples, wheat ears, and wheat stalks, and of fortified residues in strawberries, potatoes and wine. Acceptable stability was observed in all of these matrices over 24 months.

The maximum interval for which samples were stored in the residue trials considered by this Meeting was 670 days (spinach). Stability of cyprodinil residues has been verified in a study conducted for a range of plant matrices over 24 months. Mean concurrent storage stability data was generally within the range 70–120%, with the exception of avocado and watercress. For the latter, it is noted that the analytical recovery was also low (73%).

USE PATTERNS

Cyprodinil is registered in the USA for use on lemons and limes, pome fruit, bush berries, cane berries, strawberries, tropical fruits—inedible peel, Brassica vegetables, cucurbits, non-cucurbit fruiting vegetables, leafy vegetables (including Brassica leafy vegetables), beans (succulent and dry), root and tuber vegetables and herbs.

Table 3 Registered uses of cyprodinil in the USA relevant to the evaluation

Crop	Application			PHI (days), or latest growth stage at application
	Method	Rate (g ai/ha, max)	No. (max)	
Lemon Lime	Foliar	289–368	1	0
Pome fruits [a]	Foliar	158–263	6 (at the maximum rate, max. seasonal rate 1578 g ai/ha)	0
	Foliar (aerial)	158–263	2	0
Berries and other small fruits [b]	Foliar	289–368	4 (at the maximum rate, max. season rate 1471 g ai/ha)	0
	Foliar (aerial)	289–368	1	0
Strawberries	Foliar	289–368	4 (at the maximum rate, max. season rate 1471 g ai/ha)	0
	Foliar (aerial)	289–368	1	0
Assorted tropical and subtropical fruits—inedible peel [c]	Foliar	289–368	4 (at the maximum rate, max. season rate 1471 g ai/ha)	0
	Foliar (aerial)	289–368	1	0
Kiwifruit (75 WG)	Foliar	525	2	0
	Foliar (aerial)	525	2	0
Brassica vegetables (includes some Brassica leafy vegetables) [d]	Foliar	263–368	4 (at the maximum rate, max. season rate 1471 g ai/ha)	7
Fruiting vegetables, Cucurbits [e]	Foliar	289–368	4 (at the maximum rate, max. season rate 1471 g ai/ha)	1
Fruiting vegetables, other than Cucurbits [f]	Foliar	289–369	4 (at the maximum rate, max. season rate 1471 g ai/ha)	0
Leafy vegetables [g]	Foliar	289–369	4 (at the maximum rate, max. season rate 1471 g ai/ha)	0
Watercress	Foliar	289–369	4 (at the maximum rate, max. season rate 1471 g ai/ha)	0
Legume vegetables [h]	Foliar	289–369	4 (at the maximum rate, max. season rate 1471 g ai/ha)	7
Pulses [i]	Foliar	289–369	4 (at the maximum rate, max. season rate 1471 g ai/ha)	7

Crop	Application			PHI (days), or latest growth stage at application
	Method	Rate (g ai/ha, max)	No. (max)	
Root and tuber vegetables [j]	Foliar	289–369	4 (at the maximum rate, max. season rate 1471 g ai/ha)	7
Radish	Foliar	289–369	2	7
Herbs [k]	Foliar	289–369	4 (at the maximum rate, max. season rate 1471 g ai/ha)	7

[a] Apple, Pear, Crab-apple, Quince, Loquat, Mayhaw.

[b] Bush berry subgroup (Aronia berry, black currant, blueberry, high and low bush, Buffalo currant, Chilean guava, Edible honeysuckle, elderberry, European barberry, gooseberry, highbush cranberry, huckleberry, jostaberry, juneberry, lingonberry, native currant, redcurrant, salal, sea buckthorn) Cane berry subgroup (blackberry, loganberry, red and black raspberry, wild raspberry).

[c] Tropical fruits (avocado, black sapote, canistel, dragon fruit, longan, lychee, mamey sapote, mango, papaya, pulasan, rambutan, sapodilla, Spanish lime, star apple).

[d] Brassica (cole) leafy vegetables (broccoli, Chinese broccoli, broccoli raab, Brussels sprouts, cabbage, Chinese cabbage, cauliflower, cavalo broccolo, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach, rape greens, turnip greens).

[e] Cucurbits (cantaloupe, chayote, Chinese waxgourd, cucumber, gourds, honeydew, bitter melon, balsam apple, muskmelon, watermelon, pumpkin, squash, zucchini).

[f] Fruiting vegetable crop group (African eggplant, bush tomato, bell pepper, cocona, currant tomato, eggplant, garden huckleberry, goji berry, groundcherry, martynia, naranjilla, okra, pea eggplant, pepino, non-bell pepper, roselle, scarlet eggplant, sunberry, tomatillos, tomato, tree tomato).

[g] Leafy greens subgroup 4A (except Brassica and leaf petioles subgroup 4B) (amaranth, arugula, cardoon, celery, Chinese celery, celtuce, chervil, edible chrysanthemum, corn salad, cress, dandelion, dock, endive, Florence fennel, head and leaf lettuce, New Zealand spinach, orach, parsley, purslane, radicchio, rhubarb, spinach, vine spinach, Swiss chard).

[h] Beans, succulent, except cowpea (chickpea, bean (*Lupinus* spp.), bean (*Phaseolus* spp.), broad bean, bean (*Vigna* spp.).

[i] Beans, dry, except cowpea (chickpea, bean (*Lupinus* spp.), bean (*Phaseolus* spp.), broad bean, bean (*Vigna* spp.).

[j] Root vegetables (edible burdock, carrot, celeriac, chicory, garden beet, ginseng, horseradish, parsnip, oriental radish, rutabaga, salsify, skirret, turnip, turnip-root parsley, turnip rooted chervil).

[k] Herbs (dried and fresh) (angelica, balm, basil, borage, burnet, camomile, catnip, chervil (dried leaves), chives, clary, coriander leaves, costmary, culantro, curry leaves, dillweed, horehound, hyssop, lavender, lemongrass, lovage, marigold, marjoram, nasturtium, parsley (dried), pennyroyal, rosemary, rue, sage, savory (summer and winter), sweet bay, tansy, tarragon, thyme, wintergreen, woodruff, wormwood).

RESIDUES RESULTING FROM SUPERVISED TRIALS ON CROPS

The Meeting received information on cyprodinil supervised field residue trials for the following commodities:

Crop group	Commodity	Table
Citrus fruits	Lemon	4
Pome fruits	Apples	5
	Pears	6
Berries and other small fruits	Blueberries	7
	Raspberries	8
	Strawberry	9
Assorted tropical and sub-tropical fruits—inedible peel	Avocado	10
	Kiwifruit	11
	Litchi	12
Brassica (cole or cabbage) vegetables, Head cabbages, Flowerhead Brassicas	Cabbage	13

Crop group	Commodity	Table
	Broccoli	14
Fruiting vegetables, Cucurbits	Melons	15
	Cucumber	16
	Squash	17
Fruiting vegetables, other than Cucurbits	Peppers (sweet), field grown	18
	Peppers (sweet), greenhouse grown	19
	Peppers (chilli), field grown	20
	Peppers (chilli), greenhouse grown	21
	Tomato, greenhouse grown	22
	Tomato, field grown	23
Leafy vegetables (including Brassica leafy vegetables)	Lettuce, Head	24
	Lettuce, Leaf	25
	Watercress	26
	Spinach	27
	Mustard greens	28
Legume vegetables	Common bean	29
	Lima bean	30
Pulses	Beans, dry	31
Root and tuber vegetables	Carrot	32
	Radish	33
Herbs	Basil	34
	Chives	35
	Parsley	36

Citrus fruits

Lemon

Five residue trials were conducted in lemons in California, USA during 2004/05 (Thompson, 2007-a). Cyprodinil was applied as a water-dispersible granular (WG) co-formulation with fludioxonil. A single foliar application was made to the treated plot at each trial site at a target application rate of 368 g ai/ha. No spray adjuvants were included in the tank mix. Fruit was sampled on the day of application, after the spray had dried. Residues of cyprodinil were analysed using an LC/MS/MS method (method number AG-631B). Analyses were completed within 4 months of harvest.

Table 4 Residues of cyprodinil in lemons

Location, Trial no., Year (Variety)	Application				Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Orange Cove, CA, USA, 04-CA122 (Lisbon)	1	mature fruit	0.39	1800	Fruit	0	0.17	0.17	0.17
Orange Cove, CA, USA,	1	mature	0.38	1100	Fruit	0	0.16	0.22	0.19

Location, Trial no., Year (Variety)	Application				Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
04-CA123 (Lisbon)		fruit							
Riverside, CA, USA, 04-CA124 (Lisbon)	1	mature fruit	0.37	1100	Fruit	0	0.21	0.36	0.28
Riverside, CA, USA, 04-CA125 (Lisbon)	1	mature fruit	0.37	1100	Fruit	0	0.36	0.32	0.34
Porterville, CA, USA, 04-CA126 (Pryor)	1	mature fruit	0.37	1900	Fruit	0	0.35	0.27	0.31

Pome fruit

Apples

A series of twelve trials in apples was conducted in the USA during the 2008 and 2009 growing seasons (Mazlo, 2010). Five applications of cyprodinil as a 750 g/kg WG formulation were made at each site, at target intervals of 7 days, with application rates of 278–296 g ai/ha (1× the GAP of the USA). A spray adjuvant (non-ionic surfactant or crop oil concentrate was included in the tank mix for all applications). Residues of cyprodinil in apples were determined using an LC/MS/MS method (method number AG-631B). Samples were stored frozen until analysis, which took place up to 12 months later.

Pears

A series of six trials in pears was conducted in the USA during the 2008 growing season (Mazlo, 2010). Five applications of cyprodinil as a 750 g/kg WG formulation were made at each site, at target intervals of 7 days, with application rates of 256–286 g ai/ha (1× the GAP of the USA). Residues of cyprodinil in pears were determined using an LC/MS/MS method (method number AG-631B). Samples stored frozen until analysis, which took place up to 12 months later.

Table 5 Results of residue trials conducted with cyprodinil (375 g/kg WG) in apples in the USA in 2008 and 2009 (study number T003061-07) [a]

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Hereford, PA, E04PA081221, 2008 (Stark Crimson)	5 (6, 8, 7 ,8)	77, 78, 78, 85, 87	0.28, 0.28, 0.28, 0.28, 0.28	2300, 2300, 2300, 2300, 2200	0	0.54	0.49	0.52
					13	0.38	0.32	0.35
North Rose, NY, E03NY081222, 2008 (Cortland)	5 (7, 7, 7, 7)	77, 81, 81, 85, 87	0.28, 0.28, 0.28, 0.28, 0.28	610, 620, 610, 620, 610	0	0.20	0.17	0.19
North Rose, NY, E03NY081223, 2008 (Ida Red)	5 (6, 7, 7, 8)	81, 81, 85, 85, 87	0.28, 0.28, 0.28, 0.28, 0.28	2100, 2100, 2100, 2100, 2100	0	0.18	0.22	0.20
Hart, MI, C01MI081225, 2008 (Golden Delicious)	5 (8, 6, 7, 7)	81, 77–78, 88, 85, 89	0.28, 0.28, 0.28, 0.28, 0.28	750, 760, 750, 760, 760	0	0.41	0.38	0.40
					14	0.36	0.35	0.36
Shelby, MI, C01MI081226, 2008 (Ida Red)	5 (7, 7, 9, 7)	81, 85, 88, 89, 89	0.29, 0.29, 0.28, 0.28, 0.28	1200, 1200, 1200, 1200, 1200	0	0.40	0.60	0.50
					14	0.30	0.38	0.34
Cedardge, CO, W12CO081227, 2008 (Gala)	5 (7, 7, 7, 7)		0.30, 0.29, 0.28, 0.28, 0.29	1700, 1600, 1600, 1600, 1600	0	0.61	0.63	0.62
					14	0.82	0.58	0.70
Hickman, CA, W26CA081228, 2008 (Gala)	5 (7, 6, 8, 7)	75, 77, 77, 79, 89	0.28, 0.28, 0.28, 0.28, 0.28	1500, 1500, 1400, 1400, 1500	0	0.54	0.47	0.51
					14	0.23	0.31	0.27
Ephrata, WA, W18WA081229, 2008 (Braeburn)	5 (7, 7, 7, 7)	75, 78, 82, 85, 85	0.28, 0.29, 0.29, 0.28, 0.28	93, 96, 96, 95, 95	0	1.1	0.77	0.94

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
					13	0.84	0.97	0.91
Ephrata, WA, W18WA081229, 2008 (Red Delicious)	5 (7, 7, 7, 7)	75, 78, 78, 85, 85	0.28, 0.28, 0.28, 0.28, 0.28	1900, 1900, 1900, 1900, 1900	0	0.33	0.45	0.39
					5	0.40		
					10	0.23		
					14	0.36	0.40	0.38
					19	0.28		
Hood River, OR, W20OR081231, 2008 (Ginger Gold)	5 (7, 7, 7, 7)		0.29, 0.28, 0.29, 0.28, 0.29	580, 590, 540, 680, 690	0	0.30	0.26	0.28
Hood River, OR, W20OR081232, 2008 (Jona Gold)	5 (7, 7, 7, 7)		0.29, 0.28, 0.28, 0.28, 0.28	1700, 1500, 1700, 1600, 1700	0	0.18	0.34	0.26
Alto, GA, E12GA091239, 2009 (Arkansas Black)	5 (7, 7, 7, 6)	77–79, 78–79, 80, 84–85, 85	0.28, 0.28, 0.28, 0.28, 0.28	580, 590, 580, 580, 590	0	1.1	1.4	1.3
					14	0.28	0.48	0.38

[a] Apple fruit were sampled.

Table 6 Results of residue trials conducted with cyprodinil (375 g/kg WG) in pears in the USA in 2008 (study number T003061-07) [a]

Location, Trial no., Year (Variety)	Application				Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Orefield, PA, E04PA081233, 2008 (Bartlett)	5 (7, 7, 7, 7)	75, 76, 77, 78, 81	0.28, 0.28, 0.28, 0.28, 0.28	520, 510, 520, 510, 510	0.49	0.42	0.46
Poplar, CA, W32CA081234, 2008 (Olympia)	5 (7, 7, 7, 7)	77, 79, 80–81, 81, 89	0.28, 0.26, 0.28, 0.29, 0.28	710, 720, 670, 720, 730	0.73	0.57	0.65
Lindsay, CA, W32CA081235, 2008 (Olympic)	5 (7, 7, 7, 7)	78, 79–80, 81, 88, 89	0.28, 0.28, 0.28, 0.29, 0.28	1900, 1900, 1900, 2000, 1900	0.48	0.22	0.35
Ephrata, WA, W18WA081236, 2008 (Bartlett)	5 (7, 7, 7, 7)	75, 77, 79, 81, 85	0.28, 0.28, 0.28, 0.28, 0.28	96, 96, 98, 95, 97	0.32	0.40	0.36
Ephrata, WA, W18WA081237, 2008 (Concord)	5 (7, 7, 7, 7)	69, 77, 78, 84, 87	0.28, 0.28, 0.28, 0.28, 0.28	1900, 1900, 1900, 1900, 1900	0.31	0.28	0.30
Hood River, OR, W20OR081238, 2008 (Starkrimson)	5 (7, 7, 7, 7)		0.28, 0.28, 0.28, 0.29, 0.28	440, 460, 630, 530, 520	0.11	0.22	0.17

[a] Fruit samples were taken at day 0.

