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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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MEMORANDUM

Subject: Iprodione drinking water assessment, including proposed new use on pistachio (IR4) and label revisions affecting rates for strawberries, stone fruits, and grapes.

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Executive Summary

The Environmental Fate and Effects Division (EFED) conducted a drinking water assessment for iprodione in response to label amendments and proposed new uses that differ from the uses evaluated in the 1998 iprodione RED. The drinking water concentrations calculated here have been completely revised from previous calculations (i.e., as presented in the 1998 iprodione RED and subsequent drinking water memos). The need for a complete revision was due to the availability of newer models than those available for the 1998 RED as well as submissions of newer fate data by the registrant.

EFED calculated concentrations for both iprodione and the iprodione degradate 3,5-dichloroaniline (3,5-DCA), which HED has reported to be of toxicological concern. Some representative drinking water concentrations to be used HED's human health assessment are summarized in Table A for iprodione and in Table B for the degradate 3,5-dichloroaniline (3,5-DCA). These tables include the highest concentrations calculated (from rice and turf) as well as concentrations that resulted from the new uses and label amendments. A more extensive list of estimated drinking water concentrations is included within this document (see Tables 10 and 15).

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There is considerable uncertainty in the fate of iprodione and the production of 3,5-DCA due in a large part to insufficient evidence showing the degradation of iprodione and 3,5-DCA. This uncertainty is addressed by making protective assumptions regarding the degradation of these compounds, and thus resulting concentrations will likely be protective of human health. In order to address some of these uncertainties, both surface and groundwater monitoring programs were previously required of the registrant. These monitoring programs are now in progress, but only very preliminary results are available.

If there are specific questions about this assessment or if these concentration estimates result in dietary risk exceedances, contact Dirk Young (605-0206, EFED).

Table A. Some representative estimated drinking water concentrations for iprodione based on maximum allowable use. See Table 13 for a complete list.

Drinking water source	Crop	Seasonal application rate (lbs ai/A)	Acute Conc. (ppb)	Chronic Conc. (ppb)	Cancer Conc. (ppb)
Surface Water	Strawberry (label revision)	4	201	45	2.7
Surface Water	Cherries (label revision)	4	33	1.2	0.78
Surface Water	Almond/Pistachio surrogate (label revision)	4	33	1.1	0.72
Surface Water	Grapes (label revision)	4	39	1.5	0.96
Surface Water	Turf	24	330	11	6
Surface Water	Rice	1	500	500	500
Groundwater	turf	24	16	16	16

Table B. Some representative estimated drinking water concentrations for 3,5-DCA based on maximum allowable use. See Table 17 for a complete list.

Drinking water source	Crop	Seasonal iprodione application rate (lbs ai/A)	Acute Conc. (ppb)	Chronic Conc. (ppb)	Cancer Conc. (ppb)
Surface Water	Strawberry (label revision)	4	113	32	24
Surface Water	Turf	24	322	174	133
Surface water	Rice	1	200	200	200
Groundwater	Turf	24	13	13	13

Problem Formulation

This drinking water assessment uses modeling to provide estimates of surface water and groundwater concentrations of iprodione residues in source water for drinking water (pre-treatment) resulting from iprodione labeled uses. Estimated Drinking Water Concentrations (EDWC) are included for iprodione and the degradate 3,5-DCA. Routes of transport to source water are primarily from runoff, leaching, and spray drift. The coupled models PRZM and EXAMS were used to assess exposure in surface water due to runoff and drift from the proposed iprodione uses. Exposure in groundwater due to leaching was assessed with the screening model SCI-GROW. Exposure resulting from applications to rice was assessed with the Interim Rice Model.

Iprodione is moderately mobile in soil systems with a K_{oc} of around 500 ml/g (FAO classification system). Iprodione is not particularly volatile, and so it should not be subject to long-range aerial transport. Iprodione is most persistent in acidic environments, with half lives around 130 days at a pH of 5 in aquatic systems; however in neutral aquatic systems, the half life drops off to 4.7 days (pH of 7), and in basic systems, iprodione quickly dissipates (27 minutes at pH of 9). For aquatic systems, there is no strong evidence of effective mechanisms of iprodione degradation other than hydrolysis. Submitted iprodione degradation studies involving soils are characterized by high levels of unextracted and unidentified residues which lead to uncertain degradation characterizations; thus it is uncertain whether iprodione undergoes degradation in soil systems or whether it is simply temporararily sequestered and can be released over time.

The major degradates observed in laboratory and field studies are summarized in Table 1. The table also shows the fate studies that produced the degradates and the maximum percent of parent at which the degradate appeared in the study. The only degradate that the Health Effects Division has reported to be of toxicological concern is 3,5-dichloroaniline (3,5-DCA or RP-32596), and it was found in several of the laboratory studies. The submitted 3,5-DCA degradation studies were characterized by large amounts of unextracted and uncharacterized material; thus there is considerable uncertainty regarding its degradation in the environment. This assessment includes consideration for the exposure of both iprodione and 3,5-DCA.

Table 1. Table Of Degradates Formed In Environmental Fate Studies

Registrant Name	Chemical Name	Study in Which Found (Maximum % of Parent)	Reference MRID
RP32596	3,5-dichloroaniline (or 3,5-DCA)	Soil Photolysis (28%)* Aerobic Soil (9%) Aerobic Soil (3.9%) Aerobic Aquatic (9.9%) Anaerobic Aquatic (3.6%)	42897101 43091002 44590501 42503801 41755801
RP30228	3-(1-methylethyl)-N-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide	Hydrolysis (93%) Soil Photolysis (7.7%) Aerobic Soil (29%) Aerobic Aquatic (65%) Anaerobic Aquatic (60%) Terrestrial Field (--) Aquatic Field (--)	41885401 42897101 44590501 42503801 41755801 41877401 43718301
RP25040	3-(3,5-dichlorophenyl)-2,4-dioxoimidazolidine	Soil Photolysis (14%) Aerobic Soil (9.5%)	42897101 43091002
RP32490	3-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide	Aerobic Aquatic (15%) Terrestrial Field (--)	42503801 41877401
RP37176	N-(3,5-dichlorophenyl)-2-(1-methylethyl)-1-ureylenecarboxamide	Aquatic Field (--)	43718301
RP35606	[(dichloro-3,5-phenyl)-1-isopropylcarbamoyl-3]-2-acetic acid	Hydrolysis (12%)	41885401
RP36221	1-(3,5-dichlorophenyl)-5-isopropyl biuret	Aerobic Soil (13%)	44590501

*Photolysis is probably not the mechanism for production of 3,5-DCA in this study since the dark control produced nearly equivalent amounts of 3,5-DCA.

Analysis

Use Characterization

Iprodione [3-(3,5-dichlorophenyl)-N-(1-methylethyl)-2,4-dioxo-1-imidazolidinecarboxamide] is a contact and/or locally systemic fungicide. Application methods include aircraft aerial applications, groundsprays, chemigation, and dipping. It is registered for use on a variety of fruit, vegetables, and ornamentals (see Appendix 1 for more examples of registered uses). The registrant is proposing to add a new uses on pistachio (IR4), and to increase label application rates for strawberries, stone fruits and grapes. The current formulations are for outdoor use only.

