**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

June 30, 2020

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**MEMORANDUM**

**SUBJECT:** **Iprodione:** Draft Ecological Risk Assessment for Registration Review

**FROM:** Susan Thomas, Biologist
Joshua Antoline, Ph.D., Chemist
Environmental Risk Branch IV
Environmental Fate and Effects Division (7507P)

SUSAN THOMAS Digitally signed by SUSAN THOMAS Date: 2020.06.30 19:49:33 -04'00'

JOSHUA ANTOLINE Digitally signed by JOSHUA ANTOLINE Date: 2020.06.30 19:40:13 -04'00'

**THRU:** Katrina White, Ph.D., Senior Fate Scientist
Thomas Steeger, Ph.D., Senior Science Advisor
Ideliz Negrón-Encarnación, Ph.D., Risk Assessment Process Leader
Jean Holmes, DVM, Branch Chief
Environmental Risk Branch IV
Environmental Fate and Effects Division (7507P)

White, Katrina Digitally signed by White, Katrina Date: 2020.06.30 20:07:13 -04'00'

THOMAS STEEGER Digitally signed by THOMAS STEEGER Date: 2020.06.30 20:26:08 -04'00'

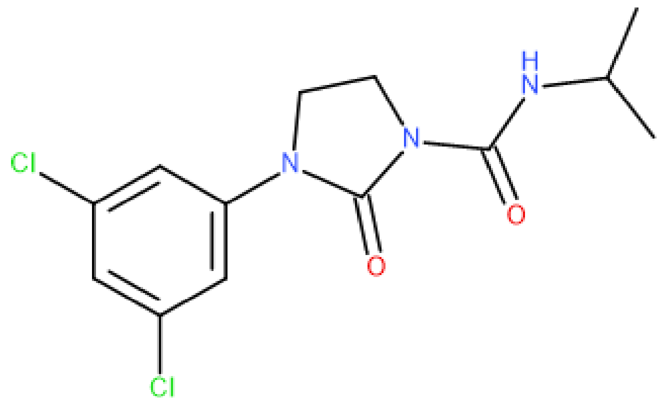
Digitally signed by Ideliz Negrón-Encarnación Date: 2020.06.30 20:13:13 -04'00'

Jean Holmes 2020.06.30 20:38:18 -04'00'

**TO:** Rachel Fletcher, Chemical Review Manager
Jill Bloom, Team Leader
Cathryn Britton, Branch Chief
Risk Management and Implementation Branch V
Pesticide Re-evaluation Division (7508P)

The Environmental Fate and Effects Division (EFED) has completed the draft environmental fate and ecological risk assessment in support of the Registration Review of the fungicide iprodione (3-(3,5-dichlorophenyl)-N-(1-methylethyl)-2,4-dioxo-1-imidazolidinecarboxamide), CAS No. 36734-19-7, PC Code 109801). The draft risk assessment (DRA) is attached.

# Draft Ecological Risk Assessment for the Registration Review of Iprodione




3-(3,5-dichlorophenyl)-N-(1-methylethyl)-2,4-dioxo-1-imidazolidinecarboxamide
Iprodione; CAS No 36734-19-7
USEPA PC Code: 109801

**Prepared by:**
Susan Thomas, Biologist
Joshua Antoline, Ph.D., Chemist

**Reviewed by:**
Katrina White, Ph.D., Senior Fate Scientist
Thomas Steeger, Ph.D., Senior Science Advisor

**Approved by:**
Jean Holmes, DVM, Branch Chief
Environmental Risk Branch IV
Environmental Fate and Effects Division
Office of Pesticide Programs
United States Environmental Protection Agency

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# 1 Executive Summary

## 1.1 Overview

This Draft Risk Assessment (DRA) examines the potential ecological risk associated with labeled uses of the fungicide iprodione (CAS No. 36734-19-7) on non-listed, non-target organisms in support of the Registration Review. Iprodione is a contact and/or locally systemic dicarboximide fungicide, intended to inhibit germination of fungal spores and the growth of mycelia. Iprodione is currently registered for use on a variety of field, fruit, and vegetable crops; and on turf (sod farms, golf courses, and ornamental turf uses). It is also registered for use as a nematicide on peanuts. Iprodione can be applied by chemigation, aircraft, and foliar ground spray, root/bulb dip, or as a seed treatment, depending on the target crop.

Taxa considered in this assessment include aquatic and terrestrial plants and animals. The Residues of Concern (ROC) for ecological risk assessment (aquatic taxa only) include parent iprodione and the degradates 3-(1-methylethyl)-N-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide (RP30228) and 3,5-dichloroaniline (3,5-DCA). Iprodione plus RP30228 (collectively referred to as iprodione SSD (structurally similar degradate) were assessed separately from 3,5-DCA since 3,5-DCA has a different mode of action than iprodione and RP30228.