Berries and other small fruits

Blueberries

Residue trials in blueberries were conducted at eight sites across the USA during the 1998 and 1999 growing seasons (Thompson, 2001). Cyprodinil was applied as a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil.

Samples were analysed for cyprodinil using an HPLC-UV method (method number AG-631B, with minor modifications). Recoveries ranged from 75–118% at fortification levels of 0.02, 0.2 and 2 mg/kg. The samples were stored frozen for up to 11 months between harvest and analysis.

Raspberries

Five residue trials in raspberries were conducted in the USA during the 1998 growing season (Starner, 2001-a). A series of four applications of a water dispersible granular formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil was made. The first two applications were made during flowering, approximately 7 days apart, followed by a gap of around 2–5 weeks before the third and fourth applications, which were made around 7 days apart around the time of commercial harvest. Fruit was sampled on the day of the last application, after the spray had dried.

Residues of cyprodinil were determined using an HPLC-UV method (method number AG-631B, with minor modifications).

Strawberries

Eight trials using a water dispersible granule fungicide containing 375 and 250 g/kg respectively of cyprodinil and fludioxonil were conducted in strawberries in the USA during 2002 (Chen, 2004). Cyprodinil was applied as a foliar-directed spray at a target rate of 368 g ai/ha using a pressurised backpack sprayer with a hand-held boom; spray adjuvants were not included. Four applications were made, at target intervals of 7 days. Fruit was sampled on the day of the last application, after the spray had dried.

Residues of cyprodinil were determined using an HPLC-UV method (method number AG-631B, with minor modifications).

Table 7 Residues of cyprodinil in blueberries [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Castle Hayne, NC, USA, NC06, 1998 (Harrison)	4 (9, 37, 7)	0.36, 0.36, 0.36, 0.36	320, 320, 320, 320	1.7	1.2	1.4
Castle Hayne, NC, USA, NC07, 1998 (Harrison)	4 (9, 37, 7)	0.36, 0.37, 0.36, 0.37	320, 330, 320, 330	1.6	1.2	1.4
Jonesboro, ME, USA, ME04, 1999 (wild)	4 (6, 71, 7)	0.37, 0.37, 0.36, 0.37	280, 280, 280, 280	1.1	0.99	1.0
Chatsworth, NJ, USA, NJ29, 1999 (Bluecrop)	4 (7, 48, 5)	0.36, 0.36, 0.37, 0.37	330, 320, 330, 330	0.56	0.45	0.50
Fennville, MI, USA, MI23, 1999 (Rubel)	4 (7, 72, 7)	0.38, 0.37, 0.37, 0.37	480, 460, 470, 470	0.92	0.96	0.94
Fennville, MI, USA, MI24, 1999 (Rubel)	4 (8, 64, 7)	0.37, 0.37, 0.37, 0.37	470, 460, 470, 470	1.9	1.9	1.9
Fennville, MI, USA, MI25, 1999 (Rubel)	4 (7, 63, 6)	0.37, 0.37, 0.37, 0.37	460, 470, 470, 470	1.5	1.8	1.7
Aurora, OR, USA, OR29, 1999 (Bluecrop)	4 (9, 77, 7)	0.38, 0.38, 0.38, 0.38	480, 480, 480, 480	0.55	0.68	0.62

[a] Fruit samples were taken at day 0.

Table 8 Residues of cyprodinil in raspberries [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Jackson Springs, NC, USA, NC05, 1998 (Southland)	4 (9, 16, 3)	0.36, 0.37, 0.36, 0.37	460, 470, 460, 460	6.2	5.6	5.9
Durham, NH, USA, NH02, 1998 (Heritage)	4 (7, 36, 8)	0.37, 0.36, 0.36, 0.36	510, 490, 500, 490	2.8	2.2	2.5
Mt Vernon, WA, USA, WA56, 1998 (Meeker red)	4 (9, 21, 8)	0.38, 0.37, 0.38, 0.37	760, 580, 630, 590	1.3	1.6	1.5
Burlington, WA, USA, WA57, 1998 (Meeker red)	4 (9, 21, 8)	0.38, 0.37, 0.37, 0.37	750, 580, 620, 600	1.7	1.4	1.6
Walla Walla, WA, USA, WA58, 1998	4 (9, 27, 7)	0.37, 0.36, 0.38,	580, 580, 590,	2.4	1.9	2.1

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
(Canby)		0.37	610			

[a] Fruit samples were taken at day 0.

Table 9 Residues of cyprodinil in strawberries [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (g ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Madera, CA, USA, CA19, 2002 (Hecker)	4 (7, 7, 7)	0.38, 0.38, 0.37, 0.37	480, 480, 470, 470	2.0	1.3	1.6
Salinas, CA, USA, CA20, 2002 (Diamonte)	4 (7, 6, 8)	0.35, 0.37 0.36, 0.36	360, 380, 560, 400	0.53	0.83	0.68
Fresno, CA, USA CA21, 2002 (Hecker)	4 (7, 7, 7)	0.38, 0.37, 0.37, 0.38	480, 470, 470, 480	1.7	2.2	2.0
Suwannee, FL, USA, FL04, 2002 (Sweet Charlie)	4 (6, 6, 7)	0.36, 0.37, 0.37, 0.37	270, 280, 280, 280	1.1	1.9	1.5
Clinton, NC, USA, NC05, 2002 (Camarosa)	4 (8, 6, 6)	0.37, 0.36, 0.37, 0.37	320, 320, 330, 330	1.3	0.87	1.1
Ithaca, NY, USA, NY07, 2002 (Jewel)	4 (6, 6, 7)	0.39, 0.37, 0.37, 0.38	490, 470, 470, 490	0.11 [b]	0.08 [b]	0.10 [b]
Aurora, OR, USA, OR05, 2002 (Totem)	4 (6, 8, 7)	0.40, 0.38, 0.39, 0.39	500, 480, 500, 500	0.29	0.32	0.30
Greenwood, WI, USA, WI02, 2002 (Honeoye)	4 (7, 7, 8)	0.37, 0.37, 0.37, 0.37	400, 400, 410, 430	0.89	0.92	0.91

[a] Fruit samples were taken at day 0.

[b] Results may be rain affected, rain fell within < 2 hours of the final application.

Assorted tropical and sub-tropical fruits—inedible peel

Avocado

Six trials in avocadoes were conducted across the USA during 2003 (Barney, 2005). Four applications of a water dispersible granular formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil, was made to each treated plot. Fruit was harvested from the treated plot on the day of the last application. The fruit were quartered in the field, and the stones discarded. It appears that the results were determined on the fruit minus stone, not on the whole fruit, as weights of the stones were not recorded.

Residues of cyprodinil were determined using an HPLC-UV method (method number AG-631B), with minor modifications.

Kiwifruit

Three residue trials for cyprodinil in kiwifruit were conducted in California in 2004 (Thompson, 2007-b). Cyprodinil was applied to kiwifruit vines with near-mature fruit as a 750 g/kg water dispersible granule formulation twice at 7–10 day intervals at a target application rate of 526 g ai/ha. Treated and control fruit were sampled on the day of the final application, after the spray had dried.

Samples were analysed for cyprodinil using HPLC/UV method number AG-631B, with minor modifications.

Lychees

Three residue trials in lychees were conducted in Florida during 2000 (Chen, 2002-a). Cyprodinil was applied as a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg

fludioxonil. Between five and seven applications were made at a target rate of 368 g ai cyprodinil/ha, commencing at fruit setting and continuing at approximately 7 day intervals until commercial maturity. Fruit was sampled on the day of the last application, after the spray had dried.

Lychees were analysed for cyprodinil using an HPLC-UV method (method number AG-631B, with minor modifications). Fruit from one site was separated into peel and peeled fruit for analysis to determine the partitioning of the residue between peel and pulp. Good recoveries were achieved in whole and peeled lychees, and peel, ranging from 71–105%. The samples were stored frozen for up to 3.5 months between harvest and analysis; recoveries after storage of cyprodinil from stability samples fortified at 1 mg/kg and stored for 125 days ranged from 67–74% (it is noted that the concurrent recovery at analysis after storage was 73%). It is unlikely that samples were adversely affected by storage.

Table 10 Residues of cyprodinil in avocadoes [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Homestead, FL, USA, FL22, 2003 (Miguel)	4 (7, 20, 7)	0.37, 0.38, 0.38, 0.38	850, 860, 860, 870	0.34	0.26	0.30
Monte Alto, TX, USA, TX14, 2003 (Lula)	4 (7, 22, 8)	0.37, 0.36, 0.37, 0.37	1800, 1800, 1900, 1900	0.07	0.09	0.08
Porterville, CA, USA, CA35, 2003 (Zutano)	4 (7, 21, 7)	0.38, 0.37, 0.37, 0.37	880, 870, 880, 890	0.22	0.13	0.18
Nipomo, CA, USA, CA36, 2003 (Gwen and Bacon)	4 (7, 19, 8)	0.38, 0.37, 0.37, 0.38	1600, 1600, 1600, 1600	0.45	0.26	0.35
Irvine, CA, USA, CA37, 2003 (Haas)	4 (7, 21, 8)	0.37, 0.38, 0.37, 0.38	750, 760, 750, 760	0.56	0.63	0.60
Orosi, CA, USA, CA38, 2003 (Haas)	4 (7, 19, 8)	0.37, 0.37, 0.37, 0.37	1600, 1600, 1600, 1600	0.21	0.25	0.23

[a] Fruit samples were taken at day 0.

Table 11 Residues of cyprodinil in kiwifruit [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Davis, CA, USA, CA70, 2004 (unspecified)	2 (10)	0.53, 0.53	670, 680	1.1	0.86	0.99
Porterville, CA, USA, CA71, 2004 (Hayward)	2 (7)	0.52, 0.52	790, 790	0.69	0.52	0.61
Parlier, CA, USA, CA72, 2004 (Hayward)	2 (7)	0.53, 0.55	880, 940	1.1	1.1	1.1

[a] Fruit samples were taken at day 0.

Table 12 Residues of cyprodinil in lychees [a]

Location, Trial no., Year (Variety)	Application			Sample	Residue (mg/kg)		
	No. (RTI, days)	Rate (g ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Homestead, FL, FL23, 2000 (Mauritius)	5 (7, 8, 6, 7)	0.37, 0.37, 0.37, 0.37, 0.37	700, 700, 700, 700, 700	Whole fruit	1.4	0.94	1.2
Homestead, FL, FL24, 2000 (Mauritius)	5 (7, 7, 7, 7)	0.38, 0.37, 0.37, 0.37, 0.37	1200, 1200, 1200, 1200, 1200	Whole fruit	0.94	1.4	1.1
Homestead, FL, FL25, 2000 (Mauritius)	7 (7, 7, 8, 8, 7, 7)	0.37, 0.37, 0.37, 0.37, 0.38, 0.38, 0.38	1200, 1200, 1200, 1200, 1200, 1200, 1200	Whole fruit	1.5	1.1	1.3
				Peeled fruit	< 0.02		
				Peel	3.1		

[a] Fruit samples were taken at day 0.

Brassica (cole or cabbage) vegetables, Head Cabbage, Flowerhead Brassicas

Cabbage

Residue trials were conducted at six sites in the USA for cabbage during 2000 (Arsenovic, 2002-a). Between four and six applications were made by foliar broadcast or foliar directed application at a target rate of 368 g ai/ha cyprodinil, with applications 1 and 2 being made at a target interval of 7 days, application 3 being made around 3 weeks after application 2, and all subsequent applications being made at a target interval of 7 days.

Cabbages, both with and without wrapper leaves, were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

Broccoli

Seven residue trials was conducted in the USA and Canada for a 375 g/kg cyprodinil and 250 g/kg fludioxonil water dispersible granule formulation in broccoli (Arsenovic, 2002-b). Between four and six applications were made at a target rate of 368 g ai/ha cyprodinil, with the first two applications being made early in the season roughly 7 days apart, while the third application was made at a target interval of 3 weeks after the second depending on how quickly the crop was maturing. The remaining applications were made at target intervals of 7 days.

Residues of cyprodinil in broccoli were determined using an HPLC-UV method (method number AG-631B, with minor modifications

With the exception of the sample from the Quebec site (where a low level of residue, 0.029 mg/kg, was found), no residues of cyprodinil were found in the untreated control samples at levels above the limit of quantitation.

Table 13 Residues of cyprodinil in cabbage [a]

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)
	No. (RTI, days)	Rate (g ai/ha)	Volume (L/ha)			
Stillwater, ME, USA, ME04, 2000 (Danish Ballhead)	4 (7, 20, 8)	0.35, 0.36, 0.38, 0.35	310, 320, 330, 310	Cabbage [a]	7	0.02
				Cabbage [a]	7	< 0.02
Weslaco, TX, USA, TX33, 2000 (Cheers)	4 (6, 19, 6)	0.37, 0.37, 0.37, 0.37	400, 390, 420, 400	Cabbage [a]	7	< 0.02
				Cabbage [a]	7	< 0.02
Gainesville, FL, USA, FL48, 2000 (Asgrow Blue Dynasty)	6 (7, 26, 8, 8, 7)	0.37, 0.38, 0.38, 0.37, 0.37, 0.38	380, 380, 380, 370, 370, 380	Cabbage [a]	8	0.36
				Cabbage [a]	8	0.08
Weslaco, TX, USA, TX34, 2000 (Cheers)	4 (8, 20, 8)	0.37, 0.37, 0.37, 0.37	450, 460, 450, 460	Cabbage [a]	7	0.19
				Cabbage [a]	7	< 0.02
Salinas, CA, USA, CA15, 2000 (Red Rookie)	4 (6, 23, 6)	0.39, 0.38, 0.36, 0.38	500, 510, 670, 720	Cabbage [a]	7	0.04
				Cabbage [a]	7	< 0.02
Arlington, WI, USA, WI03, 2000 (Blue Thunder)	4 (6, 22, 7)	0.62, 0.60, 0.61, 0.62 [b]	310, 300, 310, 310	Cabbage [a]	6	0.04
				Cabbage [a]	6	< 0.02

[a] Heads without wrapper leaves.

[b] Product was over-applied by approximately 62–68% per application. The results were scaled for MRL determination; actual results are tabulated.