EFED obtained all relevant labels from the Registration Division and then summarized the relevant content in detail (see Appendix 1). EFED conducted model simulations for most of the labeled uses (in some cases multiple scenarios for a given use) in order to derive EDWCs. Some of uses could not be directly simulated but were adequately simulated with close scenario approximations (e.g., California almond used for pistachio and Florida cabbage for Florida Chineese Mustard). The simulations that were performed were sufficiently broad to provide a realistic assessment of the varied uses of iprodione.

Environmental Fate and Transport Characterization

Iprodione is moderately mobile (per FAO classification system) in soil systems with a K_{oc} around 500 ml/g. It is not particularly volatile, and so it should not be subject to long-range aerial transport. Iprodione is most persistent in acidic environments, with half lives around 130 days at a pH of 5 in aquatic systems; however, in neutral aquatic systems, the half life drops to 4.7 days (pH of 7), and in basic systems, iprodione quickly dissipates (27 minutes at pH of 9). For aquatic systems, there is no strong evidence of effective mechanisms of iprodione degradation other than hydrolysis.

Submitted iprodione degradation studies involving soils are characterized by high levels of unextracted and unidentified residues which lead to uncertain degradation characterizations. For example, in a submitted aerobic soil degradation study, 75 to 87% of the residues were unextracted and uncharacterized after 300 days. Thus it remains unknown if and how much of these residues are parent iprodione or degradates of concern. Nevertheless, terrestrial and aquatic field dissipation studies tend to imply that iprodione dissipates in the environment with a DT_{50} of 3 to 7 days. However, because of the extraction concerns raised in the soil studies, it is unknown whether these DT_{50} values represent true degradation or simply a temporary sequestering of iprodione (or degradates of concern) that can be released over time.

The major degradates observed in laboratory and field studies are summarized in Table 1. The table also shows the fate studies that produced the degradates and the maximum percent of parent at which each of the degradates appeared in the studies. The only degradate that the Health Effects Division has reported to be of toxiclogical concern is 3,5-dichloroaniline (3,5-DCA or RP-32596), and it was found in several of the laboratory studies. This assessment includes consideration for the exposure of both iprodione and 3,5-DCA

Table 2A summarizes the general fate properties of iprodione as determined from submitted studies, and Table 3 presents the properties of 3,5-DCA. Summaries of the information available to EFED regarding the fate of iprodione and 3,5-DCA and which were used to construct these tables are presented in the following sections.

Table 2. Summary of General Fate Properties of Iprodione 3-(3,5-dichlorophenyl)-N-(1-methylethyl)-2,4-dioxo-1-imidazolidine-carboxamide

Property	**Value**	**Source/MRID**	**comments**
Molecular formula	$C_{13}H_{13}Cl_2N_3O_3$		
Molecular weight (MW)	330.2 g/mole		
Vapor pressure (20°C):	$2.7x10^{-7}$ torr	Iprodione RED	
Henry's Constant	$9.0x10^{-9}$ atm m^3/mol	calculated	=(vp/760)/(MW/sol); vp in torr; sol in mg/L; MW in g/mol
Octanol/Water Coefficient	Log_{10} K_{ow} = 3.1	Iprodione RED	
Solubility in water (20°C)	13 mg/L	Iprodione RED	
Hydrolysis half life	131 day (pH = 5) 4.7 day (pH= 7) 27 min (pH= 9)	41885401	
Photolysis aquatic half life	67 days	41861901	near surface, clear water
Photolysis soil half life	negligible	42897101	
Aerobic soil degradation half life	30 to 300 days 24 to 100 days	43091002 44590501	There were high amounts of unextracted material (75-87%)
Aerobic aquatic degradation half life	9 days	41927601 42503801	(likely due solely to hydrolysis)
Anaerobic aquatic degradation half life	7-14 days	41755801	(likely due solely to hydrolysis)
Sorption (K_{oc})	426 ml/g	43349202	(average of 4 soils), reasonably linear isotherms, Freundich exponents average 0.96

Table 3. Summary of Fate Properties of the Iprodione Degradate 3,5-DCA

Property	**Value**	**Source/MRID**	**comments**
Molecular wt	162	Product chemistry data	
Solubility	784 mg/L	EPI Suite	
Henry's Law Constant	10^{-6} atm m^3/mol	EPI Suite	
Aerobic soil degradation half life	Possibly > 9 months	45239201	high levels of un-extracted residues (see text)
Sorption (K_{oc})	500 to 850 ml/g (based on Kf)	45114101	Nonlinear, Freundlich exponent = 0.6 to 0.7

Hydrolysis

The pH-dependent hydrolysis half life of iprodione is 131 days at a pH of 5, 4.7 days at a pH of 7, and 27 minutes at a pH of 9. These values were derived from laboratory studies (MRID# 41885401) in sterile aqueous buffered solutions at 25°C. The major degradates observed were RP35606 with a maximum of 11.9% of the applied at pH 5, and RP30228, with a maximum of 93.3% of the applied at pH 9. [RP-30228 is 1-(3,5-dichlorophenyl)carbamoyl-3-isopropyl-hydantoin, and RP-35606 is 3-(isopropylcarbamoyl)-5-(3,5-dichlorophenyl)hydantoic acid.]

Photolysis in Water

Iprodione degraded slowly with a half life of 67 days in a pH 5 buffered solution irradiated continuously with a UV-filtered xenon-arc lamp (MRID# 41861901). The test ran for 33 days in conditions reported to simulate Florida sunlight. Iprodione did not degrade significantly in the dark control. No major degradates (≥10% of the applied) were observed in this study. Laboratory photolysis studies such as these are intended to provide the photolysis rate that could occur at the surface of a clear water body with access to unobstructed solar radiation; thus rates in an actual environment would be considerably lower.

Photolysis on Soil

Iprodione degraded at a somewhat higher rate under irradiated conditions than in the dark control in a soil photolysis study (MRID# 42897101). On irradiated soils, iprodione degraded with an observed DT_{50} of 7-14 days in sandy loam soil that was irradiated with a xenon-arc lamp for 8.8 hours/day for 30 days; whereas, in the dark controls, iprodione degraded with an observed DT_{50} of 14-21 days. Registrant-calculated half lives, using a first-order degradation model, were 4.64 days for the irradiated sample and 5.15 days for the dark control, thus degradation by irradiation is minimal. The major degradate observed in the irradiated soil was RP32596 [3,5-DCA] with a maximum of 28% of the applied at 14 days; while the dark control produced 37% of 3,5-DCA. Other degradates include a mixture of RP25040 [3-(3,5-dichlorophenyl)-2,4-dioxoimidazolidine] and LS720942 with a maximum of 13.75% of the applied at day 7 (3% in the dark control), and RP30228 with a maximum of 7.72% immediately post treatment (11% in the dark control).