## 1.2 Risk Conclusions Summary

**Table 1-1** summarizes potential risks associated with iprodione uses at maximum application rates. There are acute and chronic risk level of concern (LOC) exceedances for mammals and birds, acute risk LOC exceedances for freshwater invertebrates and chronic risk LOC exceedances for aquatic vertebrates and invertebrates. Since birds serve as surrogates for reptiles and terrestrial-phase amphibians, risk estimates for birds extend to these taxa as well. Since freshwater fish serve as surrogates for aquatic-phase amphibians, risk estimates for freshwater fish extend to this taxon as well. Additionally, there are chronic risks to larval bees.

Surface water monitoring data from grab samples had measured concentrations up to 141 µg/L, within the range of Estimated Environmental Concentrations (EECs) and, suggest that modeled EECs are environmentally relevant.

Risk quotients could not be calculated for terrestrial plants or for acute exposure to bees (larval and adult) due to non-definitive endpoints.  Based on the available terrestrial plant toxicity data, the likelihood of adverse effects on terrestrial plants from exposure to iprodione from registered uses is expected to be low. However, there are 16 incidents involving terrestrial plants; therefore, there is some uncertainty with this conclusion.

With respect to chronic risks to birds, even if the foliar dissipation half-life value is assumed to be 1 day (a value not supported by empirical data) rather than the default value of 35 days, risk estimates would still exceed the chronic risk LOC.

Based on both empirical bioconcentration data and modeled estimates of bioconcentration using the octanol-water partition coefficient ($K_{ow}$-based) Aquatic BioAccumulation Model (KABAM; v. 1.0), the likelihood is low that iprodione will bioaccumulate in aquatic organisms that serve as prey for birds and mammals in amounts that would result in an exceedance of the chronic risk LOC.

### 1.3 Environmental Fate and Exposure Summary

Iprodione can reach off-target waterbodies directly via spray drift, runoff, or movement of sorbed material (erosion). Iprodione is non-persistent on soil (Goring *et al.*, 1975) and degrades into RP30228 (maximum of 89.4% of the applied) and 3,5-DCA (maximum of 29.8 of the applied) in soil and aquatic environments. These degradates tend to be more persistent than the parent compound and can reach waterbodies via formation on soil followed by runoff/erosion or via degradation of iprodione in water. Iprodione is classified as moderately mobile in soil, while RP30228 is slightly to hardly mobile and is therefore more likely to move via erosion (as opposed to run-off) and to partition to sediment than the parent compound. 3,5-DCA is relatively mobile compared to iprodione

Iprodione degrades via hydrolysis (half-life of 4.2 days at pH 7, 25 °C), aerobic soil metabolism ($DT_{50}$ values[1] of 7.96 to 103 days), and aerobic aquatic metabolism ($DT_{50}$ values of 2.74 to 9 days). Iprodione hydrolysis rates are pH dependent, with hydrolysis $t_{½}$ of >1 year at pH 5, 4.2 days at pH 7, and <1 hour at pH 9. The degradate RP30228 is stable to aqueous hydrolysis but degrades in aerobic and anaerobic metabolism studies. Iprodione SSD degrades via aerobic aquatic metabolism ($DT_{50}$ values of 263 to 2,098 days), and aerobic soil metabolism ($DT_{50}$ values of 19 to 119 days). Aerobic soil and aerobic aquatic half-lives for 3,5-DCA range from 7.9 to 103 and from 12.3 to 26.1 days, respectively.

In terrestrial field dissipation studies, the $DT_{50}$ of iprodione and iprodione SSD ranged from <1 to 6.4 days and 3.13 to 43 days, respectively, but the $DT_{90}$ values of iprodione SSD were greater than 600 days, indicating rapid conversion of iprodione to RP30228 which in turn degrades slowly; this is consistent with the behavior of iprodione in lab studies. Iprodione residues were detected at up to a depth of 60 cm in the field dissipation studies indicating that leaching is a potential mode of dissipation for iprodione. The terrestrial field dissipation studies did not monitor for 3,5-DCA

Aquatic field dissipation studies showed that iprodione dissipated from the water layer (surface water $DT_{50}$ values ranging from 2.9 to 3.7 days) but persisted in the sediment layer for several

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[1] $DT_x$ = time to X% dissipation of the compound

months (sediment $DT_{50}$ values of 3.4 to 4.1 months), which is inconsistent with the measured laboratory anaerobic degradation $DT_{50}$ values of 5.38 to 7.27 days. While the aquatic field dissipation study intended to analyze for 3,5-DCA, but recoveries of 3,5-DCA from field spiked samples averaged 13.8%, suggesting extensive degradation during storage.