Table 14 Residues of cyprodinil in broccoli [a]

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Weslaco, TX, USA, TX06, 2000 (Baccus hybrid)	4 (7, 14, 8)	0.37, 0.37, 0.37, 0.37	450, 450, 450, 460	6	0.02	< 0.02	0.02
Salinas, CA, USA, CA05, 2000 (Patriot)	4 (6, 23, 6)	0.37, 0.38, 0.37, 0.38	480, 520, 680, 710	7	0.15	0.12	0.14
Salinas, CA, USA, CA06, 2000 (Marathon)	4 (6, 23, 6)	0.37, 0.38, 0.38, 0.38	480, 520, 700, 720	8	0.19	0.11	0.15
El Centro, CA, USA, CA78, 2000 (Greenbelt)	4 (7, 21, 8)	0.37, 0.38, 0.37, 0.37	510, 520, 510, 520	6	0.24	0.16	0.20
Madera, CA, USA, CA126, 2000 (Green sprouting)	4 (7, 24, 8)	0.37, 0.37, 0.38, 0.37	370, 380, 380, 370	8	0.31	0.38	0.34
Abbottsford, BC, Canada, BC04, 2000 (Greenbelt)	4 (6, 40, 6)	0.37, 0.37, 0.37, 0.38	350, 350, 350, 360	7	0.40	0.46	0.43
Saint-Lin, QC, Canada, QC05, 2000 (Marathon)	6 (8, 6, 7, 22, 7)	0.38, 0.38, 0.38, 0.38, 0.38, 0.38	360, 360, 360, 360, 360, 360	7	1.2	0.91	1.1 c0.03

[a] Broccoli heads were sampled.

Fruiting vegetables, Cucurbits

Melons

Six trials in melons (cantaloupe variety) were conducted for a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil in the USA during 2004 and 2005 (Oakes, 2007). Four applications were made by foliar broadcast at a target application rate of 368 g ai/ha cyprodinil, at target intervals of 7 days, with the final application occurring around one week prior to scheduled harvest. Melons were sampled at all sites at target PHIs of 1 and 7 days after the last application. Additional samples were collected at the decline trial sites on days 0 (after the spray had dried), 3, 5 and 9 days after the last application.

Cyprodinil residues were determined using an LC/MS method (method number 2213-01, with modifications omitting the solid phase extraction clean-up stage).

Cucumber

Seven trials in cucumber were conducted using a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil in the USA during 2004 and 2005 (Oakes, 2007). Four applications were made by foliar broadcast using a backpack sprayer or tractor-mounted boom sprayer at a target application rate of 368 g ai/ha cyprodinil, at target intervals of 7 days, with the final application occurring around one week prior to scheduled harvest. Cucumbers were sampled at all sites at target PHIs of 1 and 7 days after the last application. Additional samples were collected at the decline trial sites on days 0 (after the spray had dried), 3, 5 and 9 days after the last application.

Cyprodinil residues were determined using an LC/MS method (method number 2213-01, with modifications omitting the solid phase extraction clean-up stage).

Summer squash

Six trials in summer squash were conducted using a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil in the USA during 2004 and 2005 (Oakes, 2007). Four applications were made by foliar broadcast at a target application rate of 368 g ai/ha cyprodinil, at target intervals of 7 days, with the final application occurring around one week prior to scheduled harvest. Squash were sampled at all sites at target PHIs of 1 and 7 days after the last application.

Additional samples were collected at the decline trial sites on days 0 (after the spray had dried), 3, 5 and 9 days after the last application.

Cyprodinil residues were determined using an LC/MS method (method number 2213-01, with modifications omitting the solid phase extraction clean-up stage). Recoveries of cyprodinil from squash fortified at concentrations between 0.01–1.0 mg/kg ranged from 73–116%. Samples were stored frozen for up to 20 months between collection and analysis.

Table 15 Residues of cyprodinil in melons (cantaloupe type) [a]

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Champaign, IL, USA, 4A-FR-04-5178, 2004 (Superstar)	4 (7, 9, 5)	71, 71, 73, 75	0.38, 0.38, 0.36, 0.37	28, 23, 32, 30	1	0.05	0.04	0.05
					8	0.03	0.04	0.04
Wharton, TX, USA, SA-FR-05-5188, 2005 (Earligold)	4 (7, 7, 7)	51–71, 71–74, 75–79, 64–81	0.39, 0.37, 0.36, 0.36	190, 200, 170, 190	1	0.05	0.06	0.06
					8	0.02	0.03	0.03
Chula, GA, USA, SI-FR-04-5177, 2004 (Edisto 47)	4 (7, 7, 7)	71, 75, 79, 85	0.37, 0.37, 0.36, 0.37	120, 120, 120, 150	1	0.09	0.10	0.10
					7	0.06	0.07	0.07
Madera, CA, USA, WC-FR-04-5180, 2004 (Top Net SR)	4 (7, 7, 7)		0.37, 0.36, 0.37, 0.37	280, 280, 280, 280	0	0.24	0.14	0.19
					1	0.17	0.17	0.17
					3	0.06	0.06	0.06
					5	0.06	0.28	0.17
					7	0.10	0.11	0.11
					9	0.14	0.05	0.10
Live Oak, CA, USA, WD-FR-04-5181, 2004 (Durango)	4 (6, 7, 7)		0.37, 0.37, 0.37, 0.37	140, 140, 140, 140	1	0.08	0.10	0.09
					7	0.10	0.07	0.09
Live Oak, CA, USA, WD-FR-04-5182, 2004 (Top Mark)	4 (7, 7, 7)		0.37, 0.37, 0.37, 0.37	140, 140, 140, 140	1	0.47	0.18	0.33
					7	0.18	0.11	0.15

[a] Fruit samples were taken

Table 16 Residues of cyprodinil in cucumbers [a]

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Delavan, WI, USA, NI-FR-04-5174, 2004 (Marketmore 86)	4 (7, 7, 7)		0.37, 0.38, 375, 0.37	190, 170, 170, 190	1	0.03	0.06	0.05
					7	0.02	0.02	0.02
Conklin, MI, USA, NI-FR-04-5173, 2004 (Marketmore 86)	4 (8, 6, 8)		0.37, 0.37, 0.37, 0.36	19, 19, 19, 18	1	0.04	0.04	0.04
					7	0.02	0.01	0.02
Wharton, TX, USA, SA-FR-04-5175, 2004 (Slice master select)	4 (7, 8, 6)	61–71, 61–73, 81–84, 81–87	0.37, 0.37, 0.37, 0.38	160, 180, 180, 190	1	0.13	0.09	0.11
					8	0.04	0.10	0.07

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Chula, GA, USA, SI-FR-04-5170, 2004 (Lightning)	4 (7, 7, 7)		0.37, 0.37, 0.37, 0.38	260, 260, 260, 260	1	0.08	0.10	0.09
					7	0.02	0.03	0.03
Rose Hill, NC, USA, SJ-FR-04-5171, 2004 (Poinsett 79)	4 (6, 7, 8)		0.37, 0.37, 0.37, 0.37	150, 140, 250, 160	1	0.15	0.14	0.15
					7	0.01	< 0.01	0.01
Vero Beach, FL, USA, VF-FR-04-5172, 2004 (Straight Eight)	4 (8, 9, 7)	51–59, 61–65, 69–71, 71–77	0.36, 0.36, 0.36, 0.37	280, 280, 280, 280	1	0.21	0.26	0.24
					7	0.05	0.10	0.08
Hickman, CA, USA, WC-FR-04-5176, 2004 (Poinsett 76)	4 (6, 7, 7)	65, 65, 71, 75	0.37, 0.37, 0.37, 0.37	230, 230, 230, 230	0	0.06	0.05	0.06
					1	0.05	0.12	0.09
					3	0.03	0.03	0.03
					5	0.02	0.02	0.02
					7	0.01	0.01	0.01
					9	0.02	0.02	0.02

[a] Fruit samples were taken

Table 17 Residues of cyprodinil in summer squash [a]

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Growth stage	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Champaign, IL, USA, 4A-FR-04-5186 (Lemondrop)	4 (7, 7, 8)	71, 73, 73, 75	0.40, 0.36, 0.39, 0.40	32, 28, 28, 29	1	0.02	0.02	0.02
					6	0.01	0.01	0.01
Hudson, NY, USA, 5E-FR-04-5183 (Yellow straight)	4 (7, 7, 7)	41, 45, 47, 49	0.38, 0.35, 0.37, 0.37	400, 370, 390, 380	1	0.07	0.06	0.07
					7	0.02	0.02	0.02
Elko, SC, USA, SJ-FR-04-5184, 2004 (Lemondrop L)	4 (6, 5, 5)		0.37, 0.37, 0.37, 0.37	310, 310, 310, 300	1	0.12	0.05	0.09
					6	0.01	0.01	0.01
Vero Beach, FL, USA, VF-FR-04-5185, 2004 (Burpee hybrid zucchini)	4 (7, 8, 8)	69–71, 71–77, 77–85, 85–89	0.37, 0.38, 0.38, 0.37	280, 280, 280, 280	1	0.06	0.08	0.07
					7	0.01	0.01	0.01
Visalia, CA, USA, WC-FR-04-5187, 2004 (Black Beauty)	4 (7, 7, 7)	62, 64, 72, 75	0.37, 0.37, 0.37, 0.37	140, 140, 140, 140	0	0.02	0.03	0.03
					1	0.03	0.02	0.03
					3	< 0.01	< 0.01	< 0.01
					5	< 0.01	< 0.01	< 0.01
					7	< 0.01	< 0.01	< 0.01
					9	< 0.01	< 0.01	< 0.01

[a] Fruit samples were taken

Fruiting vegetables, other than Cucurbits

Peppers (sweet) and peppers chili

Fourteen trials were conducted in field-grown peppers (sweet peppers and chilli peppers) in the USA and Canada in 2006 (Lennon, 2011-a). At each site, a plot was treated with a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil. Four applications at a target rate of 368 g ai/ha cyprodinil were made by foliar application, with target intervals of 7 days between

applications 1 and 2, and 3 and 4, and 21 days between applications 2 and 3. Applications 1 and 2 generally took place during flowering or early fruiting, while applications 3 and 4 were to plants with near-mature fruit. Spray adjuvants were not included in the tank mix. Mature green peppers were harvested on the day of the last application, after the spray had dried.

Samples were analysed for residues of cyprodinil using an HPLC-UV method (method number AG-631B, with minor modifications).

A series of trials in greenhouse grown peppers (four trials in sweet peppers and one trial in chilli peppers) was conducted in the USA and Canada during 2005 and 2006 (Lennon, 2011-b). Plots were treated with a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil. Four applications were made at a target rate of 368 g ai/ha, with an interval of approximately 7 days between applications 1 and 2, and between 3 and 4, while the interval between applications 2 and 3 was generally around 21 days. Samples were collected at each site on the day of the final application, after the spray had dried. At one site, a decline trial was conducted, and additional samples were collected at later intervals.

Samples were analysed for cyprodinil using an HPLC/UV method (method number AG-631B, with minor modifications).

Tomato

A series of eighteen trials (fourteen in field-grown tomatoes, and four in greenhouse tomatoes) was conducted in tomatoes in the USA during the 2002 growing season (Thompson, 2005). At each site, plots were treated with four applications of a water dispersible granule containing 375 g/kg cyprodinil and 250 g/kg fludioxonil. Applications were made at target intervals of 7 days for applications 1 and 2, and applications 3 and 4, with a target interval of 21 days for applications 2 and 3. This resulted in the first two applications being conducted at late flowering/early fruiting, and the second two when fruit was maturing.

Residues of cyprodinil were determined using an HPLC-UV method (method number AG-631B).

With one exception, residues were not found above the limit of quantitation in any of the untreated control samples.

Table 18 Residues of cyprodinil in field-grown sweet peppers [a]

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Holtville, CA, USA, CA45, 2006 (Maccabi)	4 (6, 21, 6)	0.37, 0.37, 0.37, 0.37	580, 550, 560, 550	0	0.23	0.24	0.23
Five Points, CA, USA, CA46, 2006 (Baron)	4 (7, 20, 7)	0.37, 0.37, 0.37, 0.36	380, 370, 380, 370	0	0.09	0.11	0.10
Citra, FL, USA, FL19, 2006 (Camelot 3XR)	4 (7, 21, 7)	0.37, 0.38, 0.38, 0.37	330, 340, 340, 330	0	0.25	0.24	0.25
Clinton, NC, USA, NC07, 2006 (Revolution)	4 (6, 23, 7)	0.36, 0.36, 0.37, 0.36	290, 290, 300, 290	0	0.19	0.11	0.15
Dresden, ON, Canada, ON02, 2006 (Revolution)	4 (5, 22, 8)	0.38, 0.40, 0.38, 0.39	310, 320, 310, 320	0	0.05	0.02	0.04
Dresden, ON, Canada, ON03, 2006 (Aristotle)	4 (5, 21, 7)	0.41, 0.43, 0.38, 0.37	330, 350, 310, 310	0	0.04	0.03	0.04
				1	0.03	0.03	0.03
				3	0.02	0.02	0.02
				6	0.01	0.01	0.01
				13	< 0.01	< 0.01	< 0.01
Delhi, ON, Canada, ON04, 2006 (Crusader)	4 (6, 21, 8)	0.37, 0.37, 0.36, 0.37	610, 610, 590, 610	0	0.13	0.13	0.13
St Jean sur Richelieu, QC, USA, QC01, 2006 (Redstart)	4 (7, 22, 6)	0.38, 0.37, 0.37, 0.38	410, 400, 410, 410	0	0.67	0.70	0.68

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Weslaco, TX, USA, TX17, 2006 (Capistrano)	4 (7, 22, 6)	0.37, 0.37, 0.37, 0.37	320, 320, 310, 310	0	0.21	0.16	0.19

[a] Fruit samples were taken.

Table 19 Residues of cyprodinil in greenhouse grown sweet peppers [a]

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Bridgeton, NJ, USA, NJ01, 2005 (King Arthur)	4 (7, 21, 6)	0.36, 0.38, 0.35, 0.37	690, 730, 670, 710	0	0.16	0.30	0.23
Kingsville, ON, Canada, ON01, 2006 (Striker)	4 (7, 18, 7)	0.37, 0.37, 0.37, 0.37	800, 800, 1000, 1000	0	0.20	0.21	0.21
				3	0.14	0.10	0.12
				7	0.04	0.09	0.07
				12	0.02	0.03	0.03
Kingsville, ON, Canada, ON06, 2005 (Zamboni)	4 (7, 21, 7)	0.37, 0.37, 0.37, 0.37	2000, 2000, 2000, 2000	0	0.11	0.04	0.08
Crossville, TN, USA, TN01, 2005 (Spartacus F1)	4 (7, 21, 7)	0.38, 0.37, 0.36, 0.36	870, 830, 820, 830	0	0.22	0.32	0.27

[a] Fruit samples were taken.