Aerobic Aquatic Metabolism

Iprodione degraded with an observed DT_{50} of 3-7 days in a flooded silt loam sediment system incubated in the dark (MRID# 41927601 and 42503801). However, the pH of the system was 8.5, which is a level at which hydrolysis is a major mechanism of degradation. In the pH range between 7 and 9, iprodione degrades with a half life between 27 minutes and 4.7 days, as shown in a separate hydrolysis study (MRID 41885401). Thus hydrolysis is likely the means of degradation in these studies. The major degradates were RP30228, with a maximum of 64.6% of the applied at 14 days, and RP32490 [1-(3,5-dichlorophenyl)-3-carbamoyl hydantoin], with 14.6% of the applied at 2 days. RP32596 [3,5-dichloroaniline] was a maximum of 9.9% of the applied in the sediment at 30 days.

Anaerobic Aquatic Metabolism

Iprodione, at approximately 6 ppm, degraded with an observed DT_{50} of 7-14 days in anaerobic (flooded plus nitrogen atmosphere) silt loam sediment that was incubated in the dark at 25°C in an anaerobic aquatic metabolism study (MRID 41755801). The pH of the water was 7.4, which is a level at which hydrolysis is likely the most significant degradation mechanism. A sterile control showed that iprodione degrades at about the same rate under sterile conditions, but the degradate (RP-30228) did not dissipate (accounting for about 90% of applied after 1 year); whereas in the unsterilized test, it accounted for only about 10% after 1 year. Thus degradation of the parent does not appear to be microbially mediated, but degradation of RP-30228 does appear to be microbially mediated. The major degradates were RP30228 with a maximum of 70.7% of the applied at 14 days post-treatment; RP32490 with a maximum of 8.4% of the applied at 30 days. CO_2 accounted for 5.5-6.3% of the applied at 365 days. Organic volatiles were ≤0.6%, and unextracted residues were 16.7-20.0% of the applied.

Aerobic Soil Metabolism

In an aerobic soil metabolism study (MRID# 43091002) conducted in a sandy loam soil that was incubated in the dark at 25°C and 75% of 0.33 bar moisture for 276 days, unextracted and uncharacterized residues accounted for 75.8 to 86.9% of the applied ^{14}C at 181-276 days (last test interval). Thus it is difficult to estimate actual degradation rates. The half life could be higher than 300 days if all the unidentified unextracted material were iprodione. The DT_{50} of the extracted iprodione was 14-30 days. The following degradates were observed: RP30228, with a maximum of 6.92% of the applied at 14 days; RP32596 (3,5-DCA), with a maximum of 9.02% of the applied at 30 days; and RP25040, with a maximum of 9.47% of the applied at 30 days. Volatile residues totaled 5.27% of the applied at 276 days (of which 5.23% was CO_2). Note: the soil used was the same soil used in the soil photolysis study (i.e., MRID# 42897101).

In a shorter 100-day study (MRID 44590501), iprodione degraded with a half-life between 23.9 and 100 days. The shorter half life was based on the regression of extractable iprodione only. The longer half life was based on the observation that at 100 days there was more than 50% unrecovered and uncharacterized material that could have been iprodione. Degradates were RP30228 (observed at a maximum of 29.5 %), RP36221 (observed at a maximum of 12.7%), and 3,5-DCA (observed at a maximum of 3.9%).

Sorption

Batch sorption tests (MRID 43349202) for four soils are summarized in Table 4. Iprodione isotherms for these four soils are reasonably linear, with Freundlich exponents from 0.85 to 0.91. The mean of the organic carbon partitioning coefficients is 426 ml/g which would be classified as moderately mobile by the FAO mobility classification scheme (USEPA, 2006).

Table 4. Sorption Parameters for Iprodione (4).

Soil	Fraction of Organic Carbon (foc)	Freundlich Coefficient K_F (1, 2)	Freundlich Exponent N (1)	K_{oc} (ml/g) (3)
Loam	0.085	43.1	0.908	507
Sandy loam	0.011	2.45	0.905	223
Loamy sand	0.005	2.16	0.858	431
Clay	0.012	6.52	1.204	543

(1) Freundlich Isotherm $S= K_FC^N$

(2) K_F has units of [mg/kg][L/mg]^N,

(3) K_{oc} value is based on the sorption coefficient (S/C, where S is sorbed concentration and C is aqueous concentration) that occurs at an aqueous concentration of 1 mg/L, which has a numerical value that is equivalent to K_F/f_{oc}.

(4) These values were calculated by the registrant using the amount of decanted volume of water as the amount of water in contact with the soil, as opposed to the correct way of performing this calculation which would have been to use the total volume of water. An assessment of this error showed that the volume of water would have been underestimated by about 10% (see MRID 43349202 Table A11.3). This type of error would most significantly affect the lower K_d estimates; whereas higher K_d values would be less affected. For the cases reported in this table the sorption coefficient error should be less than 20%. One value reported by the registrant had a K_d of 0.06 and the error associated with this would be so great as to make its value meaningless and thus this value was excluded from the analysis and this table.

Terrestrial Field Dissipation

Two terrestrial field dissipation studies are available (both described in MRID #41877401). Neither study monitored for the degradate 3,5-DCA. The two studies were conducted in California and North Carolina and are summarized below.

In a study conducted in San Juan Bautista, California, iprodione was applied 8 times to carrots at 1 lb ai/A/application. Iprodione dissipated with an observed DT_{50} of 7 days in the 0-15 cm soil layer of a silt loam soil (pH 7.9-8.0). The degradates RP30228 and RP32490 were recovered from the 0-15 and the 15-30 cm soil depths. Iprodione and its degradates were not detected below the 30-cm soil level. RP30228 was a maximum average of 0.47 ppm at 28 days after treatment, declining only to 0.15 ppm at 538 days. RP32490 was observed at relatively low levels ($\leq$0.09 ppm) in the field. Field spike recoveries of iprodione at this site were 66 to 86%.

In a study conducted in North Carolina, iprodione was applied 8 times to carrots at 1 lb ai/A/application. The observed DT_{50} was less than 3 days in the 0-15 cm soil depth of a loamy sand soil (soil pH of 6.2 – 6.8). RP30228 and RP32490 were observed only in the 0-15 cm soil depth. No residues of these degradate or iprodione were detected below 15 cm. The concentrations of RP30228 were lower (ranging from 0.01 to 0.08 ppm until 492 days). Recoveries of iprodione field spikes at this site were 66 to 86%.

Aquatic Field Dissipation

In aquatic field dissipation studies (MRID #43718301), iprodione was applied twice to flooded rice paddies at 0.5 lb/acre at a 15-day interval at two site—one in Waller County TX, and one in Washington County, MS. Iprodione was applied to the rice foliage at both sites (55% canopy coverage at TX, 85% at MS). The two sites were flooded for 1 month. The pH of the flood waters at both sites were in the range for which iprodione readily degrades by hydrolysis. Flood water dissipation half lives were 3.7 days in Texas and 2.9 days in Mississippi; soil half lives however were on the order of months. Maximum concentrations observed in both studies were around 500 ppb. Storage sample recoveries for 3,5-DCA were only 18%, and thus this study is not suitable for characterizing the formation or persistence of 3,5-DCA. The major degradates observed at both sites were RP 30228 and RP 37176

Volatilization/Long-Range Transport

Iprodione is not particularly volatile as indicated by the approximated Henry's Law constant (derived from vapor pressure, solubility, and molecular weight) of 2.7×10^{-9} atm m^3/mol. Thus long-range transport should not be a particular concern. The Agency has not received any direct measurements of volatility information for 3,5-DCA. In the absence of such data, the Agency used EPISuite which estimated that the Henry's Law constant is much higher than for the parent (around 10^{-6} atm m^3/mol). Although this value would imply that 3,5-DCA should be more volatile than the parent, it did not show up in any of the volatile traps in the submitted laboratory studies.