Surface water EECs were calculated for iprodione, iprodione SSD, and 3,5-DCA with the Pesticide in Water Calculator (PWC version 1.52). The Total Residues method was used to model the iprodione SSD. The EECs range from 1.33 to 963 µg/L for iprodione SSD and from 0.25 to 81.8 µg/L for 3,5-DCA. Iprodione SSD EECs are approximately 5x to 10x higher than the parent only EEC. The Total Residues method may overestimate the EECs because the persistent degradate RP30228 is less mobile than the parent compound and the parent sorption coefficient was used in modeling total residues. The maximum EECs were associated with the applications to turf and ornamentals. The EECs for turf and 3-crop cycle lettuce-broccoli-lettuce rotation were further refined using Formation-Decline modeling. Additionally, the EECs for a 1-crop cycle average application to lettuce was further refined using Formation-Decline modeling. The EECs calculated with the Total Residues method were 4x to 6x larger than the EECs calculated using Formation-Decline, the latter of which is considered to be more refined.

Iprodione has been detected in surface and groundwater monitoring samples at concentrations up to 141 µg/L and 0.098 µg/L, respectively. These values do not include the degradates and likely do not capture the peak surface water concentrations but do indicate that iprodione modeled EECs are environmentally relevant.

### 1.4 Ecological Effects Summary

Based on the available data, iprodione is classified as moderately toxic to freshwater fish and to estuarine/marine fish and invertebrates, and highly toxic to freshwater invertebrates, on an acute exposure basis. Iprodione is slightly toxic to birds and mammals on an acute oral exposure basis, and slightly toxic to birds on a sub-acute dietary exposure basis.

Chronic exposure of freshwater fish to iprodione in a 34-d early life stage test led to a 10% reduction in larval survival at the Lowest Observed Adverse Effect Concentration (LOAEC) of 550 µg a.i./L, resulting in a No Observed Adverse Effect Concentration (NOAEC) of 260 µg a.i./L. A 30-week full life cycle test was also conducted with freshwater fish and resulted in a NOAEC of 84.9 µg a.i./L, the highest concentration tested, at which there were no observed adverse effects. The calculated EECs are higher than the highest level tested.

Chronic exposure of freshwater invertebrates to iprodione led to a 11% reduction in the number of offspring per adult, and a 17% reduction in average dry weight at the LOAEC of 557 µg a.i./L, resulting in a NOAEC of 288 µg a.i./L. No adverse effects were observed from chronic exposure of estuarine/marine vertebrates to iprodione up to the highest concentration tested, resulting in a NOAEC of 57 µg a.i./L.

Chronic exposure of marine/estuarine invertebrates to iprodione resulted in a 14% reduction in the number of young per female at the LOAEC of 62 µg resulting in a NOAEC of 30 µg a.i./L.

A 21-d life cycle toxicity test with freshwater invertebrates exposed to 3,5-DCA (the only taxa for which there are empirical data with 3,5-DCA) showed a 15% reduction in the number of offspring per adult per reproductive day and a 25% reduction in dry weight at the LOAEC of 46 µg a.i./L when compared to the negative control, resulting in a NOAEC of 22 µg a.i./L. Compared to a NOAEC of 288 µg a.i./L for iprodione, freshwater invertebrates are an order of magnitude more sensitive to 3,5-DCA.

There are no toxicity data available on benthic invertebrates exposed to iprodione or 3,5-DCA.

Exposure of non-vascular aquatic plants to iprodione resulted in reduced yield (11-26%), biomass (10-27%), and/or growth rate (2-8%), yielding $IC_{50}$ values ranging from 330-5,548 µg a.i./L. With an $IC_{50}$ value of >12,640 µg a.i./L (no observed effects up to the highest tested concentration), vascular aquatic plants are less sensitive to iprodione than non-vascular aquatic plants.

Chronic exposure of birds to iprodione led to a 24% reduction in weight gain and 27% reduction in the number of hatchlings per eggs set at the LOAEC of 1,000 mg a.i./kg-diet, resulting in a NOAEC of 300 mg a.i./kg-diet.

The endpoint for mammals is based on a rat 2-generation reproduction study. A 6% decrease in parental body weight gain was measured as well as an 8% reduction in food consumption at the LOAEC of 1,000 mg a.i./kg-diet, resulting in a NOAEC of 300 mg a.i./kg-diet.

Acute contact and oral exposure studies of iprodione with adult bees resulted in no adverse effects up to 100 µg a.i./bee (the highest concentration tested); therefore, iprodione is classified as practically non-toxic to adult bees on both an acute contact and acute oral exposure basis. In the available chronic toxicity test with larval bees, exposure to iprodione led to a 67 – 100% reduction in adult emergence at treatment groups ≥ 10.5 µg a.i./larva/day), resulting in a NOAEL of 7.5 µg a.i./larva/day. There are no chronic toxicity data available for adult bees and no acute toxicity data available for larval worker bees.

There were no adverse effects detected for any tested monocotyledonous (monocot) or dicotyledonous (dicot) terrestrial plant species from iprodione exposure in either seedling emergence or vegetative vigor tests, resulting in an $IC_{25}$ ≥7.62 lbs a.i./A for both tests.