Table 20 Residues of cyprodinil in field-grown chilli peppers [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Las Cruces, NM, USA, NM03, 2006 (Joe E. Parker)	4 (7, 19, 8)	0.37, 0.37, 0.37, 0.37	230, 230, 230, 230	0.22	0.12	0.17
Las Cruces, NM, USA, NM04, 2006 (Joe E. Parker)	4 (6, 21, 6)	0.37, 0.37, 0.37, 0.37	840, 840, 850, 840	0.36	0.19	0.27
Wooster, OH, USA, OH06, 2006 (San Ardo)	4 (7, 21, 7)	0.37, 0.37, 0.37, 0.37	630, 650, 670, 640	0.23	0.18	0.20
Weslaco, TX, USA, TX16, 2006 (Sonora Anaheim)	4 (6, 20, 8)	0.37, 0.37, 0.37, 0.37	360, 370, 370, 370	0.33	0.22	0.28
Citra, FL, USA, FL20, 2006 (Mesilla 242)	4 (7, 21, 7)	0.37, 0.38, 0.37, 0.39	330, 340, 330, 350	0.82	0.52	0.67

[a] Fruit samples were taken at day 0.

Table 21 Residues of cyprodinil in greenhouse grown chilli peppers [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Weslaco, TX, USA, TX01, 2005 (TAM Veracruz)	4 (6, 18, 6)	0.37, 0.37, 0.37, 0.37	330, 330, 330, 330	0.58	0.60	0.59

[a] Fruit samples were taken at day 0.

Table 22 Residues of cyprodinil in greenhouse tomatoes [a]

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)	
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Bridgeton, NJ, USA, NJ14, 2002 (FL47)	4 (7, 21, 7)	0.38, 0.39, 0.38, 0.38	710, 720, 710, 700	0	0.13	0.21	0.17
Weslaco, TX, USA, TX12, 2002 (Mariachi RZ)	4 (7, 7, 7)	0.39, 0.37, 0.37, 0.37	510, 490, 490, 490	0	0.17	0.28	0.22
Crossville, TN, USA, TN02, 2002 (Celebrity)	4 (8, 21, 7)	0.37, 0.37, 0.37, 0.37	940, 940, 930, 940	0	0.18	0.21	0.20 c0.01
				3	0.30	0.35	0.32
				7	0.26	0.08	0.17
				14	0.07	0.14	0.10
Fort Collins, CO, USA, CO05, 2002 (Trust)	4 (7, 22, 7)	0.37, 0.37, 0.37, 0.36	280, 280, 280, 270	0	0.02	0.04	0.03

[a] Fruit samples were taken

Table 23 Residues of cyprodinil in field-grown tomatoes [a]

Location, Trial no., Year (Variety)	Application			Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	rep 1	rep 2	mean
Salisbury, MD, USA, MD01, 2002 (Mountain Pride)	4 (10, 22, 7)	0.37, 0.37, 0.37, 0.37	490, 490, 490, 480	0.10	0.08	0.09
Freeville, NY, USA, NY10, 2002 (Celebrity)	4 (7, 22, 7)	0.37, 0.38, 0.39, 0.38	370, 380, 390, 390	0.13	0.19	0.16
Citra, FL, USA, FL20, 2002 (Sun Pride)	4 (7, 21, 7)	0.37, 0.38, 0.37, 0.38	380, 380, 380, 390	0.20	0.19	0.20
Citra, FL, USA, FL21, 2002 (Sun Pride)	4 (8, 20, 7)	0.37, 0.37, 0.37, 0.37	370, 370, 380, 380	0.24	0.24	0.24
Clinton, NC, USA, NC10, 2002 (Mountain Spring)	4 (7, 21, 8)	0.37, 0.37, 0.37, 0.36	260, 260, 260, 250	0.15	0.13	0.14
Visalia, CA, USA, CA43, 2002 (Ace)	4 (6, 21, 7)	0.37, 0.37, 0.37, 0.37	440, 430, 430, 440	0.06	0.10	0.08
Five Points, CA, USA, CA44, 2002 (Heinz 8892)	4 (6, 20, 7)	0.38, 0.38, 0.39, 0.38	320, 320, 330, 330	0.24	0.28	0.26
Parlier, CA, USA, CA45, 2002 (Shady Lady)	4 (7, 21, 7)	0.38, 0.37, 0.37, 0.36	320, 320, 330, 320	0.22	0.17	0.20
Visalia, CA, USA, CA46, 2002 (Rio Grande)	4 (6, 21, 7)	0.37, 0.37, 0.37, 0.37	440, 430, 430, 440	0.13	0.09	0.11
Porterville, CA, USA, CA47, 2002 (APT 410)	4 (7, 21, 7)	0.37, 0.37, 0.38, 0.37	290, 280, 290, 290	0.24	0.36	0.30
Mesilla, NM, USA, NM05, 2002 (Rio Grande)	4 (7, 7, 7)	0.36, 0.37, 0.36, 0.37	200, 220, 220, 210	0.05	0.07	0.06
				0.05	0.03	0.04
				0.03	0.02	0.03
				0.02	0.02	0.02
Rincon, NM, USA, NM06, 2002 (Rio Grande)	4 (7, 21, 7)	0.37, 0.38, 0.38, 0.38	210, 210, 210, 210	0.15	0.14	0.14
Prosser, WA, USA, WA13, 2002 (Big Boy)	4 (7, 20, 8)	0.37, 0.37, 0.38, 0.36	440, 440, 460, 440	0.01	0.02	0.02
Arlington, WI, USA, WI20, 2002 (Puebla)	4 (6, 22, 7)	0.38, 0.37, 0.37, 0.38	320, 310, 310, 320	0.14	0.12	0.13

[a] Fruit samples were taken at day 0

Leafy vegetables (including Brassica leafy vegetables)

Lettuce

A series of fourteen residue trials for cyprodinil in lettuce (both head and leafy varieties) was conducted in the USA during the 2001 growing season (Chen, 2003-a). At each site, a plot was treated with a water dispersible granule containing 375 g/kg cyprodinil and 250 g/kg fludioxonil. Four foliar applications at a target rate of 368 g ai/ha cyprodinil were made at target intervals of 7 days. Samples were collected on the day of the last application, after the spray had dried. At the head lettuce trial sites, samples both with and without wrapper leaves were collected. Additional samples were collected at 7 and 14 days after the last application at two of the leaf lettuce sites to generated decline data.

Residues of cyprodinil in lettuce were determined using an HPLC-UV method (method number AG-631B, with minor modifications).

Spinach

Eleven residue trials in spinach were conducted in the USA and Canada during 2008 and 2009 (Thompson, 2011). At each site, a plot was treated with a water dispersible granule containing 375 g/kg cyprodinil and 250 g/kg fludioxonil. Four applications at a target rate of 368 g ai/ha cyprodinil were made by foliar application, with target intervals of 7 days between applications 1 and 2 and 3 and 4, and 14 days between applications 2 and 3. Spray adjuvants were included in the tank mix at most of the sites. Samples were collected on the day of the last application, after the spray had dried. At one site, additional samples were collected at intervals of 2-14 days after the last application in order to generate decline data.

Residues of cyprodinil in spinach were determined using HPLC-UV (method number AG-631B, with minor modifications).

Residues were found in control samples at levels at or very slightly above the LOQ at two sites.

Watercress

Two field trials were conducted in watercress in Florida during 1999 (Starner, 2001-b). A water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil was applied four times at a target rate of 368 g ai/ha cyprodinil, with target intervals of 7 days. Samples were collected at on the day of the last application, after the spray had dried.

Residues of cyprodinil in watercress were determined using HPLC-UV (method number AG-631A, with minor modifications). Samples were stored frozen for up to 10 months before analysis. Untreated control samples of watercress fortified at 2 mg/kg and stored frozen for up to 10 months showed recoveries of 63–73% (mean recovery = 67%). It is noted that the recoveries are slightly below the generally accepted range of 70–120%; the samples may have been adversely affected by storage to a small extent.

Mustard greens

Seven field trials in mustard greens was conducted in the USA during 2000 (Arsenovic, 2001-c). Four applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil at a target rate of 368 g ai/ha cyprodinil were made at target intervals of 7 days between applications 1 and 2 and 3 and 4, and 14 days between applications 2 and 3. Samples were collected at a target interval of 7 days after the last application.

Residues of cyprodinil in mustard greens were determined using HPLC-UV (method number AG-631B, with minor modifications).

Table 24 Residues of cyprodinil in head lettuce [a]

Location, Trial no., Year (Variety)	Application			Sample	Residue (mg/kg)
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		
Freeville, NY, USA, NY11, 2001 (Ithaca)	4 (6, 6, 6)	0.36, 0.37, 0.39, 0.35	450, 460, 490, 450	Heads with wrapper leaves	2.7
				Heads without wrapper leaves	0.07
Gainesville, FL, USA, FL15, 2001 (Crispino MTO)	4 (7, 8, 6)	0.37, 0.37, 0.37, 0.37	370, 380, 370, 370	Heads with wrapper leaves	21
				Heads without wrapper leaves	1.6
Mesilla, NM, USA, NM04, 2001 (Merit)	4 (7, 7, 7)	0.36, 0.37, 0.37, 0.35	340, 360, 340, 320	Heads with wrapper leaves	2.9
				Heads without wrapper leaves	0.15
Aurora, OR, USA, OR06, 2001 (Summer Time)	5 (8, 7, 8, 8)	0.37, 0.37, 0.37, 0.37, 0.37	380, 380, 380, 380, 380	Heads with wrapper leaves	5.1
				Heads without wrapper leaves	3.2
Willard, OH, USA, OH06, 2001 (Ithaca)	4 (6, 8, 8)	0.38, 0.38, 0.38, 0.36	560, 570, 360, 550	Heads with wrapper leaves	2.3
				Heads without wrapper leaves	0.69
Salinas, CA, USA, CA27, 2001 (Sharp Shooter)	4 (7, 7, 7)	0.37, 0.38, 0.37, 0.38	480, 500, 490, 510	Heads with wrapper leaves	1.6
				Heads without wrapper leaves	0.63
Holtville, CA, USA, CA29, 2001 (Red Coach 74)	4 (6, 7, 7)	0.40, 0.37, 0.36, 0.36	370, 380, 360, 370	Heads with wrapper leaves	2.0
				Heads without wrapper leaves	0.32
Parlier, CA, USA, CA31, 2001 (Bayview)	4 (8, 6, 8)	0.38, 0.38, 0.38, 0.38	360, 350, 350, 350	Heads with wrapper leaves	2.2
				Heads without wrapper leaves	0.31

[a] Samples were taken at day 0.

Table 25 Residues of cyprodinil in leaf lettuce

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Salisbury, MD, USA, MD08, 2001 (Salad Bowl)	5 (6, 6, 14, 9)	0.37, 0.37, 0.37, 0.37, 0.37	310, 310, 310, 310, 310	Leaves	0	12	15	14
Live Oak, FL, USA, FL16, 2001 (Waldmanns Dark Green MTO)	4 (6, 7, 8)	0.37, 0.38, 0.37, 0.37	370, 380, 370, 380	Leaves	0	25	24	24
				Leaves	7	13	15	14
				Leaves	14	11	7.8	9.5
Mesilla, NM, USA, NM05, 2001 (Salad Bowl)	4 (7, 7, 7)	0.38, 0.38, 0.38, 0.40	340, 350, 370, 360	Leaves	0	9.3	11	10
Salinas, CA, USA, CA28, 2001 (Green Gene's #1)	4 (7, 7, 7)	0.38, 0.54, 0.38, 0.38	420, 740, 500, 500	Leaves	0	10	9.9	10
				Leaves	7	1.3	1.4	1.3
				Leaves	14	0.31	0.27	0.29
Holtville, CA, USA, CA30, 2001 (Royal Groon)	4 (7, 7, 6)	0.37, 0.37, 0.37, 0.37	370, 380, 380, 380	Leaves	0	8.8	8.3	8.5

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Parlier, CA, USA, CA32, 2001 (Green Vision)	4 (7, 7, 7)	0.39, 0.40, 0.39, 0.37	350, 360, 350, 340	Leaves	0	11	11	11

Table 26 Residues of cyprodinil in watercress [a]

Location, Trial no., Year (Variety)	Application			Sample	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Fellsmere, FL, USA, FL28, 1999 (B & W New and Improved Variety No. 3)	4 (6, 7, 7)	0.39, 0.37, 0.38, 0.37	477, 457, 481, 476	Leaves	12	12	12
Fellsmere, FL, USA, FL29, 1999 (B & W Standard Variety No. 1)	4 (6, 7, 7)	0.37, 0.37, 0.36, 0.38	703, 705, 700, 720	Leaves	9.2	12	10

[a] Samples were taken at day 0

Table 27 Residues of cyprodinil in spinach leaves

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	Adjuvant		rep 1	rep 2	mean
Salisbury, MD, USA, MD22, 2008 (Melody)	4 (7, 13, 6)	0.37, 0.37, 0.37, 0.37	290, 290, 290, 290	Silwet L77 (0.25% v/v)	0	6.4	5.7	6.1
Freeville, NY, USA, NY30, 2008 (Tyee)	4 (6, 14, 6)	0.37, 0.37, 0.37, 0.37	320, 320, 320, 320	Induce (1% v/v)	0	16	11	13
Weslaco, TX, USA, TX02, 2008 (Samish)	4 (7, 15, 7)	0.37, 0.37, 0.37, 0.37	40, 240, 360, 360	ROC (0.5% v/v, 3 and 4 only)	0	15	13	14
Charleston, SC, USA, SC07, 2008 (Skookum hybrid)	4 (7, 14, 7)	0.37, 0.37, 0.36, 0.37	310, 320, 320, 310	Activator 90 (0.25% v/v)	0	6.7	4.6	5.6
Weslaco, TX, USA, TX03, 2008 (Space F1)	4 (6, 15, 6)	0.37, 0.37, 0.37, 0.37	200, 200, 200, 210	None	0	9.8	9.5	9.6
Brighton, CO, USA, CO13, 2008 (Spinner)	4 (6, 12, 8)	0.39, 0.39, 0.39, 0.37	340, 340, 350, 330	Activator 90 (0.058% v/v)	0	11	12	11 c0.02
Holtville, CA, USA, CA18, 2008 (1B12A)	4 (8, 13, 7)	0.38, 0.38, 0.36, 0.38	230, 240, 220, 230	Induce (1% v/v)	0	10	11	11 c0.02
Salinas, CA, USA, CA17, 2008 (Whale)	4 (7, 14, 6)	0.38, 0.37, 0.38, 0.38	250, 320, 420, 420	R-11 (0.125% v/v)	0	6.8	6.4	6.6
Harrow, ON, Canada, ON13, 2009 (Unipack 151)	4 (8, 16, 6)	0.37, 0.38, 0.38, 0.38	300, 310, 310, 310	Merge (1% v/v, app 1 only)	0	11	13	12
					2	0.49	0.64	0.56
					6	0.07	0.05	0.06
					12	0.03	0.02	0.02
					14	< 0.02	< 0.02	< 0.02
Agassiz, BC, Canada, BC02, 2008 (Unipack)	4 (8, 13, 8)	0.38, 0.38, 0.38, 0.38	330, 330, 330, 330	Assist (1% v/v)	0	37	27	32
Ste-Clotilde, QC, Canada, QC04,	4 (6, 14, 7)	0.39, 0.36, 0.37, 0.36	370, 340, 350, 340	Merge (1% v/v)	0	8.8	7.7	8.3

Location, Trial no., Year (Variety)	Application				DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)	Adjuvant		rep 1	rep 2	mean
2008 (Unipack 151)								

Table 28 Residues of cyprodinil in mustard green leaves

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Bridgeton, NJ, USA, NJ26, 2000 (Southern Giant Curled)	4 (6, 22, 6)	0.37, 0.36, 0.36, 0.36	390, 380, 380, 370	8	5.0	5.9	5.4
Crossville, TN, USA, TN15, 2000 (Southern Giant Curled)	4 (6, 21, 7)	0.36, 0.37, 0.37, 0.37	330, 330, 340, 340	7	0.38	0.36	0.37
Gainesville, FL, USA, FL49, 2000 (Florida Broadleaf)	4 (7, 13, 8)	0.37, 0.38, 0.37, 0.37	350, 390, 370, 370	7	7.3	8.7	8.0
Clinton, NC, USA, NC17, 2000 (Southern Giant Curled)	4 (6, 22, 7)	0.38, 0.38, 0.38, 0.38	310, 310, 310, 310	7	0.22	0.24	0.23
Weslaco, TX, USA, TX35, 2000 (India)	4 (13, 14, 7)	0.37, 0.37, 0.38, 0.38	450, 450, 450, 460	6	0.29	0.44	0.36
Salinas, CA, USA, CA16, 2000 (Southern Giant Curled)	4 (7, 23, 6)	0.37, 0.37, 0.36, 0.37	490, 540, 680, 700	7	0.75	0.66	0.71
Lansing, MI, USA, MI05, 2000 (Southern Giant Curled)	4 (7, 22, 6)	0.61, 0.61, 0.60, 0.58 [a]	380, 380, 380, 370	7	0.71	0.48	0.59

[a] Product was over-applied by approximately 62–68% per application. The results were scaled for MRL determination; actual results are tabulated.