3,5-DCA sorption

Batch sorption tests (MRID 45114101) for five soils are summarized in Table 5. Isotherms of 3,5-DCA for these five soils are nonlinear, with Freundlich exponents around 0.7. This means that the sorption affinity increases as concentrations decreases, and that 3,5-DCA will become less mobile as concentrations decrease. According to standard EFED practice, this chemical is classifieds as moderately mobile (USEPA, 2006), with an average K_{oc} of 664 ml/g.

Table 5. Batch Sorption Resuslts for 3,5-DCA

Soil	FreundlichCoefficient [1,2] K_F	FreundlichExponent[1,2] N	K_{oc}[3] (ml/g)
Sandy loam	1.75	0.68	593
Loamy sand	7.17	0.634	626
Silt loam	10.98	0.692	380
Clay	9.17	0.743	932
Pond sediment	4.635	0.646	788

(1) Freundlich Isotherm $S= K_F C^N$

(2) K_F has units of $[mg/kg][L/mg]^N$,

(3) K_{oc} value is based on the sorption coefficient (S/C, where S is sorbed concentration and C is aqueous concentration) that occurs at an aqueous concentration of 1 mg/L, which has a numerical value that is equivalent to K_F/f_{oc}.

3,5-DCA Aerobic Soil Degradation

An aerobic soil metabolism study of 3,5-DCA on two different soils, showed little evidence that 3,5-DCA appreciably degraded over a 9-month period at 25°C (MRID#45239201). Apparent dissipation was caused by a high level of unextracted residue. Unextracted residues accounted for 66% and 81% of the applied in the two systems. The only residues that were distinguishable from the parent amounted to only 4 to 5% of the applied ^{14}C.

Monitoring

Following the 1998 Iprodione RED, surface water monitoring was required for iprodione and the degradate 3,5-DCA. Following the 2000Vinclozolin RED (vinclozolin has the same 3,5-DCA degradate), groundwater monitoring of iprodione and the degradate 3,5-DCA was added to the monitoring requirements. The surface water monitoring program started in 2006 in watersheds that contained high numbers of golf courses. A ground water monitoring program was initiated by the registrant in conjunction with Suffolk County New York after iprodione was reported in Suffolk County groundwater. These two programs are ongoing and only preliminary results have been received. The preliminary report did not provide adequate ancillary information to enable thorough evaluation of the data. For example, although the report indicates that samples were taken from private drinking water wells, irrigation wells, vineyard wells, and golf course wells, the spatial context of the sampling locations were not given so it is unknown whether the sampling locations are representative of iprodione use areas. Additionally, well depths were not given for most of the samples which would be required in order to evaluate whether these are reasonable sampling wells. For some of the samples it was not apparent whether the samples were taken from ground water or from surface water.

The intent of the report was to show that work had begun on the monitoring program rather than to provide conclusions regarding iprodione groundwater issues. However, a cursory review of the reported results indicates that there were detections of iprodione and 3,5-DCA. All of the reported iprodione groundwater detections were at concentrations less than 1 ppb, except for one detection in an irrigation well that was 5.75 ppb (well depth not given but water table depth was stated to be 80 ft). Surface water detections of iprodione were higher with 3 detections greater than 1 ppb—8.8 ppb at a golf course pond, 1.1 ppb at a golf course pond, and 2.6 ppb at unknown type of surface water (identified as a greenhouse). Lower and less frequent concentrations were reported for 3,5-DCA in groundwater, with the maximum concentration of 0.44 ppb in a golf course well. Surface water detections of iprodione include 4 ppb and 1.5 ppb in golf course ponds, along with three other golf course pond samples less than 1 ppb. The iprodione/3,5-DCA assessment may need to be reevaluated upon receipt of the final monitoring reports.

The 1998 Iprodione RED reviewed several non-targeted surface and groundwater studies (e.g., Oregon, Wisconsin, California, STORET) that showed little evidence of iprodione with mostly less than 0.1 ppb detections, but with higher values (1 to 3.5 ppb) reported in one drainage ditch. A recent check (Jan 2006) of NAQWA revealed no information regarding iprodione or 3,5 DCA detections.

Drinking Water Exposure Modeling

Drinking water concentrations were determined for both iprodione and the degradate 3,5-DCA. The parent concentrations are calculated in the first section that follows, and the degradate concentrations are calculated in the section that follows the parent.

Drinking Water Estimates for Parent Iprodione

Methods for Determining Parent (Iprodione) Concentrations

Iprodione drinking water estimated concentrations were determined for the iprodione uses listed in Table 6. For surface water concentration calculations due to all uses except rice, the models used were PRZM 3.12beta and EXAMS 2.98.04 along with the appropriate index reservoir scenario. For the rice use, surface water concentrations were determined using the Interim Rice Model. For groundwater concentrations, SCIGROW 2.3 was used.

Input parameters for PRZM/EXAMS are given in Tables 6 and 7. Input parameters for the Interim Rice Model are given in Table 8. Input parameters for Scigrow are given in Table 9. Parameter selections were determined according to EFED guidance (EFED, 2002) unless otherwise specified.

For the PRZM/EXAMS simulations, various application dates were simulated in an attempt to capture the well-known variability associated with application dates. The application dates that are given in Table 6 are the ones that were used for presenting the primary results, and these dates were chosen with consideration for the label recommendations for application timing and preharvest interval (see Appendix 1) along with the crop dates associated with each PRZM scenario file. The primary application dates used in these simulations were selected from the approximate middle of the possible window of applications (using the model user's best judgement); however, the selection of the date is not a precise process, and there may be some variability about the date selection. In order to address this variability, simulations were also made using applications dates before and after those dates given in Table 6, but within the temporal window of possible application dates. The possible temporal window was evaluated using the application information from the labels (see Appendix 1) along with the emergence and harvest dates associated with each scenario.