### 1.5 Identification of Data Need

- OECD 237 Acute larval Honey Bee (*Apis mellifera*). No data submitted. Unable to calculate an 8-day $LD_{50}$ from the 21-day chronic toxicity test to be used as a surrogate.
- OECD 245 Chronic adult Honey Bee (*Apis mellifera*). No data submitted. Chronic adult honey bee toxicity data would help to quantify and further refine the risk of chronic effects to

honey bees. Pending the results of the Tier I bee data, Tier II colony-level data might also be warranted.

- 600/R-99/064 Chronic Freshwater Invertebrate (sediment exposure) – two species (*i.e.*, *Chironomus dilutus*, *Hyalella azteca*); 600/R-01/020 Chronic Estuarine/Marine Invertebrate (sediment exposure) – *Leptocheirus plumulosus*. The degradate RP30228 is persistent in aquatic environments and is likely to be found in benthic environments. No benthic toxicity data are available to evaluate potential risk to sediment-dwelling organisms. Available data for the water-column toxicity data suggest that adverse effects to sediment-dwelling organisms may occur. Benthic toxicity data could be used to refine the assessment.

**Table 1-1. Summary of Risk Quotients (RQ) for Taxonomic Groups from Current Uses of Iprodione.**

| Taxa | Exposure Duration | Risk Quotient (RQ) Range[1] | RQ Exceeding the LOC | Additional Information/ Lines of Evidence |
|---|---|---|---|---|
| Freshwater Fish | Acute | <0.01-0.04 | No | -- |
| | Chronic | ≤0.73 | No, see additional information | After refinement with Formation-Decline, there were no chronic risk LOC exceedances, but there are still some uncertainties with regard to the full life cycle study. The full life cycle study did not test high enough, as the EECs are higher than the highest tested concentration. Also, the early life stage study, which the RQ is based on, would not capture the potential reproductive effects for this compound. |
| Estuarine/ Marine Fish | Acute | Not calculated | N/A | There was 30% mortality observed in the highest tested concentration; therefore, an $LC_{50}$ could not be calculated. EECs are lower than the highest level tested where 30% mortality occurred. |
| | Chronic | ≤3.8 | Yes, see additional information | Risk exceeded LOC for use on turf and lettuce (3CC) but does not exceed the LOC for use on lettuce (1CC) at average application rate using Formation-Decline EECs. There were no adverse effects observed from chronic exposure of estuarine/marine vertebrates to iprodione; however, there is uncertainty because the fish were not exposed at a high enough concentration to observe effects and to cover the predicted exposure.. |
| Freshwater Invertebrates (Water-Column Exposure) | Acute | ≤1.1 | Yes | RQ exceeds LOCs for turf and lettuce (3CC) based on Formation-Decline modeling. Risk does not exceed the LOC for use on lettuce (1CC) at average application rates using Formation-Decline modeling. |
| | Chronic | ≤0.75 (Iprodione SSD)<br>≤1.1 (3,5-DCA) | Yes | Iprodione SSD: No LOC exceedances with Formation-Decline modeling.<br>3,5-DCA: Risk exceeding LOCs for use on ornamentals only assuming 30% iprodione may be converted to 3,5-DCA. |
| Freshwater Invertebrates (Sediment Exposure) | Acute | No data | No data | Sorption coefficients for RP30228 trigger the need for a sediment exposure assessment. |
| | Chronic | No data | No data | |

| Taxa | Exposure Duration | Risk Quotient (RQ) Range[1] | RQ Exceeding the LOC | Additional Information/ Lines of Evidence |
|---|---|---|---|---|
| Estuarine/ Marine Invertebrates (Water-Column Exposure) | Acute | <0.01-0.11 | No | Refinement using Formation-Decline modeling show chronic LOC exceedances for use on turf and lettuce (1CC and 3CC). Based on a study with 29% reduction in reproduction at the LOAEC. |
| | Chronic | ≤29 | Yes | |
| Estuarine/ Marine Invertebrates (Sediment Exposure) | Acute | No data | No data | Sorption coefficients for RP30228 trigger the need for a sediment exposure assessment. Additionally, water column data for iprodione indicates potential chronic risk to sediment dwelling benthic invertebrates. |
| | Chronic | No data | No data | |
| Mammals | Acute | T-Rex: <0.01-1.4<br>KABAM: <0.01 | Yes | Risk exceeding LOC's for uses on potato, turf and ornamentals. |
| | Chronic | T-Rex: 0.08-106<br>KABAM: <0.60 | Yes | Risk exceeding LOC's for all uses. Based on a study with 6-7% reduction in body weight and 8% reduction in food consumption. |
| Birds | Acute | T-Rex: <0.01-6.2<br>KABAM: 0.01 | Yes | Risk exceeding LOC's for all uses. |
| | Chronic | T-Rex: 0.05-12<br>KABAM: <0.07 | Yes | Risk exceeding LOC's for all uses. Based on a study with 24% reduction in weight gain and 27% reduction in the number of hatchlings per eggs set. Refinements (using LOAEC instead of NOAEC) reduce the RQs by 70% but still result in exceedances for crucifers, ornamentals and turf. |
| Bees[2] | Acute Adult | Not calculated | N/A | 6-8% mortality in acute oral or contact studies. EECs are lower than level where effects are observed. |
| | Chronic Adult | No data | No data | Outstanding uncertainty due to lack of definitive data. |
| | Acute Larval | No data | No data | No data |
| | Chronic Larval | <0.01-10 | Yes | Risk exceeding LOC's for uses on onions, lettuce, crucifers, turf and ornamentals. Based on a study with 67-100% mortality in the two highest concentration treatment groups. |
| Aquatic Plants | N/A | ≤0.76 | No | No risk exceeding LOC when based on Formation-Decline modeling. |
| Terrestrial Plants | N/A | Not calculated | N/A, see additional information | No adverse effects up to 7.62 lbs a.i./acre, which is higher than applications rates except for the soil drench app rate of 22 lbs a.i./A. There were 16 reported incidents in IDS and 11 incidents reported in the aggregate database for plants; susceptible plants might be sensitive to iprodione. |