Legume vegetables

Beans (edible pods and succulent seeds)

Eight residue trials were conducted in the USA for cyprodinil in common beans (snap beans, succulent pods and seeds) during 2001 (Chen, 2003-b). Four late season applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil were made at target intervals of 7 days and a target application rate of 368 g ai/ha cyprodinil. Samples of succulent beans with pods were collected at a target PHI of 7 days after the last application. Additional duplicate samples at target intervals of 0 and 14 days were collected at two sites.

Bean samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

Beans (succulent shelled)

Eight residue trials were conducted in the USA in succulent shelled lima beans during 2001 (Chen, 2003-c). A series of 4–6 late season applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil was made to the treated plot at target intervals of 7 days and a target application rate of 368 g ai/ha cyprodinil. Samples of succulent beans with and without pods were collected at a target PHI of 7 days after the last application.

Bean samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

Table 29 Residues of cyprodinil in common beans (snap beans), pods and succulent seeds

Location, Trial no., Year (Variety)	Application	Sample	DAT	Residue (mg/kg)

	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Ithaca, NY, USA, NY09, 2001 (Labrador)	4 (7, 7, 7)	0.38, 0.36, 0.37, 0.36	290, 270, 270, 270	Pods and seeds	8	0.15	0.16	0.16
Salisbury, MD, USA, MD05, 2001 (Slenderette)	4 (6, 7, 8)	0.37, 0.37, 0.38, 0.37	380, 380, 380, 380	Pods and seeds	7	0.18	0.19	0.18
Gainesville, FL, USA, FL18, 2001 (Blue lake)	4 (7, 7, 7)	0.37, 0.38, 0.39, 0.38	280, 290, 290, 290	Pods and seeds	7	0.24	0.22	0.23
East Lansing, MI, USA, MI09, 2001 (Strike)	4 (7, 7, 7)	0.37, 0.37, 0.37, 0.37	190, 190, 180, 190	Pods and seeds	0	0.42	0.41	0.41
				Pods and seeds	7	0.18	0.17	0.17
				Pods and seeds	14	0.07	0.07	0.07
Madison, WI, USA, WI08, 2001 (Hystyle)	4 (7, 7, 6)	0.39, 0.37, 0.38, 0.38	200, 190, 190, 190	Pods and seeds	7	0.11[a]	0.09[a]	0.10 [a]
Holtville, CA, USA, CA34, 2001 (Derby)	4 (7, 7, 8)	0.37, 0.37, 0.37, 0.38	390, 400, 380, 380	Pods and seeds	0	1.09	0.92	1.0
				Pods and seeds	6	0.52	0.46	0.49
				Pods and seeds	15	0.31	0.24	0.27
Twin Falls, ID, USA, ID05, 2001 (Idelite Garden Bean)	4 (8, 7, 8)	0.38, 0.38, 0.38, 0.39	340, 340, 330, 350	Pods and seeds	8	0.14	0.13	0.13
Madison, OH, USA, OH09, 2001 (Bronco)	4 (8, 8, 6)	0.37, 0.37, 0.37, 0.38	370, 370, 360, 380	Pods and seeds	6	0.13	0.11	0.12

[a] Results may be rain affected; rain fell within < 4 hours of the final application.

Table 30 Residues of cyprodinil in succulent shelled lima beans seeds

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)			
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	rep 3	mean
Salisbury, MD, USA, MD03, 2001 (Eastland)	4 (7, 7, 7)	0.38, 0.39, 0.39, 0.39	370, 380, 380, 380	8	< 0.02	< 0.02		< 0.02
Salisbury, MD, USA, MD04, 2001 (Green Baby)	4 (7, 7, 7)	0.38, 0.39, 0.39, 0.39	370, 390, 380, 380	8	< 0.02	< 0.02		< 0.02
Clinton, NC, USA, NC08, 2001 (Thorogreen)	6 (6, 7, 8, 6, 8)	0.37, 0.37, 0.37, 0.37, 0.38, 0.37	280, 280, 280, 280, 290, 280	7	< 0.02	< 0.02		< 0.02
Kimberly, ID, USA, ID07, 2001 (Henderson)	5 (6, 8, 8, 8)	0.39, 0.38, 0.36, 0.39, 0.36	230, 230, 230, 230, 230	7	0.04	0.04	0.03	0.04
Salinas, CA, USA, CA26, 2001 (not specified)	4 (7, 7, 7)	0.38, 0.37, 0.38, 0.36	590, 620, 860, 820	6	0.02	0.02	< 0.02	0.02
Salinas, CA, USA, CA81, 2001 (not specified)	5 (7, 7, 7, 7)	0.38, 0.38, 0.38, 0.38, 0.37	750, 720, 800, 750, 810	8	< 0.02	< 0.02		< 0.02
Fremont, OH, USA, OH11, 2001 (Fordhook)	5 (6, 8, 8, 6)	0.37, 0.38, 0.39, 0.37, 0.38	360, 380, 390, 380, 380	8	< 0.02	< 0.02		< 0.02
Tifton, GA, USA, GA08, 2001 (Cangreen)	5 (7, 7, 7, 8)	0.37, 0.37, 0.38, 0.38, 0.37	470, 470, 470, 470, 470	8	0.04	0.04	0.02	0.03

Where three replicates are reported, replicates 1 and 2 are replicate analyses of the same sample, while replicate 3 is an analysis of a second sample. Where two replicates are reported, replicates 1 and 2 are replicate samples.

Pulses

Beans, dry

Nine residue trials for cyprodinil in dry beans were conducted in the USA during 2001 (Chen, 2003-d). Four late season applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil were made to the treated plot at target intervals of 7 days and a target application rate of 368 g ai/ha cyprodinil. Samples of dry beans were collected at a target PHI of 7 days after the last application.

Dry bean samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

With the exception of the samples from the Salinas, California site (trial number CA25), where it appears that the control and treated samples were inadvertently switched, residues were not found in the untreated control samples at levels above the limit of quantitation.

Table 31 Residues of cyprodinil in beans (dry) seeds

Location, Trial no., Year (Variety)	Application			DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Velva, ND, USA, ND07, 2001 (Othello)	4 (7, 7, 7)	0.37, 0.36, 0.37, 0.37	190, 180, 190, 190	7	0.03	0.03	0.03
Brookings, SD, USA, SD04, 2001 (Vista)	4 (7, 8, 7)	0.37, 0.38, 0.38, 0.37	200, 200, 210, 200	7	0.19	0.10	0.15
Aurora, SD, USA, SD05, 2001 (Vista)	6 (7, 8, 7, 7, 6)	0.37, 0.39, 0.38, 0.38, 0.38, 0.38	200, 210, 210, 210, 210, 210	7	0.04	0.05	0.04
Holt, MI, USA, MI10, 2001 (Strike)	4 (6, 8, 7)	0.37, 0.37, 0.37, 0.37	190, 190, 180, 190	6	0.04	0.03	0.04
Fort Collins, CO, USA, CO08, 2001 (Bill Z)	4 (7, 7, 7)	0.44, 0.38, 0.37, 0.38	220, 190, 180, 190	7	0.02	0.03	0.02
Wellington, CO, USA, CO09, 2001 (UI 126)	4 (7, 7, 7)	0.41, 0.37, 0.37, 0.37	210, 190, 180, 190	6	0.02	0.02	0.02
Kimberly, ID, USA, ID06, 2001 (Chase Pinto)	4 (6, 8, 8)	0.38, 0.36, 0.37, 0.37	190, 180, 190, 190	6	0.02	0.05	0.04
Fremont, OH, USA, OH10, 2001 (not reported)	4 (6, 8, 8)	0.35, 0.39, 0.39, 0.37	350, 390, 390, 380	8	0.03	0.02	0.02
Salinas, CA, USA, CA25, 2001 (not reported)	4 (7, 7, 7)	0.37, 0.38, 0.38, 0.38	580, 620, 630, 860	5	< 0.02	< 0.02	< 0.02

Root and tuber vegetables

Carrot

Ten trials were conducted in the USA and Canada for cyprodinil in carrots during 2000 and 2004 (Chen, 2002-b and Barney, 2006-a). Four applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil were made at a target interval of 7 days (between applications 1 and 2 and between applications 3 and 4) and 21 days between applications 2 and 3 at a target application rate of 368 g ai/ha cyprodinil. Duplicate samples of treated carrot roots were collected at a target PHI of 7 days after the last application, and frozen within 3 hours of collection. Decline samples were collected at one site at intervals between 0 and 21 days after the last application.

Carrot root samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

Table 32 Residues of cyprodinil in carrot roots

Location, Trial no., Year (Variety)	Application	DAT	Residue (mg/kg)

	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)		rep 1	rep 2	mean
Weslaco, TX, USA, TX05, 2000 (Nantes coreless, a baby carrot variety)	4 (7, 21, 6)	0.38, 0.38, 0.37, 0.38	370, 380, 390, 410	7	0.16	0.09	0.12
Salinas, CA, USA, CA04, 2000 (Minicor, a baby variety)	4 (6, 23, 6)	0.37, 0.37, 0.38, 0.37	480, 500, 700, 680	8	0.18	0.18	0.18
Laingsburg, MI, USA, MI01, 2000 (Premium)	4 (7, 21, 7)	0.61, 0.58, 0.61, 0.58 [a]	390, 370, 380, 370	7	0.09	0.11	0.10
Prosser, WA, USA, WA43, 2000 (Bolero)	4 (8, 24, 7)	0.38, 0.37, 0.38, 0.37	390, 370, 380, 370	7	0.09	0.12	0.10
El Centro, CA, USA, CA86, 2000 (Caropak)	4 (6, 21, 6)	0.38, 0.38, 0.36, 0.37	520, 530, 500, 510	8	< 0.02	0.03	0.02
Madera, CA, USA, CA104, 2000 (Nantes)	4 (7, 21, 7)	0.37, 0.37, 0.37, 0.38	380, 380, 380, 380	7	0.05	0.05	0.05
Chowchilla, CA, USA, CA105, 2000 (Imperator)	4 (7, 21, 7)	0.38, 0.37, 0.37, 0.37	380, 380, 380, 380	7	0.07	0.04	0.05
Abbotsford, BC, Canada, BC06, 2000 (Bolero)	4 (6, 19, 8)	0.37, 0.37, 0.37, 0.37	350, 350, 350, 350	6	0.38	0.42	0.40
Live Oak, FL, USA, FL75, 2000 (Navajo F1)	4 (8, 22, 6)	0.19, 0.19, 0.19, 0.19 [b]	290, 290, 280, 290	8	0.03	0.05	0.04
Citra, FL, USA, FL16, 2004 (Indiana F1)	4 (7, 21, 7)	0.38, 0.38, 0.39, 0.39	280, 280, 290, 290	0	0.36	0.37	0.37
				3	0.36	0.32	0.34
				7	0.34	0.31	0.33
				14	0.35	0.44	0.39
				21	0.35	0.35	0.35

[a] Product was over-applied by 56–65% per application. The results were scaled for MRL determination; actual results are tabulated.

[b] Product was under-applied at an average of 52% of the target rate per application. The results were scaled for MRL determination; actual results are tabulated.

Radish

Six trials were conducted in the USA for cyprodinil in radish during 2004 (Barney, 2007). Two late season applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil were made to the treated plot at a target interval of 7 days and a target application rate of 368 g ai/ha cyprodinil. Samples of radish roots and tops were collected at a target PHI of 7 days after the last application.

Radish root and top samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications.

Table 33 Residues of cyprodinil in radish roots and tops

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Freeville, NY, USA, NY06, 2004 (Cheriette F1)	2 (6)	0.39, 0.41	300, 310	Roots	7	< 0.01	< 0.01	< 0.01
				Tops	7	0.44	0.46	0.45
Citra, FL, USA, FL14, 2004 (Fireball)	2 (8)	0.38, 0.38	290, 280	Roots	7	0.03	0.03	0.03
				Tops	7	0.57	0.50	0.53
Citra, FL, USA, FL15, 2004 (Fireball)	2 (7)	0.38, 0.37	290, 280	Roots	7	0.03	0.02	0.03
				Tops	7	1.3	1.2	1.3
Salinas, CA, USA, CA08, 2004 (Cheriette)	2 (6)	0.38, 0.39	430, 400	Roots	7	0.19	0.10	0.14
				Tops	7	0.13	0.20	0.17

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Willard, OH, USA, OH01, 2004 (Cabernet)	2 (7)	0.38, 0.39	280, 280	Roots	7	< 0.01	< 0.01	< 0.01
				Tops	7	0.48	0.32	0.40
Moxee, WA, USA, WA02, 2004 (Crunchy Royale)	2 (7)	0.36, 0.36	390, 390	Roots	8	< 0.01	< 0.01	< 0.01
				Tops	8	0.12	0.14	0.13

Herbs

Basil

Three residue trials were conducted in the USA during 2000 (Chen, 2002-c). Four applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil were made at a target rate of 368 g ai/ha cyprodinil. Applications 1 and 2 were timed for earlier in the growing season, and applications 3 and 4 closer to harvest. Samples were collected at a target PHI of 7 days after the final application. Additional samples were harvested at one site and dried, initially by lying out in the field, then indoors using an electric fan for 48 hours before frozen storage, to determine the effect of drying on residue levels.