Table 6. Use-Specific Scenarios and Usage Inputs for Surface Water Modeling Iprodione

Use	Application method	FEED Scenario	Iprodione Application Rate [lb. a.i./A]	Number of applications	Date of Application (interval)
almond/pistachio	ground spray	CA Almond	1	4	Feb7, 14,28, Mar7
almond/pistachio	aerial spray	CA Almond	1	4	Feb7, 14,28, Mar7
canola	ground spray	ND Canola	0.45	1	Jul 1
canola	aerial	ND Canola	0.45	1	Jul 1
cotton	in furrow	CA Cotton	0.27	1	May 5
cotton	in furrow	MS Cotton	0.27	1	May 1
cotton	in furrow	NC Cotton	0.27	1	June 1
stone fruits	aerial	GA Peaches	1	4	Mar 1,8,15,22
stone fruits	aerial	MI Cherries	1	4	Apr 25 May1,8,15
berries	ground spray	Or Berries	1	4	May 20, 31,14, 30
grapes	ground spray	NY Grapes	1	4	June20,30, July10,20
grapes	ground spray	CA Grapes	1	4	May 1,11, 21,31
strawberry	Aerial Spray	FL Strawberry	0.5	10	May 1,8,15,22, June11,18, 25,Jul 2,22,29
strawberry	Aerial Spray	FL Strawberry (new use)	1.0	4	May1,8,15,22
bean	Aerial Spray	MI Beans	1	2	June 1, 21
bean	Aerial Spray	OR Beans	1	2	May 5, 26
carrot	Aerial Spray	FL Carrot	1	4	Nov 20,27, Dec3,10
carrot	Aerial Spray	FL Carrot 5 lb	0.5	10	starting Oct 9 (7 day interval)
onion	Aerial Spray	GA onion	0.75	5	start Mar 1 (14 day interval)
onion	Aerial Spray	CA onion	0.75	5	start Jan 10 (14 day interval)
onion	Aerial Spray	GA onion	0.5	10	start Mar 1 (7 day interval)
onion	Aerial Spray	CA onion	0.5	10	start Feb 18 (7 day interval)
Lettuce[2]	Aerial /Ground Spray	CA lettuce	1	3	start Feb 20 (10 day interval)
potato	Aerial Spray	Me Potatoes	1	4	start on July 1 (10 day interval)
Turf (golf courses, sod farms, ornamental turf)	Ground spray	PA turf	4	6	July 1 start (14 day interval)
Turf (golf courses, sod farms, ornamental turf)	Ground spray	FL Turf	4	6	July 1 start (14 day interval)
Turf (golf courses, sod farms, ornamental turf)	Ground spray	PA turf	1.25	4	July 21 start (7 day interval)
Turf (golf courses, sod farms, ornamental turf)	Ground spray	FL Turf	1.25	4	July 1 start (7 day interval)
ornamentals	Ground spray	OR Ornamental	1.25	4	July 1 start (7 day interval)
Rice	Not applicable	Interim Rice Model	0.5	2	Not applicable

(2) Lettuce label only allows that the 1st application be aerial, and the others are ground spray. Because implementation of this mixed scheme is inconvenient with current modeling tools, two simulations were made---one with all aerial and one with all ground spray. The expected results lie somewhere between the two. As the results show, the differences are negligible.

Table 7. PRZM (v3.12beta) and EXAMS (2.98.04) input parameters for Iprodione

PARAMETER (units)	VALUE	SOURCE	COMMENT
Application Rate (kg a.i./ha)	see Table 6	Label	See Table 6
Number of Applications	see Table 6	Label	
Interval between Applications	see Table 6	Label	
Molecular weight	330.2 g/mol	Iprodione RED, 1998	—
Henry's Law Constant	2.7 x 10^{-9}atm-m^3/mol	Iprodione RED, 1998	—
Vapor Pressure (torr)	2.7 x 10^{-7} torr	Iprodione RED, 1998	—
Solubility in Water @ 20 ^oC, pH 8	13 mg/L	Iprodione RED, 1998	—
Soil Partition Coefficient K_{OC}	426 ml/g	MRID: 43349202	Mean of 4 soils
CAM (Chemical Application Method)	See Table 6		See Table 6
Depth of Incorporation	default 4 cm	Iprodione label.	
Application efficiency	Ground spray: 0.99 Aerial spray: 0.95	Input Guidance.	
Spray drift fraction	Ground spray: 0.064 Aerial spray: 0.16	Input Guidance.	
Percent Cropped Area	see Table 6	PCA guidance	National-scale values (note: this adjustment is not applied to turf or ornamental uses).see Table 6, above
Application date (day/month)	various	Labels	See Table 6, above
Hydrolysis Half-life @ pH =7	4.7 days	MRIDs: 41885401	pH 7 is the pH of the standard water bodies
Anaerobic Aquatic Metabolism Half-life (days)	stable	MRID: 43091002; 44590501	Studies provided were dominated by hydrolysis, so assumed stable
Aerobic Soil Metabolism Half-life	300 days	MRIDs: 43091002; 44590501	For iprodione, half life was estimated (deviating from Input Parameter Guidance, as guidance does not cover this situation) from 2 studies—one in which the half-life was >100 and one in which the half life was 300 days
Aqueous Photolysis Half-life @ pH 7	67 days	MRID: 41861901	3,5-DCA assumed stable
Aerobic Aquatic Metabolism Half-life	stable	MRID: 41927601; 42503801	Studies provided were dominated by hydrolysis, so assumed stable to aerobic metabolism

Table 8. Interim Rice Model input parameters for Iprodione

Input Parameter	Value	Source	Comment
Annual Application Rate	1.0 lb a.i./A	Label	Two applications (@ 0.5) allowed on label at 14 day intervals by aerial spray
Soil Organic Carbon Partitioning Coefficient (K_{OC})	426 mL/g	MRID: 43349202	Average of 4 soils

Table 9. SCI-GROW (v2.3) input parameter values for Iprodione

Input Parameter	Value	Source	Comment
Maximum Yearly Application Rate (lb a.i./A)	24	Label.	
Organic Carbon Partition Coefficient (Koc)	469 ml/g	MRID: 43349202	Median Koc
Aerobic Soil Metabolism Half-life	300 days	MRID: 43091002, 44590501	For iprodione, half life was estimated (deviating from Input Parameter Guidance, as guidance does not cover this situation) from 2 studies—one in which the half-life was >100 and one in which the half life was 300 days

[1]Parameters are selected as per Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides; Version 1, February 28, 2002, except where noted.

Results: Surface Water Concentration of Parent (Iprodione)

Model output from the surface water modeling using PRZM/EXAMS (along with an appropriate PCA factor) is given in Table 10. The highest concentrations (excluding rice use) are from uses on Florida turf, and this is due in a large extent to the high labeled application rate for turf, which is 24 lb of active ingredient per acre per year. The Florida turf use results in drinking water concentrations of **330 ppb for acute, 11 ppb for chronic and 6 ppb for cancer.** These values represent the one-in-ten-year peak concentration, the one-in-ten-year mean concentration, and the 30-year mean concentration, respectively. Acute concentrations from all the modeled crops and with PCA taken into account fall in the range of 5 to 330 ppb; chronic concentrations are in the range of 0.5 to 11 ppb; and cancer concentrations are in the range of 0.1 to 5 ppb. Tier 2 scenarios that result in particularly high peak surface water concentrations include Florida turf, Pennsylvania turf, Florida strawberries, Florida carrots, and Georgia onions.