CC=crop cycle; N/A=not applicable; IDS=incident database system
Level of Concern (LOC) Definitions:
Terrestrial Animals: Acute risk=0.5; Chronic risk=1.0; Terrestrial invertebrates: Acute risk=0.4; Chronic risk=1.0;
Aquatic Animals: Acute risk=0.5; Chronic risk=1.0
Risk to Aquatic or Terrestrial Plants: 1.0
[1] RQs for aquatic taxa reflect exposure estimates for Iprodione SSD (parent and degradate RP30228) and maximum application rates allowed on labels, except where otherwise stated. Formation-Decline modeling results were utilized to calculate the aquatic RQs for iprodione SSD and the 30% formation assumption was used to calculate the RQs for 3,5-DCA.

[2] RQs for terrestrial invertebrates are based on exposure to honey bees (*Apis mellifera*), which are also a surrogate for other species of bees. Risks to other terrestrial invertebrates (*e.g.*, earthworms, beneficial arthropods) are only characterized when toxicity data are available.

## 2 Introduction

This Draft Risk Assessment (DRA) examines the potential ecological risks associated with labeled uses of iprodione on non-listed non-target organisms. Federally listed threatened/endangered species ("listed") are not evaluated in this document**.**

The Food Quality Protection Act (FQPA) requires EPA to screen pesticides for the potential to produce effects like those produced by estrogen in humans and gives EPA the authority to screen certain other chemicals and to include other endocrine effects. In response, EPA developed the Endocrine Disruptor Screening Program (EDSP), additional information on the EDSP is available in **Appendix A**.

The DRA uses the best currently available scientific information on the use, environmental fate and transport, and ecological effects of iprodione. The general risk assessment methodology is described in the *Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs* ("Overview Document") (USEPA, 2004a). Additionally, the process is consistent with other guidance produced by the Environmental Fate and Effects Division (EFED) as appropriate. When necessary, risks identified through standard risk assessment methods are further refined using available models and data. This risk assessment incorporates the available exposure and effects data and most current modeling and methodologies.

## 3 Problem Formulation Update

The purpose of problem formulation is to provide the foundation for the environmental fate and ecological risk assessment being conducted for the labeled uses of iprodione. The problem formulation identifies the objectives for the risk assessment and provides a plan for analyzing the data and characterizing the risk. As part of the Registration Review (RR) process, a detailed preliminary Problem Formulation for this DRA was published to the docket in December 2012 (USEPA, 2012, DP Barcode 402502).[2] The following sections summarize the key points of the preliminary Problem Formulation and discuss key differences between the analysis outlined there and the analysis conducted in this DRA.

Based on previous risk assessments, potential risks associated with the use of iprodione include acute risk to aquatic vertebrates and invertebrates and to aquatic plants and chronic risk to terrestrial mammals and birds. At that time terrestrial plant data were unavailable, so risks to terrestrial plants could not be precluded.

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[2] https://www.regulations.gov/document?D=EPA-HQ-OPP-2012-0392-0003 (accessed 1/27/2020)

Since the preliminary Problem Formulation was completed, the following fate and exposure data have been submitted:

- Adsorption/Desorption of RP32490 (MRID 49664103)
- Hydrolysis study of 3,5-DCA (MRID 49526513)
- Aqueous photolysis study of 3,5-DCA (MRID 49664101)
- Photodegradation on soil study 3,5-DCA (MRID 49726501)
- Aerobic soil metabolism study of iprodione (MRID 49726502)
- Aerobic aquatic metabolism study of iprodione (MRID 49726503)
- Aerobic aquatic metabolism study of 3,5-DCA (MRID 49726504)
- Anerobic aquatic metabolism study of iprodione (MRID 49726505)
- Anaerobic aquatic sediment metabolism study of 3,5-DCA (MRID 49726506)
- Absorption/Desorption study of RP30228 (MRID 50586101)
- Non-guideline evaluation of soil comparability between EU soils use in RP30228 adsorption/desorption study and US soils in iprodione use areas (no MRID)

More specific information on these new data is described in **Section 5** and **Section 8**. The additional data result in updated aquatic modeling input values and reduced uncertainty in estimating exposure.