Basil leaf samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

Chives

Three residue trials were conducted in the USA during 2000 (Chen, 2002-d). Four applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil were made at a target rate of 368 g ai/ha cyprodinil. Applications 1 and 2 were timed for earlier in the growing season, and applications 3 and 4 closer to harvest. Samples were collected at a target PHI of 7 days after the final application. Additional samples were harvested at one site and air dried in a greenhouse before frozen storage, to determine the effect of drying on residue levels.

Chives samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

Parsley

Four residue trials were conducted in the USA during 2003 (Barney, 2006-b). Four applications of a water dispersible granule formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil were made at a target rate of 368 g ai/ha cyprodinil. Applications 1 and 2 were timed for earlier in the growing season, and applications 3 and 4 closer to harvest. Samples of fresh parsley were collected at a target PHI of 7 days after the final application. Additional samples were collected at each site and dried for 1–7 days, either using an air dryer or in a greenhouse.

Parsley leaf samples were analysed for cyprodinil residues using an HPLC-UV method (method number AG-631B, with minor modifications).

Residues were not found in any of the untreated control samples of fresh parsley leaves at levels above the limit of quantitation. Low levels of residue just above the limit of quantitation were found in control samples of dried parsley leaves from one trial site.

Table 34 Residues of cyprodinil in basil

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Freeville, NY, USA, NY29, 2000 (Genovese)	4 (7, 15, 7)	0.60, 0.62, 0.57, 0.56	330, 340, 316, 311	Fresh leaves	8	2.1	2.2	2.1
Gainesville, FL, USA, FL58, 2000 (HBA 105)	4 (6, 22, 7)	0.38, 0.37, 0.37, 0.38	280, 280, 280, 290	Fresh leaves	7	2.0	1.5	1.7
Visalia, CA, USA, CA113, 2000 (Italian Large Leaf)	4 (7, 21, 7)	0.37, 0.37, 0.37, 0.37	390, 380, 380, 370	Fresh leaves	7	1.5	1.5	1.5
				Dried leaves	7 (3)	8.8		

Table 35 Residues of cyprodinil in chives

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Salisbury, MD, USA, MD11, 2000 (Fancy)	4 (8, 18, 8)	0.59, 0.60, 0.60, 0.60	390, 400, 400, 400	Fresh leaves	6	1.1	1.0	1.0
Aurora, OR, USA, OR04, 2000 (Standard open)	4 (7, 21, 7)	0.38, 0.38, 0.38, 0.38	520, 530, 530, 530	Fresh leaves	7	1.1	1.0	1.1
Porterville, CA, USA, CA114, 2000 (Common)	4 (7, 21, 7)	0.39, 0.38, 0.37, 0.39	160, 150, 150, 150	Fresh leaves	7	0.69	0.56	0.62
				Dried leaves	7	2.9	3.0	2.9

Table 36 Residues of cyprodinil in parsley

Location, Trial no., Year (Variety)	Application			Sample	DAT	Residue (mg/kg)		
	No. (RTI, days)	Rate (kg ai/ha)	Volume (L/ha)			rep 1	rep 2	mean
Willard, OH, USA, OH04, 2003 (Dark Green Italian Flat Leaf)	4 (6, 22, 8)	0.37, 0.37, 0.37, 0.37	480, 510, 340, 470	Fresh leaves	6	3.1	2.8	3.0
				Dried leaves	6 (7)	20	21	20
Salinas, CA, USA, CA34, 2003 (Italian Dark Green)	4 (8, 21, 6)	0.37, 0.38, 0.36, 0.37	430, 320, 520, 540	Fresh leaves	7	3.2	2.7	2.9
				Dried leaves	8 (2)	23	18	20
Citra, FL, USA, FL21, 2003 (Italian Dark Green)	4 (7, 14, 6)	0.37, 0.37, 0.36, 0.38	370, 370, 370, 380	Fresh leaves	7	14	19	16
				Dried leaves	7 (5)	109	115	112 c0.11, 0.10
Aurora, OR, USA, OR05, 2003 (Italian Plain Leaf)	4 (7, 21, 8)	0.37, 0.37, 0.37, 0.38	420, 420, 420, 430	Fresh leaves	6	8.4	5.8	7.1
				Dried leaves	6 (2)	31	28	30

FATE OF RESIDUES IN PROCESSING

Lemons

A processing study in lemons was conducted in the USA (Barney, 2010). Cyprodinil was applied as a water-dispersible granular formulation containing 375 g/kg cyprodinil and 250 g/kg fludioxonil using an airblast sprayer. A petroleum oil spray adjuvant was included in the tank mix. A single application

was made at 375 g ai/ha cyprodinil and fruit was sampled on the day of application after the spray had dried.

The lemons were transported fresh to the processing laboratory, and processing was completed within nine days of harvest. The fruit was washed in a tank, and undesirable fruit was removed. Washed fruit was then scarified using a modified Hobart abrasive peeler, and the collected emulsion was screened to remove flavedo fragments and passed through a cream separator and an IEC centrifuge to separate the oil from water. The first run free oil was removed, and the remaining emulsion frozen and stored overnight, thawed, centrifuged again, and the separated oil added to the first run oil. Scarified fruit was then transferred to a juice extractor and halved and juiced using a reaming auger. The extracted juice was then pulped and screened to remove solid material such as peel fragments, seeds, and vesicular and segment membranes. Finally, the peel was shredded, and flavedo fragments, rag and seeds from earlier stages added. The resulting wet pulp was then treated with lime, pressed and dried to < 10% moisture to give dried citrus pulp, before finally being milled using a hammer mill and the moisture content checked. Samples of fresh fruit, oil, juice and dried pulp were collected and frozen for transport to the analytical laboratory.

Residues of cyprodinil in lemon and processed fractions were determined using method number AG-631B, with analysis by HPLC with UV detection. The extraction procedure was modified for analysis of the oil samples by inclusion of an additional clean-up of the aqueous acidic extract by partition with hexane, prior to the solid phase extraction clean up using a strong cation exchange (SCX) cartridge. Samples were stored frozen until analysis, and all samples were analysed within 10 months of collection.

Table 37 Residues of cyprodinil in lemon fresh fruit and processed fractions

Location, Year (variety)	Application			Sample	PHI, days	Residues (mg/kg)				PF
	No.	Rate (kg ai/ha)	Volume (L/ha)			Rep 1	Rep 2	Rep 3	Mean	
Nipomo, CA, USA, 2009 (Lisbon)	1	0.38	980	Fruit	0	0.19	0.21		0.20	NA
				Juice	0	< 0.01	< 0.01		< 0.01	< 0.05
				Dried pulp	0	0.58	0.64		0.61	3.1
				Oil	0	35	35	33	34	171

Tomatoes

A processing study in tomatoes was conducted as part of the package of residue trials in field and greenhouse tomatoes (Thompson, 2005).

The effect of washing tomatoes in the field was studied, with samples of tomatoes being washed and dried before dispatch to the laboratory. Samples were washed for approximately 10 seconds, patted dry, and then frozen for transport to the laboratory.

Additionally, large samples of tomatoes (both untreated control and treated) from a single site were shipped to a processing laboratory. Processing was completed within two days of harvest, and samples were frozen within an hour of collection.

Tomato samples were first washed by passing through a flume, and a spray washer, then a second flume, and finally a second spray washer. Washed tomatoes were crushed in a grinder, and then pumped into a hot break system where they were heated to approximately 96 °C using a heat exchanger, followed by pumping into a finisher where the resulting hog crush was screened to remove pomace (seeds and peel fragments). Pomace was weighed and discarded, and the filtered juice was passed to a vacuum evaporator, where the volume was reduced to a range of 8–16% solids content to give tomato purée. A weighed portion of the purée was transferred to a steam jacketed kettle, heated with stirring to 89–91 °C, and filled into cans, which were sealed, inverted and water cooled, then

dried, labelled and frozen. The remaining purée was transferred to a vacuum kettle evaporator, and the volume reduced by heating to a solids content of 24–35%. The resulting paste was transferred to a steam-jacketed kettle, heated to 89–91 °C, then filled into cans, which were sealed, inverted and water cooled, then dried, labelled and frozen.

Samples of unwashed and washed tomatoes, tomato purée and tomato paste were analysed by HPLC-UV (method number AG-631B, with minor modifications). Recoveries in tomatoes are summarised in the tomato residue data section above. Recoveries of cyprodinil from tomato puree ranged from 88–102% at fortification levels ranging from 0.02–2.0 mg/kg. Recoveries of cyprodinil from tomato paste ranged from 72–101% at fortification levels of 0.01–2.0 mg/kg.

Table 38 Residues of cyprodinil in raw tomatoes and processed products

Location, Trial No, Year (variety)	Application			Sample	PHI (days)	Residue (mg/kg)			PF
	No. (RTI, days)	Rate (kg ai/ha)	Spray volume (L/ha)			Rep 1	Rep 2	Mean	
Five Points, CA, USA, CA44, 2002 (Heinz 8892)	4 (6, 20, 7)	0.38, 0.38, 0.39, 0.38	320, 320, 330, 330	Fruit	0	0.25	0.24	0.25	–
				Puree	0	0.12	0.13	0.13	0.52
				Paste	0	0.56	0.55	0.56	2.3
Clinton, NC, USA, NC10, 2002 (Mountain Spring)	4 (7, 21, 8)	0.37, 0.37, 0.37, 0.36	260, 260, 260, 250	Unwashed fruit	0	0.15	0.14	0.14	–
				Washed fruit	0	0.05	0.05	0.05	0.37
Weslaco, TX, USA, TX12, 2002 (Mariachi RZ)	4 (7, 7, 7)	0.39, 0.37, 0.37, 0.37	510, 490, 490, 490	Unwashed fruit	0	0.17	0.28	0.22	–
				Washed fruit	0	0.10	0.10	0.10	0.43

RESIDUES IN ANIMAL COMMODITIES

No new animal feeding studies were supplied to the Meeting.

APRAISAL

Cyprodinil was first evaluated for residues and toxicological aspects by the 2003 JMPR. The 2003 Meeting established an ADI of 0–0.03 mg/kg bw for cyprodinil and concluded that an ARfD was not necessary. The 2003 Meeting recommended a number of maximum residue levels for cyprodinil. The residue definition was established as cyprodinil for both compliance with MRLs and dietary risk assessment, for both plant and animal commodities. The residue is fat soluble.

Cyprodinil was scheduled by the Forty-fourth CCPR meeting in 2012 for evaluation of residue data for additional crops by the 2013 JMPR.

Methods of analysis

The Meeting received two analytical methods for determination of cyprodinil residues in plant matrices which were relevant to this evaluation. The LOQ for the HPLC-UV and HPLC-MS/MS methods was 0.01 mg/kg.

Stability of residues in stored analytical samples

The Meeting received information on the storage stability of cyprodinil residues in plant matrices from trials conducted in conjunction with the residue studies submitted to the Meeting. These data and stability data from JMPR 2003 cover the maximum storage period for samples in the residue studies submitted to the Meeting.

Results of supervised residue trials on crops

The Meeting received supervised trial data for application of cyprodinil to dry beans, lima beans, common beans (snap beans), berry fruit (blueberries, caneberries and strawberries), brassica vegetables (broccoli and cabbage), cucurbit fruiting vegetables (cantaloupe, cucumber and squash), other fruiting vegetables (sweet pepper, chili pepper, and tomato), herbs (parsley, basil and chives), leafy vegetables (mustard greens, lettuce, spinach and watercress), lemons (including processing data), pome fruit (apples and pears), root vegetables (carrot and radish), and tropical fruits-inedible peel (avocado, kiwifruit and litchi).

Citrus fruits

Cyprodinil is registered in the USA for use on lemons and limes at a GAP of 1 × 0.37 kg ai/ha, and a 0-day PHI.

Three residue trials were conducted in lemons at GAP in the USA. Residues in lemons at the 0-day PHI were 0.19, 0.31 and 0.34 mg/kg.

The Meeting determined that there were insufficient data for the estimation of a maximum residue level in lemons.

Pome fruits

The 2003 JMPR estimated a maximum residue level of 0.05 mg/kg in apple based on a previous GAP in the USA of 4 × 0.26 kg ai/ha, with applications only until the end of flowering. The 2003 JMPR estimated a maximum residue level of 1 mg/kg in pear based on the European GAP of 3 × 0.38 kg ai/ha, with a 14-day PHI.

The Meeting received new residue data from the USA for both apples and pears at a different GAP from those previously considered. Cyprodinil is registered in the USA for use in apples and pears at a GAP of 6 × 0.26 kg ai/ha, and a 0-day PHI.

Nine residue trials were conducted in apples at GAP in the USA. Residues in apples at the 0-day PHI were 0.20, 0.28, 0.40, 0.50, 0.51, 0.52, 0.70, 0.94, and 1.3 mg/kg.

Five residue trials were conducted in pears at GAP in the USA. Residues in pears at the 0-day PHI were 0.17, 0.35, 0.36, 0.46, and 0.65 mg/kg.

The Meeting noted that the USA GAP is for the pome fruits group, and considered a group maximum residue level. To consider a group maximum residue level, residues in individual crops should be similar (e.g., medians should not differ by more than 5×). The Meeting agreed to estimate a maximum residue level for the crop group Pome fruits. In deciding whether to combine the datasets for apple and pear for use in the statistical calculator or to only utilize the data from the commodity with the highest residues, the Meeting recognized the similarity of the datasets (confirmed by the Mann-Whitney U test), and decided to combine the datasets for apples and pears for the purposes of determining a group maximum residue level for pome fruit. Residues found were: 0.17, 0.20, 0.28, 0.35, 0.36, 0.40, 0.46, 0.50, 0.51, 0.52, 0.65, 0.70, 0.94 and 1.3 mg/kg.

The Meeting estimated a maximum residue level of 2 mg/kg for pome fruit, and a STMR of 0.48 mg/kg. The Meeting withdrew its previous maximum residue level recommendations of 0.05 mg/kg for apple and 1 mg/kg for pear.

Berries and other small fruits

Cyprodinil is registered in the USA for use in bushberries at a GAP of 4 × 0.37 kg ai/ha with a 0-day PHI.

Five residue trials were conducted at GAP in blueberries in the USA. Residues in blueberries at the 0-day PHI were 0.50, 0.62, 1.0, 1.4 and 1.9 mg/kg.

The 2003 JMPR estimated a maximum residue level of 0.5 mg/kg in raspberries, red, black based on the Swiss GAP of 2 × 0.45 kg ai/ha, with a 14-day PHI.