For iprodione use on rice, the Interim Rice Model gives a concentration (acute and chronic) of **500 ppb**, which is the highest surface water concentration of any use (see Table 11). The Interim Rice Model is a Tier1estimate in which concentrations are calculated from an assumed equilibration of pesticide with hypothetical quantities of water and sediment, and without any degradation of the pesticide. This model is intended to serve only as a screen, and if concerns are raised by the output of this model, further refinements should be considered. Maximum concentrations of iprodione measured in two aquatic field dissipation studies conducted on rice in Mississippi and Texas were also around 500 ppb, where measurements were taken within the paddy. Downstream concentrations would be expected to be lower than 500 ppb due to dilution and degradation

Table 10. Ranges of Iprodione Tier II Estimated Drinking Water Concentrations (including PCA adjustment) for surface water.

Use	Application method	Scenario	Application Rate [lb. a.i./A]	Number of applications	PCA	Peak[(1)] (ppb)	Chronic (ppb)	Cancer (ppb)
almond	ground spray	CA Almond	1.0	4	0.87	30.5	0.9	0.5
almond	aerial spray	CA Almond	1.0	4	0.87	33.1	1.1	0.7
canola	ground spray	ND Canola	0.45	1	0.87	8.7	0.2	0.1
canola	aerial	ND Canola	0.45	1	0.87	8.7	0.2	0.1
cotton	in furrow	CA Cotton	0.27	1	0.20	5.5	0.1	0.1
cotton	in furrow	MS Cotton	0.27	1	0.20	9.6	0.4	0.2
cotton	in furrow	NC Cotton	0.27	1	0.20	6.7	0.2	0.1
peaches	aerial	GA Peaches	1	4	0.87	21.8	0.7	0.5
cherries	aerial	MI Cherries	1	4	0.87	33.1	1.2	0.8
berries	ground spray	Or Berries	1	4	0.87	10.4	0.5	0.3
grapes	ground spray	NY Grapes	1	4	0.87	39.2	1.5	1.0
grapes	ground spray	CA Grapes	1	4	0.87	14.8	0.6	0.3
strawberry	Aerial Spray	FL Strawberry	0.5	10	0.87	109	4.2	3.3
strawberry	Aerial Spray	FL Strawberry	1.0	4	0.87	201	4.5	2.7
bean	Aerial Spray	MI Beans	1	2	0.87	27.8	1.4	1.0
bean	Aerial Spray	OR Beans	1	2	0.87	20.9	1.3	0.9
carrot	Aerial Spray	FL Carrot	1	4	0.87	86.1	3.0	1.7
Carrot	Aerial Spray	FL Carrot	0.5	10	0.87	109	5.0	2.6
Onion	Aerial Spray	GA onion	0.75	5	0.87	74.0	2.7	2.0
Onion	Aerial Spray	CA onion	0.75	5	0.87	20.0	0.9	0.6
Onion	Aerial Spray	GA onion	0.5	10	0.87	89.6	3.5	2.6
Onion	Aerial Spray	CA onion	0.5	10	0.87	35.7	1.5	0.9
lettuce	Aerial /Ground Spray	CA lettuce	1	3	0.87	65/66[(2)]	2.1/2.0[(2)]	1.2/1.1[(2)]
potato	Aerial Spray	Me Potatoes	1	4	0.87	50.5	2.3	1.7
Turf	Ground spray	PA turf	4	6	1.0	240	8.8	4.6
Turf	Ground spray	FL Turf	4	6	1.0	334	11.0	6.0
Turf	Ground spray	PA turf	1.25	4	1.0	66	1.8	0.9
Turf	Ground spray	FL Turf	1.25	4	1..0	63	1.6	1.0
ornamentals	Ground spray	OR Ornamental	1.25	4	0.87	18.3	0.6	0.4

(1) denotes variability due to application date changes over 7 day period

(2) Lettuce label only allows that the 1st application be aerial, and the others are ground spray. Because implementation of this mixed scheme is inconvenient with current modeling tools, two simulations were made—one with all aerial and one with all ground spray. The expected results lie somewhere between the two. As the results show, the differences are negligible.

Results: Groundwater Concentration of Parent (Iprodione)

SCI-GROW was used to estimate the ground water concentration resulting from the use of iprodione. SCI-GROW is based on the fate properties of the pesticide (i.e., the median K_{oc} and mean aerobic soil metabolism half-life), the application rate, and the concentration data from 13 small-scale ground water monitoring studies. The concentration for parent iprodione estimated using SCI-GROW is approximately 0.65 ppb/lb of iprodione. Thus for the highest application rates such as those on turf (24 lb/acre), groundwater concentration would be **15.6 ppb** (see Table 11).

Table 11. Ground Water Estimated Drinking Water Concentrations (EDWC) of Iprodione.

Use	Iprodione App. Rate (lbs ai/A)	Peak & Chronic EEC (ppb)
turf	24	15.6
Generic 1 lb/acre	1	0.65

Drinking Water Estimates for the degradate 3,5-DCA

Methods for Determining Parent (Iprodione) Concentrations

All processes that describe iprodione degradation that the registrant has submitted show that every pathway forms 3,5-DCA. Therefore, it is reasonable to assume that 3,5-DCA can be simulated with the same scenarios as iprodione and with the same molar application rate as iprodione. Six scenarios were chosen for 3,5-DCA simulations by selecting scenarios that gave the highest parent concentration from Table 10 (*i.e.*, FL turf, PA turf, FL strawberry, CA lettuce, GA onion, and FL carrot). For groundwater, the ppb-per-pound-applied concept was used as previously described for the parent above. Application rates for these scenarios are the same as the equivalent iprodione applications except that they were adjusted by the molecular weight ratio (162/330). Chemical input parameters are summarized in Tables 12 for surface water, Table 13 for rice, and Table 14 for ground water.

As supported by registrant-submitted information, the fundamental assumption here is that all iprodione degrades to 3,5-DCA at one time or another. However, it is not known when the formation of 3,5-DCA will occur with respect to the time of application of iprodione to a field. It is not likely (as supported by registrant studies) that this transformation would occur rapidly. Rapid formation of 3,5-DCA from iprodione promotes high acute estimates because of the greater availability of DCA at one time; whereas slower formation would dampen peak 3,5-DCA formation, but have less impact on long-term average concentration. Thus, acute estimates derived in this manner are likely conservative. Importantly, conservative assumptions were made during the calculations of both 3,5-DCA and its parent iprodione, which would be contradictory if both assumptions occurred. For example, in the calculation of 3,5-DCA, it was assumed that rapid transformation of iprodione to 3,5-DCA occurred; whereas in the calculation for iprodione, it was assumed that iprodione degraded slowly. Clearly both cases cannot occur, but it is uncertain which case is the actual case. Thus both cases are presented in this assessment with the understanding that the concentrations derived for 3,5-DCA and iprodione are not intended to represent concurrent exposure concentrations.