In the 2012 preliminary Problem Formulation, EFED did not identify the need for sediment toxicity data for the parent or degradate RP30228 despite the log $K_{OW}$ of iprodione (>3), which is a trigger for the requirement for sediment toxicity data (40 CFR Part 158.630). The data available at that time indicated that neither compound was persistent in aquatic environments (USEPA, 2012, DP Barcode 402502).[3] Based on the newly submitted hydrolysis and aquatic metabolism studies, degradate RP30228 has been shown to persist in aquatic environments. In the absence of sediment toxicity data, potential risk to benthic organisms is based on the available toxicity data for aquatic invertebrates that occupy the water as opposed to the benthic sediment.

Since the preliminary Problem Formulation was completed, the following ecotoxicity data have been submitted:

- Acute toxicity to the freshwater fish *Pimephales promelas* (Fathead Minnow) (MRID 49526509)
- Acute toxicity to the freshwater fish *Oncorhynchus mykiss* (Rainbow Trout) (MRID 49526508)
- Acute toxicity to the estuarine/marine fish *Cyprinodon variegatus* (Sheepshead Minnow) (MRID 49526510)

[3] Sediment data may be required if the soil-water distribution coefficient ($K_d$) is ≥ 50 L/kg, $K_{OC}$s are ≥1000 L/kg-organic carbon, or the log $K_{OW}$ is ≥ 3 (40 CFR Part 158.630). Sediment data may also be requested if there may be a toxicity concern.

- Chronic fish full life-cycle test with *Pimephales promelas* (Fathead Minnow) (MRID 49767901
- Chronic toxicity to the freshwater invertebrate *Daphnia magna* for Iprodione TGAI (MRID 49653701) and the degradate, 3,5-DCA (MRID 49526511)
- Acute and chronic toxicity to the estuarine/marine invertebrate *Americamysis bahia* (MRID 49526507 and 49726507, respectively)
- Toxicity to non-vascular plants and algae, *Anabaena flos-aquae* (MRID 49526506), *Navicula pelliculosa* (MRID 49526505) and *Raphidocelis subcapitata* formerly *Pseudokirchneriella subcapitata* (MRID 49526504)
- Subacute dietary toxicity study with the Zebra finch (*Taeniopygia guttata*) (MRID 49526512)
- Chronic avian reproduction study with Bobwhite Quail (*Colinus virginianus*) (Acc. No. 00099126)
- Acute contact and oral toxicity to adult honey bees (*Apis mellifera*) (MRID 50586102)
- Chronic toxicity to larval honey bees (*Apis mellifera* spp. *mellifera*) (MRID 49526514)
- Toxicity to terrestrial plants via vegetative vigor (MRID 49526503) and seedling emergence (MRID 49526502).

These new data are described in more detail in the effects characterization (**Section 6)**. Some of these new data filled gaps where previously there were no data (*i.e*., freshwater fish full life cycle, freshwater invertebrate (*D. magna)* life cycle with 3,5-DCA; acute test with the marine/estuarine invertebrate (*A. bahia*); avian sub-acute dietary study with the Zebra Finch; avian reproduction study with the Bobwhite Quail; honey bee acute adult oral and contact and larval chronic studies; and, the two terrestrial plant studies with parent iprodione). In some cases the new data replaced studies that were previously deemed unacceptable (*i.e*., acute exposure to Fathead Minnow, Rainbow Trout and Sheepshead Minnow; the life cycle exposure with the freshwater invertebrate *D. magna* to iprodione; and, the non-vascular plant toxicity tests with *Anabaena* and *Navicula*); or replaced a non-definitive endpoint (*i.e*., toxicity test with *Raphidocelis*); however, only three of the new studies provided endpoints that are more sensitive than previously submitted data. The acute exposure of Fathead Minnow has an $LC_{50}$ of 6,160 µg a.i./L, which is more sensitive than the $LC_{50}$ from the Rainbow Trout acute exposure (9,460 µg a.i./L) previously used for assessment; the fish full life cycle with Fathead Minnow (NOAEC of 85 µg a.i./L) is more sensitive than the previously used chronic toxicity endpoint from the early life-stage test with Fathead Minnow (NOAEC of 260 µg a.i./L); and, the sub-acute dietary exposure of the Zebra Finch ($LC_{50}$ of 1,800 mg a.i./kg-diet), is more sensitive than the Northern Bobwhite Quail study that was previously used ($LC_{50}$ of >5,620 mg a.i./kg-diet) for assessment.