The Meeting received residue data from the USA for raspberries. Cyprodinil is registered in the USA for use in caneberries at a GAP of 4 × 0.37 kg ai/ha, with a 0-day PHI.

Five residue trials were conducted in raspberries in the USA. Residues in raspberries at the 0-day PHI were 1.5, 1.6, 2.2, 2.5, and 5.9 mg/kg.

The 2003 JMPR estimated a maximum residue level of 2 mg/kg in strawberries, based on various GAPs in Europe.

The Meeting received residue data from the USA in strawberries. Cyprodinil is registered in the USA for use in strawberries at a GAP of 4 × 0.37 kg ai/ha, with a 0-day PHI.

Eight residue trials were conducted in strawberries in the USA. Residues in strawberries at the 0-day PHI were 0.10, 0.30, 0.68, 0.91, 1.1, 1.5, 1.6, and 2.0 mg/kg.

The Meeting noted that the USA GAP is the same for all berry fruit (except grapes) and considered a group maximum residue level. To consider a group maximum residue level, residues in individual crops should be similar (e.g., medians should not differ by more than 5×). The Meeting agreed to estimate a maximum residue level for the group Berry fruit (except grapes). In deciding whether to combine the datasets for blueberries, raspberries and strawberries for use in the statistical calculator or to only utilize the data from the commodity with the highest residues, the Meeting agreed not to combine the data sets (Kruskal-Wallis test). Therefore, recommendations on berry fruit will be based on raspberries, as the commodity with the highest residues. Based on the data set for raspberries, the Meeting estimated a maximum residue level of 10 mg/kg for Berries and other small fruits, except grapes, together with an STMR of 2.2 mg/kg. The Meeting withdrew its previous maximum residue level recommendations of 0.5 mg/kg for raspberries, red, black and 2 mg/kg for strawberry.

Assorted tropical and sub-tropical fruits - inedible peel

Avocado

Cyprodinil is registered in the USA for use in avocado at a GAP of 4 × 0.37 kg ai/ha, with a 0-day PHI.

Six trials were conducted in avocados in the USA. Residues in avocados at the 0-day PHI were 0.08, 0.18, 0.23, 0.30, 0.35, and 0.60 mg/kg.

The Meeting estimated a maximum residue level of 1 mg/kg for avocados, along with an STMR of 0.265 mg/kg.

Kiwifruit

Cyprodinil is registered in the USA for use in kiwifruit at a GAP of 2 × 0.53 kg ai/ha, with a 0-day PHI.

Three residue trials were conducted in kiwifruit in the USA. Residues in kiwifruit at the 0-day PHI were 0.61, 0.99, and 1.1 mg/kg.

The Meeting determined that there were insufficient data for the estimation of a maximum residue level in kiwifruit.

Litchi (lychee)

Cyprodinil is registered in the USA for use in litchi at a GAP of 4 × 0.37 kg ai/ha, with a 0-day PHI.

One residue trial was conducted in litchi in the USA. Residues in litchi at the 0-day PHI were 1.3 mg/kg.

The Meeting determined that there were insufficient data for estimation of a maximum residue level in litchi.

Brassica vegetables

Cabbages, Head

Cyprodinil is registered in the USA for use in brassica vegetables at a GAP of 4 × 0.37 kg ai/ha, with a 7-day PHI.

Six trials were conducted in cabbage in the USA. Residues in cabbages (with wrapper leaves) at a PHI of 6–8 days were < 0.02, 0.02 (s), 0.02, 0.04, 0.19, and 0.36 mg/kg, where (s) indicates a result scaled to account for application rates outside ± 25% of GAP. Residues in cabbages (without wrapper leaves) were < 0.02 (5), and 0.08 mg/kg.

The Meeting estimated a maximum residue level of 0.7 mg/kg for head cabbages, along with an STMR of 0.03 mg/kg.

Flowerhead Brassicas

Six trials were conducted in broccoli in the USA and Canada. Residues in broccoli at a PHI of 6–8 days were 0.02, 0.15, 0.20, 0.34, 0.43 and 1.1 mg/kg.

The Meeting estimated a maximum residue level of 2 mg/kg for broccoli, along with an STMR of 0.27 mg/kg and agreed to extend the MRL and STMR to the subgroup Flowerhead brassicas.

Fruiting vegetables, Cucurbits

The 2003 JMPR estimated maximum residue levels of 0.2 mg/kg for both cucumber and summer squash, based on data matching Spanish and Italian GAPs of 4 × 0.038 kg ai/hL with a 7-day PHI, and 3 × 0.30 kg ai/ha with a 7-day PHI respectively.

The Meeting received residue data from the USA in melon, cucumber and summer squash.

Cyprodinil is registered in the USA for use in fruiting vegetables, other than cucurbits at a GAP of 4 × 0.37 kg ai/ha, with a 1-day PHI.

Five residue trials were conducted in melons in the USA. Residues in melons at the 1-day PHI were 0.05, 0.06, 0.10, 0.17 and 0.33 mg/kg.

Seven residue trials were conducted in cucumber in the USA. Residues in cucumber at the 1-day PHI were 0.04, 0.05, 0.09 (2), 0.11, 0.15, and 0.24 mg/kg.

Five residue trials in were conducted summer squash in the USA. Residues in summer squash at the 1-day PHI were 0.02, 0.03, 0.07 (2), and 0.09 mg/kg.

The Meeting noted that the USA GAP is for all cucurbit fruiting vegetables, and considered a group maximum residue level. To consider a group maximum residue level, residues in individual crops should be similar (e.g., medians should not differ by more than 5×). The Meeting agreed to estimate a maximum residue level for the group Fruiting vegetables, Cucurbits. In deciding whether to combine the datasets for melons, cucumbers and summer squash for use in the statistical calculator or to only utilize the data from the commodity with the highest residues, the Meeting recognized the similarity of the datasets (confirmed by the Kruskal-Wallis test), and decided to combine the datasets.

Combines residues were: 0.02, 0.03, 0.04, 0.05 (2), 0.06, 0.07 (2), 0.09 (3), 0.10, 0.11, 0.15, 0.17, 0.24, and 0.33 mg/kg.

The Meeting estimated a maximum residue level of 0.5 mg/kg for Fruiting vegetables, Cucurbits, together with an STMR of 0.09 mg/kg. The Meeting withdrew the previous maximum residue level recommendations of 0.2 mg/kg for cucumber and summer squash.

Fruiting vegetables, other than Cucurbits

The 2003 JMPR estimated a maximum residue level of 0.2 mg/kg for eggplant, based on data matching the Italian GAP of 3 × 0.30 kg ai/ha, with a 7-day PHI, and the Spanish GAP of 3 × 0.038 kg ai/hL, with a 7-day PHI. Based on a combined data set from three European GAPs (Italy: 3 × 0.30 kg ai/ha, with a 7-day PHI, Spain: 3 × 0.038 kg ai/hL, with a 7-day PHI, and Switzerland: 0.30 kg ai/ha, with a 3-day PHI), the 2003 JMPR estimated a maximum residue level of 0.5 mg/kg for tomatoes. The 2003 JMPR estimated a maximum residue level of 0.5 mg/kg for peppers, sweet, based on data matching the Italian GAP of 3 × 300 g ai/ha, with a 7-day PHI, and the Spanish GAP of 3 × 38 g ai/hL, with a 7-day PHI.

The Meeting received residue data from the USA and Canada in tomatoes, sweet peppers and chili peppers. Both field and greenhouse trial data were supplied for all three crops.

Cyprodinil is registered in the USA for use in fruiting vegetables, other than cucurbits, at a GAP of 4 × 0.37 kg ai/ha, with a 0-day PHI.

Eleven residue trials were conducted in sweet pepper in the USA and Canada. Residues in sweet pepper at the 0-day PHI were 0.04, 0.10, 0.13, 0.15, 0.19, 0.21 (GH), 0.23, 0.23 (G), 0.25, 0.27 (GH), and 0.68 mg/kg. 'GH' indicates a trial conducted in a greenhouse, all other trials were conducted in the field.

Five trials were conducted in chili pepper in the USA. Residues in chili pepper at the 0-day PHI were 0.20, 0.27, 0.28, 0.59 (GH), and 0.67 mg/kg.

Sixteen trials were conducted in tomatoes in the USA. Residues in tomatoes at the 0-day PHI were 0.02, 0.03 (GH), 0.06, 0.09, 0.11, 0.13, 0.14 (2), 0.16, 0.17 (GH), 0.20, 0.22 (GH), 0.24, 0.26, 0.30, and 0.32 (GH) mg/kg.

A series of residue trials in fruiting vegetables (eggplant, sweet pepper and tomato), was considered by the 2003 JMPR. Most of the trials were conducted in greenhouse crops, and in accordance with a GAP of 3 × 0.38 kg ai/ha applications, with a 7-day PHI. The majority were conducted as decline trials and have data for the USA PHI of 0 days. The application rates from the 2003 trials are within ±25% of the USA GAP (4 × 0.37 kg ai/ha).

At a PHI of 0 days, residues of cyprodinil in greenhouse grown eggplant from trials from Italy and Spain relevant to USA GAP were 0.07, 0.14, and 0.23 (2) mg/kg.

At a PHI of 0 days, residues of cyprodinil in greenhouse grown tomato from trials from Greece, Italy, Spain, Switzerland and the UK, relevant to USA GAP were 0.08, 0.12, 0.13, 0.20, 0.21 (2), 0.22 (3), 0.23, 0.25 (3), 0.36, 0.41 mg/kg.

At a PHI of 0 days, residues of cyprodinil in field and greenhouse grown sweet pepper from Spanish and Italian trials relevant to USA GAP were 0.02, 0.26 (G), 0.27, 0.41 (GH), 0.73 (GH), 1.0 (GH), and 1.2 (GH) mg/kg. (GH) indicates a result from a greenhouse trial.

The Meeting agreed to combine the datasets for the USA (field and greenhouse) and European (greenhouse) to give a larger dataset for the purposes of estimation of dietary parameters and a maximum residue level for fruiting vegetables, other than cucurbits.

Residues in field and greenhouse grown tomatoes from trials carried out in the USA, Greece, Italy, Spain, Switzerland and the UK relevant to USA GAP were 0.02, 0.03 (G), 0.06, 0.08 (G), 0.09, 0.11, 0.12 (GH), 0.13, 0.13 (GH) , 0.14 (2), 0.16, 0.17 (G), 0.20, 0.20 (GH), 0.21 (GH) (2), 0.22 (GH) (4), 0.23 (GH), 0.24, 0.25 (GH) (3), 0.26, 0.30, 0.32 (GH), 0.36 (GH), 0.41 (GH) mg/kg.

Residues in field and greenhouse grown sweet pepper from trials carried out in the USA, Spain and Italy relevant to USA GAP were 0.02, 0.04, 0.10, 0.13, 0.15, 0.19, 0.21 (GH), 0.23, 0.23 (GH), 0.25, 0.26 (GH), 0.27, 0.27 (GH), 0.41 (GH), 0.68, 0.73 (GH), 1.0 (GH), and 1.2 (GH) mg/kg.

The Meeting considered that the USA GAP is for all fruiting vegetables, other than cucurbits, except mushroom and sweet corn, and considered a group maximum residue level. To consider a group MRL, residues in individual crops should be similar (e.g. medians should not differ by more than 5×). The Meeting agreed to estimate a maximum residue level for the group fruiting vegetables, other than cucurbits, except mushroom and sweet corn. In deciding whether to combine the datasets for sweet peppers, chili peppers, tomatoes and eggplants for use in the statistical calculator or to only utilize the data from the commodity with the highest residues, the Meeting agreed not to combine the data sets (Kruskal-Wallis test). Therefore, recommendations on fruiting vegetables, other than cucurbits, except mushroom and sweet corn will be based on the 2003 data set for sweet peppers, as the commodity with the highest residues.

Based on the combined data set for sweet pepper, the Meeting estimated a maximum residue level of 2 mg/kg for fruiting vegetables, other than cucurbits, except sweet corn and mushrooms, together with an STMR of 0.24 mg/kg. The Meeting agreed to withdraw the previous maximum residue level recommendations of 0.2 mg/kg for eggplant, 0.5 mg/kg for tomatoes, and 0.5 mg/kg for peppers, sweet.

The Meeting noted that the residues in chili pepper and other commodities within the group of fruiting vegetables differed significantly. Using the default dehydration factor of 7 for peppers, the following data set was obtained for dried chili peppers: 1.4, 1.9, 2.0, 4.1, and 4.7 mg/kg. The Meeting estimated a maximum residue level of 9 mg/kg for dried chili peppers, together with an STMR-P of 2.0 mg/kg.

Brassica leafy vegetables

Cyprodinil is registered in the USA for use in brassica leafy vegetables (including mustard greens), at a GAP of 4 × 0.37 kg ai/ha, with a 7-day PHI.

Seven trials were conducted in mustard greens in the USA in accordance with GAP. Residues in mustard green leaves at the 7-day PHI were 0.23, 0.36, 0.36 (s), 0.37, 0.71, 5.4, and 8.0 mg/kg, where (s) indicates a result scaled to account for application rates outside ±25% of GAP.

The Meeting estimated a maximum residue level of 15 mg/kg for mustard greens, together with an STMR of 0.37 mg/kg. The Meeting agreed to extrapolate to estimate a maximum residue level of 15 mg/kg for brassica leafy vegetables.

Leafy vegetables, except brassica leafy vegetables

The 2003 JMPR estimated maximum residue levels of 10 mg/kg for lettuce, head and lettuce, leaf, based on data matching GAP for France (2 × 0.19 kg ai/ha, with a 14-day PHI) and Italy (3 × 0.26 kg ai/ha, with a 14-day PHI).

The Meeting received residue data from the USA and Canada in head lettuce, leaf lettuce, spinach, and watercress.

Cyprodinil is registered in the USA for use in leafy vegetables, other than brassica leafy vegetables, at a GAP of 4 × 0.37 kg ai/ha, with a 0-day PHI.

Eight trials were conducted in lettuce, head in accordance with the USA GAP. Residues in lettuce heads, with wrapper leaves at the 0-day PHI were 1.6, 2.0, 2.2, 2.3, 2.7, 2.9, 5.1, and 21 mg/kg. Residues in lettuce head with wrapper leaves removed were 0.07, 0.15, 0.31, 0.32, 0.63, 0.69, 1.6, and 3.2 mg/kg.

Six trials were conducted in leaf lettuce, in accordance with the USA GAP. Residues in lettuce leaves at the 0-day PHI were: 8.5, 10 (2), 11, 14, and 24 mg/kg.

Ten trials were conducted in spinach in accordance with the USA GAP. Residues in spinach at the 0-day PHI were 5.6, 6.1, 6.6, 8.3, 11 (2), 12, 13, 14, and 32 mg/kg.

One trial was conducted in watercress in accordance with the USA GAP. Residues in watercress at the 0-day PHI were 12 mg/kg.