Table 12. PRZM (v3.12 beta) and EXAMS (2.98.04) input parameters for 3,5-DCA

PARAMETER (units)	VALUE	SOURCE	COMMENT
Application Rate (kg a.i./ha)	various		See Table 6, above; two scenarios selected for modeling 3,5-DCA to represent a range of hydrologic characteristic
Number of Applications	various		
Interval between Applications	various		
Molecular weight	160 g/mol	Iprodione RED, 1998	-
Henry's Law Constant	10^{-6} atm-m^3/mol	EPI Suite	-
Vapor Pressure (torr)	2.7 x 10^{-9}	EPI Suite	-
Solubility in Water @ 20 ^{o}C, pH= 8	784 mg/L	EPI Suite	-
Soil Organic Carbon Partition Coefficient (K_{oc})	664 ml/g	MRID: 43349202	Mean value
CAM (Chemical Application Method)	various	label	See Table 6, above
Depth of Incorporation	default 4 cm	Iprodione label.	Default PRZM value
Application efficiency	Ground spray: 0.99 Aerial spray: 0.95	Input Guidance.	
Spray drift fraction	Ground spray: 0.064 Aerial spray: 0.16	Input Guidance.	
Percent Cropped Area	see Table 6	PCA guidance	See Table 6
Application date	various	Labels	See Table 6
Hydrolysis Half-life	Assumed Stable	No data	3,5-DCA assumed stable
Aqueous Photolysis Half-life @ pH 7	Assumed Stable	No data	3,5-DCA assumed stable
Aerobic Aquatic Metabolism Half-life	Assumed Stable	No data	3,5-DCA assumed stable
Anaerobic Aquatic Metabolism Half-life	Assumed Stable	No data	3,5-DCA assumed stable
Aerobic Soil Metabolism Half-life	Stable	MRID: 45239201	Large amounts of unextracted material were present in study

[1] Parameters are selected as per Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides; Version I, February 28, 2002, except as noted..

[2] 3,5,DCA application rate = iprodione application rate adjusted by molecular weight ratio (162/330 = 0.49)

Table 13. Interim Rice Model input parameters for 3.5-DCA

Input Parameter	Value	Source	Comment
Annual Application Rate	0.49 lb iprodione./A	Label	3,5,DCA application rate = iprodione application rate adjusted by molecular weight ratio (162/330 = 0.49)
Soil Organic Carbon Partitioning Coefficient (K_{oc})	662 ml/g	MRID: 43349202	Average of 4 soils

Table 14. SCI-GROW (v2.3) input parameter values for 3,5-DCA.

Input Parameter	Value	Source	Comment
Maximum Application Rate (lb a.i./A)	Turf: 2.94	Label	3,5,DCA application rate = iprodione application rate adjusted by molecular weight ratio (162/330 = 0.49)
Number of Applications per Year	Turf: 4	Label	These represent highest and lowest annual applications (see Table 6, above)
Organic Carbon Partition Coefficient (K_{oc})	626 ml/g	MRID: 45114101	Median Koc
Aerobic Soil Metabolism Half-life	stable	MRID: 45239201	

Results: Surface Water Concentration of Degradate 3,5-DCA

Results for surface water concentrations of 3,5-DCA are given in Table 15 for rice and the six PRZM/EXAMS surface water simulations. As with the parent, the highest concentrations (excluding rice) resulted from the Florida turf scenario with acute concentration of 322 ppb a chronic concentration of 174 ppb and a cancer concentration of 133 ppb For ground water (see Table 16), SCIGROW results give 0.53 ppb of 3,5-DCA for every pound of iprodione applied; therefore a 24 pound application would give 13 ppb.

Table 15. Summary of surface water simulations resulting in high 3,5-DCA concentrations (PCA factor included).

Scenario	PCA	Acute (ppb)	Chronic (ppb)	Cancer (ppb)
Rice (Tier 1)	--	200	200	200
FL Turf	1.0	322	174	133
PA Turf	1.0	308	231	161
FL strawberries	0.87	130	35	28
CA lettuce	0.87	80	57	43
GA Onion	0.87	79	26	19
FL Carrot (5 lb)	0.87	77	22	15

Table 16. Ground Water Estimated Drinking Water Concentrations (EDWC) of I3,5-DCA

Use	Application Rate of the parent (iprodione)	Peak & Chronic Concentrations of 3,5-DCA
turf	24 lbs ai/A	13 ppb
Generic 1 lb/acre	1 lbs ai/A	0.53 ppb

Drinking Water Treatment Effects

No specific information on the effects of drinking water treatment are available for iprodione or its degradate 3,5-DCA

Uncertainties and Data Gaps

Prominent uncertainties include the characterization and quantification of the degradation of iprodione and 3,5-DCA.. Uncertainties also are associated with the formation of 3,5-DCA. Degradation quantification was confounded by large amounts of unextracted material that was reported in the degradation studies conducted with soil for both iprodione and 3,5-DCA. The amount of unextracted and uncharacterized material hindered accurate estimation of degradation rates, but did tend to suggest that iprodione and 3,5-DCA do degrade very slowly in the presence of soil. Another uncertainty is the formation rate 3,5-DCA. Although proposed pathways for degradation (included with submitted studies), suggest that 3,5-DCA is formed during nearly all degradation processes, it was not frequently observed in high amounts except in the soil photolysis study. Yet in the soil photolysis study, photolysis did not appear to be the cause of 3,5-DCA formation since nearly equivalent amounts were observed in the dark controls; therefore the mechanism for 3,5-DCA formation in the study that produced the most 3,5-DCA is not clear. These uncertainties have led to the conservative exposure assessment described here.

There is also uncertainty associated with general model representativeness as well as in the selection of input parameters. In this regard, one of the potentially important parameters that can impact concentration estimates is the selection of appropriate application dates. Although the pesticide application dates were selected to be most appropriate according to the model user's best judgment and with considerations for label restrictions and simulated cropping dates, variability nevertheless results because the application window (the time span during a season that a pesticide may likely be applied) for a pesticide may be wide and the actual application dates are unknown. Some of this variability has been captured and is presented in Appendix 2. Such variability is caused by the temporal proximity of a pesticide application to rain events. As with all model estimates, the values presented here should not be viewed as precise estimates.

References

EFED (2002). Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides; Version I, February 28, 2002.

USEPA (2006). Standardized Soil Mobility Classification Guidance. U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs, Environmental Fate and Effects Division, Memorandum, April 21, 2006.