## 3.1 Mode of Action for Target Pests

Iprodione (3-(3,5-dichlorophenyl)-*N*-isopropyl-2,4-dioxoimidazolidine-1-carboxamide) is a member of the imide class of dicarboximide fungicides (Fungal Resistance Action Committee (FRAC) code 2). It is a contact/locally systemic fungicide used to control a wide range of fungal genera, including *Bortryis*, *Alternaria*, *Rhizoctonia*, and *Sclerotinia* on a wide range of agricultural and non-agricultural crops. Other FRAC code 2 fungicides include procymidone and vinclozolin. It also demonstrates nematostatic activity against second stage juvenile root-knot nematode *Meloidogyne incognita*.

Iprodione inhibits DNA and RNA synthesis in germinating fungal spores by inhibiting the MAP/histidine kinase enzyme involved in osmotic signal transduction. It has been proposed that iprodione also inhibits the enzyme NADH cytochrome c reductase leading to lipid peroxidation, preventing lipid and membrane production and inhibiting mycelium growth (Hayes, 2007). No mechanism of action for the nematostatic activity has been proposed.

## 3.2 Label and Use Characterization

### 3.2.1 Label Summary

Iprodione is formulated as an emulsifiable concentrate, soluble concentrate, flowable concentrate, granule, wettable powder, dry flowable solid, and a ready-to-use product. Iprodione is currently registered for use on a variety of field, fruit and vegetable crops; and, on turf (sod farms, golf courses, and ornamental turf uses).[4] There are 38 active Section 3 registrations and four Section 24c special local need registrations for iprodione. The pesticide can be applied by chemigation, aircraft, drench, dip, and foliar ground spray. Prior assessments have estimated exposure for maximum annual application rates ranging from 0.27 (cotton) to 24 (turf and ornamentals) lbs a.i./A/yr.

The Biological and Economic Analysis Division (BEAD) prepared the April 2018 Pesticide Label Use Summary (PLUS) Report summarizing all registered uses of iprodione based on actively registered labels (USEPA, 2019a, 2020). **Table 3-1** summarizes the application methods, rates, timing, and restrictions for representative use patterns assessed in this DRA. EFED selected use patterns to show the range of potential risk, including providing risk estimates for uses with historically high usage (*i.e.*, almonds, onions, stone fruit), use patterns with high application rates (*i.e.*, turf, ornamentals, crucifers, potatoes), use patterns that historically resulted in high EECs (*i.e.*, carrots, grapes, lettuce), as well as use patterns with unique application methods that would also generate lower-bound exposure estimates (carrot seed treatment, cotton in-furrow). While a rice use was included in the PLUS report, it was not assessed as the rice use pattern is being removed from labels.

Restrictions that were on all labels and applied to all use patterns include:

- Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high-water mark;

[4] Registered uses for iprodione include: caneberries, almonds, beans (dried and succulent), blueberries, broccoli, carrots (including tops), clover, conifers and evergreens, cotton, crucifers, crucifers for seed, currants, elderberries, garlic, ginseng, gooseberries, grapes, turf (sod farms, golf courses, and ornamental turf), mustard cabbage, onions, ornamentals, peanuts, peas (dried type), potatoes, stone fruits, and strawberries.

- Do not apply product when wind direction is towards aquatic areas; and,
- Applications should not occur during temperature inversions.

Other common restrictions include:

- A 25-foot vegetative buffer strip between the application site and any adjacent water body (*e.g.*, lake, reservoir, river, permanent stream, marsh, natural pond, estuary, or commercial fish pond) for all uses except applications to golf courses.
- Do not graze animals in treated field or orchards.
- Do not feed cover crops grown in treated fields or orchards to livestock.
- Do not make sequential applications of iprodione- and vinclozolin-containing products.
- Do not apply to turf cut higher than 1" on golf holes where water bodies are present.
- For aerial application:
    - Maximum release height no greater than 10 feet above the top of the largest plant unless greater height is required for aircraft safety; and,
    - Avoid applications at windspeeds below 2 mph.
-