The Meeting noted that the USA GAP is the same for all leafy vegetables other than brassica leafy vegetables and considered a group maximum residue level. To consider a group maximum residue level, residues in individual crops should be similar (e.g., medians should not differ by more than 5×). However, the Meeting agreed not to combine the data sets (Kruskal-Wallis test). TAs a result recommendations on leafy vegetables other than brassica leafy vegetables were based on the spinach dataset, as the commodity with the highest residues. Based on the dataset for spinach, the Meeting estimated a maximum residue level of 50 mg/kg for leafy vegetables, except brassica leafy vegetables, together with an STMR of 11 mg/kg. The Meeting agreed to withdraw the previous maximum residue level recommendations of 10 mg/kg for lettuce, head and lettuce, leaf.

Legume vegetables

The 2003 JMPR estimated a maximum residue level of 0.5 mg/kg for beans (in pods), except broad bean and soya bean, based on data matching the GAPs of Spain (3 × 0.038 kg ai/hL, with a 14-day PHI) and (2 × 0.38 kg ai/ha, with a 14-day PHI).

The Meeting received residue data from the USA in common beans (snap beans, pods and succulent seed) and lima beans (succulent shelled seeds).

Cyprodinil is registered in the USA for use in beans (succulent), including chickpea, lupin, kidney, lima, mung, navy, pinto, snap, wax, and broad bean, asparagus bean and blackeyed pea, with a GAP of 4 × 0.37 kg ai/ha, with a 7-day PHI.

Eight trials were conducted in common beans (pods and succulent seeds) in accordance with the USA GAP. Residues in pod and seed samples at the 7-day PHI were 0.10, 0.12, 0.13, 0.16, 0.17, 0.18, 0.23, and 0.49 mg/kg.

The Meeting estimated a maximum residue level of 0.7 mg/kg in beans, except broad bean and soya bean (green pods and immature seeds), together with an STMR of 0.165 mg/kg. The Meeting agreed to withdraw the previous maximum residue level recommendation of 0.5 mg/kg for beans, except broad bean and soya bean (green pods and immature seeds).

Six trials were conducted in lima beans (seeds without pods) in accordance with the USA GAP. Residues in succulent seeds at the 7-day PHI were < 0.02 (3), 0.02, 0.03 and 0.04 mg/kg.

The Meeting estimated a maximum residue level of 0.06 mg/kg for beans, shelled, together with an STMR of 0.02 mg/kg.

Beans (dry)

Cyprodinil is registered in the USA for use in beans (dry) at a GAP of 4 × 0.37 kg ai/ha, with a 7-day PHI.

Nine trials in beans (dry) were conducted in accordance with the USA GAP. Residues in beans at the 7-day PHI were < 0.02, 0.02 (3), 0.03, 0.04 (3), and 0.15 mg/kg.

The Meeting estimated a maximum residue level of 0.2 mg/kg for beans, dry, together with an STMR of 0.03 mg/kg.

Carrots

Cyprodinil is registered in the USA for use in carrots at a GAP of 4 × 0.37 kg ai/ha, with a 7-day PHI.

Ten trials in carrots were conducted in the USA and Canada in accordance with the USA GAP. Residues in carrots at the 7-day PHI were: 0.02, 0.05 (2), 0.06 (s), 0.08 (s) 0.10, 0.12, 0.18,

0.39, and 0.40 mg/kg, where (s) indicates a result scaled to account for application rates outside ±25% of GAP.

The Meeting estimated a maximum residue level of 0.7 mg/kg for carrots, together with an STMR of 0.09 mg/kg.

The Meeting noted that the US GAP for parsnips is the same as that for carrots, and agreed to extrapolate the residue data for carrots and estimated a maximum residue level of 0.7 mg/kg for parsnips, together with an STMR of 0.09 mg/kg.

Radish

Cyprodinil is registered in the USA for use in radish at a GAP of 2 × 0.37 kg ai/ha, with a 7-day PHI.

Five trials in radish were conducted in accordance with the USA GAP. Residues in radish roots at the 7-day PHI were < 0.01 (3), 0.03, and 0.14 mg/kg.

Residues in radish tops at the 7-day PHI were 0.13, 0.17, 0.40, 0.45, and 1.3 mg/kg.

The Meeting estimated a maximum residue level of 0.3 mg/kg for radish, together with an STMR of 0.01 mg/kg.

The Meeting agreed that residues of cyprodinil arising in radish tops would be covered by the proposed maximum residue level of 15 mg/kg for brassica leafy vegetables.

Herbs

Cyprodinil is registered in the USA for use in herbs at a GAP of 4 × 0.37 kg ai/ha, with a 7-day PHI.

Three trials in basil were conducted in accordance with the USA GAP. Residues in fresh basil leaves at the 7-day PHI were 1.5, 1.7 and 2.1 mg/kg. Residues in dried basil leaves at the 7-day PHI were 8.8 mg/kg.

Three trials in chives were conducted in accordance with the USA GAP. Residues in fresh chives at the 7-day PHI were 0.62, 1.0, and 1.1 mg/kg. Residues in dried chives at the 7-day PHI were 2.9 mg/kg.

Four trials in parsley were conducted in accordance with the USA GAP. Residues in fresh parsley at the 7-day PHI were 2.9, 3.0, 7.1, and 16 mg/kg. Residues in dried parsley at the 7-day PHI were 20 (2), 30, and 112 mg/kg.

The Meeting noted that the USA GAP is for all herbs and considered a group maximum residue level. To consider a group maximum residue level, residues in individual crops should be similar (e.g., medians should not differ by more than 5×). The Meeting agreed to estimate a maximum residue level for the group herbs. In deciding whether to combine the datasets for basil, chives and parsley for use in the statistical calculator, or to only utilize the data from the commodity with the highest residues, the Meeting agreed not to combine the data sets (Kruskal-Wallis test). Therefore, recommendations on herbs were based on parsley, as the commodity with the highest residues. Based on the data set for fresh parsley, the Meeting estimated a maximum residue level of 40 mg/kg for herbs, together with an STMR of 5.05 mg/kg.

The Meeting estimated a maximum residue level of 300 mg/kg for dried herbs except hops, dry, based on the data set for dried parsley, together with an STMR of 25 mg/kg.

Processing studies

A processing study for lemons was evaluated by the current Meeting; however as the residue data set for lemons was insufficient for the estimation of a maximum residue level or STMR, STMR-P values for citrus processed products were not estimated.

Some processing data for tomatoes was generated as part of the residue trial in tomatoes provided to the Meeting. Processing studies for apples, barley, grapes, plums, tomatoes and wheat

were considered by the 2003 JMPR. The studies in apples and tomatoes are relevant to the crops being considered by the current Meeting. Processing factors are tabulated below.

RAC	Processed product	PF
Apples	Wet pomace	3.5
	Juice	0.03
Tomatoes	Juice	0.17
	Purée	0.52
	Paste	0.86, 2.3

The processing factors were applied to the STMRs for the raw commodities to produce the following STMR-P values: wet apple pomace 1.8 mg/kg; apple juice 0.015 mg/kg; tomato juice 0.036 mg/kg; tomato purée 0.11 mg/kg; and tomato paste 0.48 mg/kg.

Residues in animal commodities

Farm animal dietary burden

Dietary burden calculations incorporating all commodities considered by the current and 2003 Meetings for beef cattle, dairy cattle, broilers and laying poultry are presented in Annex 6. The calculations are made according to the livestock diets of the USA/Canada, the European Union, Australia and Japan as laid out in the OECD table.

	US/CAN		EU		AU		Japan	
	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean
Beef cattle	0.91	0.37	13.9	1.8	5.8	1.4	0.46	0.46
Dairy cattle	1.7	0.87	13.5	1.4	**23.3** [a]	**1.8** [b]	0.26	0.26
Poultry – broiler	0.49	0.49	0.80	0.54	0.12	0.12	0.066	0.066
Poultry – layer	0.49	0.49	**4.1** [c]	**0.76** [d]	0.12	0.12	-	-

[a] Highest maximum dairy cattle dietary burden suitable for HR and MRL estimates for mammalian milk

[b] Highest mean dairy cattle dietary burden suitable for STMR estimates for mammalian milk

[c] Highest maximum poultry dietary burden suitable for HR and MRL estimates for poultry meat and eggs

[d] Highest mean poultry dietary burden suitable for STMR estimates for poultry meat and eggs

Animal commodity maximum residue levels

Mammals

A feeding study on lactating dairy cattle was considered by the 2003 JMPR.

Lactating Holstein dairy cows were dosed daily by gelatin capsule with cyprodinil at the equivalent of 5, 15 and 50 ppm in the dry-weight diet for 28 consecutive days. Milk was collected throughout and on days 28, 29, and 30, a cow from each dosing group was slaughtered for tissue collection. Cyprodinil residues were not detected (LOQ 0.01 mg/kg) in the milk (days 0, 1, 3, 7, 14, and 21), kidney, or fat of cows from the highest dose group (50 ppm), nor in milk (day 26) or muscle from any dose groups. Cyprodinil was present in liver (highest residue 0.013 mg/kg) from the highest dose group but not from the other groups.

The 2003 JMPR estimated a maximum residue level of 0.0004* mg/kg (F) for milk, together with an STMR of 0 mg/kg, based on a maximum dietary burden for dairy cattle of 8.2 ppm, and a mean dietary burden of 0.53 ppm.

The highest dietary burden for dairy cattle is for Australia (max. dietary burden of 23.3 ppm and mean dietary burden of 1.8 ppm). The Meeting noted that no residues of cyprodinil were quantified in milk above the LOQ (0.01 mg/kg) at feeding levels up to 50 ppm in cattle. The Meeting concluded that the existing maximum residue level and STMR for milk remain appropriate.

The 2003 JMPR estimated maximum residue levels of 0.01* mg/kg (fat) and STMRs of 0 mg/kg for meat (from mammals other than marine mammals), and edible offal (mammalian). These limits were based on a maximum dietary burden of 8.2 ppm, and a mean dietary burden of 0.53 ppm.

As for dairy cattle, the highest dietary burdens for calculation of meat MRLs are 23.3 ppm (max.) and 1.8 ppm (mean), considering all the use patterns evaluated by the 2003 JMPR and the present Meeting. Given that no residues of cyprodinil were found above the LOQ in muscle or fat of cattle at a feeding level of 50 ppm, the Meeting considers that the existing maximum residue level for meat (from mammals other than marine mammals), and the STMR values remain appropriate. No residues were found above the LOQ in kidney even at the highest dose of 50 ppm. In liver, no residues were found above the LOQ in liver at feeding levels of 5 and 15 ppm, while at 50 ppm, low residues up to 0.013 mg/kg were found. The Meeting estimated a maximum residue level of 0.01 mg/kg for edible offal (mammalian), together with an STMR of 0 mg/kg. The Meeting agreed to withdraw the previous recommendation of 0.01* mg/kg for edible offal (mammalian).

Poultry

A feeding study in poultry was not presented to the 2003 JMPR or to the present Meeting.

The 2003 JMPR estimated maximum residue levels of 0.01* mg/kg for eggs and poultry, edible offal of, and 0.01* mg/kg (fat) for poultry meat and STMRs of 0 mg/kg. These limits were based on a maximum dietary burden of 2.6 ppm and a mean dietary burden of 0.50 ppm, and consideration of the laying hen metabolism study.

Based on the use patterns considered by the 2003 JMPR and the present Meeting, the Meeting noted that the highest dietary burden for poultry (both for meat and egg producing birds) was the EU diet, with a maximum dietary burden of 4.1 ppm and a mean dietary burden of 0.76 ppm.

As noted by the 2003 JMPR, cyprodinil parent compound was not detected in poultry tissues in the laying hen metabolism study (except in kidney at 0.001 mg/kg), even at feeding levels of 215 and 226 ppm. Cyprodinil was detected in eggs at 0.002-0.011 mg/kg from birds dosed at 215 and 226 ppm. Given that these feeding levels are around 50 times the maximum dietary burden of 4.1 ppm estimated for poultry, the Meeting considers that the existing maximum residue levels, and STMR values for poultry commodities remain appropriate.

RECOMMENDATIONS

CCN	Commodity name	Recommended maximum residue level, mg/kg		STMR (P), mg/kg
		New	Previous	
FP 0226	Apple	W	0.05	
FI 0326	Avocado	1		0.265
VD 0071	Beans (dry)	0.2		0.03
VP 0061	Beans, except broad bean and soya bean (green pods and immature seeds)	0.7	0.5	0.165
VP 0062	Beans, shelled	0.06		0.02
FB 0018	Berries and other small fruits, except grapes	10		2.2
VL 0054	Brassica leafy vegetables	15		0.37
VB 0041	Cabbages, head	0.7		0.03
VR 0577	Carrot	0.7		0.09
VC 0424	Cucumber	W	0.2	

CCN	Commodity name	Recommended maximum residue level, mg/kg		STMR (P), mg/kg
		New	Previous	
DH 0170	Dried herbs, except hops, dry	300		25
MO 0105	Edible offal (mammalian)	0.01	0.01*	0
VO 0440	Egg plant	W	0.2	
VB 0042	Flowerhead Brassicas	2		0.27
VC 0045	Fruiting vegetables, Cucurbits	0.5		0.09
VO 0050	Fruiting vegetables, other than Cucurbits, except sweet corn and mushroom	2		0.24
HH 0092	Herbs	40		5.05
VL 0053	Leafy vegetables, except brassica leafy vegetables	50		11
VL 0482	Lettuce, Head	W	10	
VL 0483	Lettuce, Leaf	W	10	
VR 0588	Parsnip	0.7		0.09
FP 0230	Pear	W	1	
HS 0444	Peppers Chili, dried	9		2.0
VO 0445	Peppers, Sweet	W	0.5	
FP 0009	Pome fruit	2		0.48
VR 0494	Radish	0.3		0.01
FB 0272	Raspberries, Red, Black	W	0.5	
VC 0431	Squash, Summer	W	0.2	
FB 0275	Strawberry	W	2	
VO 0448	Tomato	W	0.5	

CCN	Commodity name	STMR (P), mg/kg
JF 0226	Apple juice	0.015
	Apple pomace, wet	1.8
JF 0448	Tomato juice	0.036
	Tomato purée	0.11
	Tomato paste	0.48

DIETARY RISK ASSESSMENT

Long-term intake

The International Estimated Dietary Intakes (IEDIs) of cyprodinil were calculated for the 13 GEMS/food cluster diets using STMRs/STMR-Ps estimated by the current Meeting and by the 2003 JMPR. The ADI is 0–0.03 mg/kg bw and the calculated IEDIs were 5–40% of the maximum ADI (0.03 mg/kg bw). The Meeting concluded that the long-term intakes of residues of cyprodinil,

resulting from the uses considered by the current Meeting and by the 2003 JMPR, are unlikely to present a public health concern.

Short-term intake

The 2003 JMPR decided that an ARfD was unnecessary and concluded that the short-term intake of cyprodinil is unlikely to present a public health concern.

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