Appendix 1

Table A1-1 Summary of Labeled Uses for Iprodione

Crop	Label	Application timing	Application rate [lb ai/ app]	Number of applications (interval)	Application Method
Almond	Rorval Fungicide 264-453	1st at pink bud 2nd full bloom 3rd petal fall 4th up to 5 weeks after petal fall	0.5 to 1 lb (1)	4 applications	Foliar ground spray
Almond	Rorval 4 Fungicide 264-482	1st at pink bud 2nd full bloom 3rd petal fall 4th up to 5 weeks after petal fal	0.5 to 1 lb (1)	4 applications	Aerial and Foliar ground spray
Canola	Rorval Fungicide 264-453	20 – 30 % bloom (~60 days after planting) 45 day PHI	0.45 lb	1 application	Foliar ground spray
Canola	Rorval 4 Fungicide 264-482	20 – 30 % bloom (~60 days after planting) 45 day PHI	0.45 lb	1 application	Aerial (also ground spray)
Canola Seed Treatment	Foundation Lite 264-XXX	Not applicable	0.02 lb/acre (assuming 10 lb seed per acre)	---	Seed treatment
Cotton	Rorval 4 Fungicide 264-482	At planting	0.20 to 0.27 lb/acre(2)	1 application	In-furrow spray
Peanuts	Rorval 4 Fungicide 264-482	when needed PHI = 10	1 lb(3)	3 applications (14-21 days)	Ground spray
Pistachio (New use)	Rorval 4 Fungicide 264-482	14 day PHI	0.5 to 1 lb (2 lb max/season)	4 applications (30 days)	Aerial or Ground Spray
Stone Fruit (Peaches, Apricots, Cherries, prunes, plums)	Rorval 4 Fungicide 264-482	When bud present, Not after petal fall 7 day PHI	0.5 to 1 lb (1)	4 applications (7 -14 days)	Aerial or Ground Spray
Ginseng	Rorval 4 Fungicide 264-482	When needed 36 dat phi	0.75 to 1 lb	5 applications (14 days)	Foliar spray
Berries	Rorval 4 Fungicide 264-482	Early bloom Full bloom + 2 others at 14 day interval, 0 PHI	0.5 to 1 lb	4 applications	Foliar ground spray

Grapes	Rorval 4 Fungicide 264-482	1st early to mid bloom 2nd prior to bunch closing 3rd start of fruit opening 4th up to 7 days prior harvest	0.5 to 1 lb	4 applications	Foliar spray and chemigation (except NY)
Strawberries (tank mix)	Rorval 4 Fungicide 264-482	Non specific, but no later than 10% bloom.	0.5 lb	10 applications (7-14 days)	Aerial and ground
Strawberries (foliar spray)	Rorval 4 Fungicide 264-482	Non specific, but no later than 10% bloom. 0 PHI	0.75 to 1 lb	4 applications Additional sprays on 10 – 14 day interval up to day of harvest	Aerial and ground
Beans	Rorval 4 Fungicide 264-482	1st bloom 2nd peak bloom	0.75 to 1 lb	2 applications	Aerial and ground
Broccoli	Rorval 4 Fungicide 264-482	Immediately after thinning	1 lb	2 applications 0 PHI	Ground spray
Carrots	Rorval 4 Fungicide 264-482	Non specific	0.5 to 1 lb	4 applications (7-14 days) 0 PHI	Aerial and ground
Carrots	Rorval 4 Fungicide 264-482	Non specific	0.5 lb	10 applications (7-10 days) 0 PHI	Aerial and ground
Chinese Mustard (only FL)	Rorval 4 Fungicide 264-482	Non specific	0.5 lb	4 applications (10-14 days) 10 day PHI	Foliar spray
Dry Bulb Onion	Rorval 4 Fungicide 264-482	Non specific	0.75 lb	5 applications (14 days) 7 day PHI	Aerial and ground spray, chemigation
Dry Bulb Onion (tank mix)	Rorval 4 Fungicide 264-482	Non specific	0.5 lb	10 applications (7-10 days) 7 day PHI	Aerial and ground spray, chemigation
Lettuce	Rorval 4 Fungicide 264-482	1st at 3 leaf stage	0.75 to 1 lb	3 applications (10 days) 14 PHI	Aerial and ground spray, chemigation (aerial allowed only on 1st application)
Potatoes	Rorval 4 Fungicide 264-482	Non specific	0.5 to 1 lb	4 applications (10-14 days) 14 PHI	Aerial and ground spray, chemigation
Garlic	Rorval 4 Fungicide 264-482	At planting	2 lb,	1 application	In furrow

Rice (Not in CA)	Rorval 4 Fungicide 264-482	1st joint movement to booting 2nd not after 75% heading	0.5 lb	2 applications (14 days)	aerial
Turf	Chipco Brand 26019 Fungicide 432-891 432-889 Super GT 432-1408	Non specific	17.6 oz product per 1000 ft^2/year (equivalent to 24 lb ai /acre/year)	6 applications	
Turf (foliar drench)	Chipco Brand 26019 Fungicide 432-891 432-889 Super GT 432-1408 26/36 Fungicide 432-RURU	Non specific	1.25 lb/acre ai	4 applications (7-14 days)	
Ornamental	Super GT 432-1408	Non specific	0.5 to 1.25 lb	4 applications (7 to 14 days)	Foliar spray

(1) Assuming that rate on label refers to product and not the ai, ai = 0.5 x product
(2) Actual rate depends on row spacing
(3) Label appears to be inconsistent, max is either 3 lb or 2.5 lb.

Appendix 2

Table A2-1 gives the raw data from PRZM/EXAMS output (PCA not included) as summarized from the "*.out" output files. Also shown is the effect of application date on the peak concentrations. Application date has a smaller affect on the chronic and cancer values and thus these were not recorded. Raw data is recorded here to assist with possible refinements if required in the future. Table A2-1 gives the raw data for 3,5-DCA.

Table A2-1. Raw PRZM/EXAM output (PCA not included) and range of peaks generated by changing application date.

Scenario	1-in-10 yearly highest yearly (ppb)	Range of Peak (ppb)	1-in-10 yearly average (ppb)	30 year average (ppb)
CA Almond	35	27–42	1.0	0.54
CA Almond	38	30–43	1.3	0.83
ND Canola	10	8–12	0.24	0.11
ND Canola	10	7.7–11	0.27	0.13
CA Cotton	6.3	Not performed	0.15	0.08
MS Cotton	11.	Not performed	0.49	0.19
NC Cotton	7.7	Not performed	0.26	0.17
GA Peaches	25	20-36	0.81	0.63
MI Cherries	38	34-49	1.4	0.9
Or Berries	12	12-13	0.62	0.38
NY Grapes	45	38-60	1.7	1.1
CA Grapes	17	17-20	0.72	0.40
FL Strawberry	125	84-183	4.8	3.8
FL Strawberry	231	Not performed	5.2	3.1
MI Beans	32	27-40	1.6	1.1
OR Beans	24	21-36	1.5	1.0
FL Carrot	99	88-138	3.4	2
FL Carrot	125	123-227	5.7	3.0
GA onion	85	51-100	3.1	2.3
CA onion	23	19-46	1	0.7
GA onion	103	73-111	4	3
CA onion	41	27 – 58	1.7	1
CA lettuce	75/76[(2)]	45-89	2.4/2.3[(2)]	1.4/1.3[(2)]
Me Potatoes	58	42-95	2.6	2
PA turf	240	200 -250	8.8	4.6
FL Turf	334	186-380	11	6
PA turf	66	52-81	1.8	0.9
FL Turf	63	56-106	1.6	1
OR Ornamental	21	8-26	0.73	0.41

[2] approximated, see description in text of document

Table A2-2 Raw data for 3,5-DCA

Scenario	Peak (ppb)	1-in-10 yearly average (ppb)	30 year average (ppb)
Florida Turf	322	175	134
PA Turf	308	231	161
FL strawberry	149	40	32
CA Lettuce	92	64	50
GA Onion	89.5	30	22
FL Carrot	87	25	17