**Table 3-1. Summary of Selected Maximum Labeled Use Patterns for Iprodione.**

| Use Site/ Location | Form[1] | App Target | App Type | App Equip | App Time | Max Single Rate lbs ai/A | Max # App/yr* | Max Annual Rate lbs ai/A/yr* | MRI (d) | PHI (d) | Comments (*e.g.* geographic/application timing restrictions, pollinator specific language) | Drift Restrictions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Broadcast Treatments** | | | | | | | | | | | | |
| Almonds | EC, FLC, SC | Foliage/ Plant | Broad | G, A, AB | All | 0.50 | 4 | 2.00 | NS | NS | Do not apply 5 weeks after petal fall | 25 ft buffer from all waterbodies |
| Lettuce | FLC | Foliage/ Plant | Broad | G, A, C | Post-emergence | 1.00 | NS (3/CC) | NS (3.00/CC) | 10 | 14 | Aerial applications only for first spray | 25 ft buffer from all waterbodies |
| | EC, SC | Foliage/ Plant | Broad | G, A | Post-emergence | 1.00 | NS (3/CC) | NS (3.00/CC) | 10 | 14 | Aerial Application only for first spray. Disallowed in CA | 25 ft buffer from all waterbodies |
| Carrots | EC, FLC, SC | Foliage/ Plant | Broad | G, A, AB, C | All | 1.00 | NS (4/CC) | NS (4/CC) | 7 | 0 | NS | 25 ft buffer from all waterbodies |
| Onion | FLC | Foliage/ Plant | Broad | G, A, AB, C | All | 0.75 | NS (4/CC) | NS (3.00/CC) | 7 | 7 | CA only | 25 ft buffer from all waterbodies |
| | FLC | Foliage/ Plant | Broad | G, A, AB, C | All | 1 | NS (4/CC) | NS (4.00/CC) | 7 | 7 | CO only | 25 ft buffer from all waterbodies |
| | EC | Foliage/ Plant | Broad | G, A, AB, C | All | 0.75 | NS (5/CC) | NS (3.75/CC) | 14 | 7 | NS | 25 ft buffer from all waterbodies |
| Crucifers for seed | EC | Foliage/ Plant | Broad | G, A, AB | All | 1.00 | NS (5/CC) | NS (5.00/CC) | NS | NS | CA only | 25 ft buffer from all waterbodies |
| | FLC | Foliage/ Plant | Broad | G, A, AB | All | 2.00 | NS (3/CC) | NS (6.00/CC) | NS | NS | OR only | 25 ft buffer from all waterbodies |
| Broccoli | FLC, EC, SC | Plant | Broad | G, C | Post-emergence | 1.00 | NS (2/CC) | NS (2.00/CC) | NS | 0 | NS | 25 ft buffer from all waterbodies |
| Stone Fruit | FLC, EC, SC | Foliage/ Plant | Broad | A, G, AB | All | 1.00 | 2 | 2.00 | NS | NS | May not be applied after petal fall | 25 ft buffer from all waterbodies |
| Potato | FLC, EC, SC, | Foliage/ Plant, Soil | Broad | G, A, C | All | 1.00 | NS (4/CC) | NS (4.00/CC) | 10 | 14 | NS | 25 ft buffer from all waterbodies |

| Use Site/ Location | Form[1] | App Target | App Type | App Equip | App Time | Max Single Rate lbs ai/A | Max # App/yr* | Max Annual Rate lbs ai/A/yr* | MRI (d) | PHI (d) | Comments (*e.g.* geographic/application timing restrictions, pollinator specific language) | Drift Restrictions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turf[1]/ Ornamentals | SC, DF, G, WP, RTU | Foliage/ Plant | Broad | G, A, C | Post-emergence | 5.51 | 6 | 24 | 14 | NS | Chemigation Disallowed in CA Not for residential use | 25 ft buffer from all waterbodies except for applications to golf courses |
| Ornamentals | SC, DF, WP, RTU | Plant | Drench | Soil Drench | Seeding or Transplant | 22.1 | 6 | 24 | 14 | NS | Not for residential use | 25 ft buffer from all waterbodies |
| Grapes, Wine | EC, FLC, SC | Foliage/ Plant | Broad | G, A, C, AB | All | 1.00 | 4 | 4.00 | NS | 7 | Chemigation Disallowed in NY | 25 ft buffer from all waterbodies |
| Cotton | EC, FLC, SC | Soil | In-Furrow | G | At Plant | 0.272 | 1 | 0.272 | NS | NS | Applied to open seed furrow before closure. | 25 ft buffer from all waterbodies |
| **Seed Treatments** | | | | | | | | | | | | |
| Carrots | EC | Seed | Slurry Seed Treatment | Seed Treatment Equipment | At plant | 0.005 lb a.i./lb seed[2] | 1/CC | NS (0.037/CC) | NS | NS | CA, ID, NE, WA only. Assumed seeding rate of 7.4 lb/A[2] | NS |
| | | | Soak Seed Treatment | Soaking Tank | At plant | 0.0833 lb a.i./lb seed[2] | 1/CC | NS (0.616/CC) | NS | NS | CA only. Assumed seeding rate of 7.4 lb/A[2] | NS |

App=application; equip=equipment -=not specified; EC=emulsifiable concentrate; SC=soluble concentrate; FLC=flowable concentrate; WP=wettable powder; DF=dry flowable; G=granular; Broad=broadcast; MRI = minimum retreatment interval; PHI=preharvest interval; A=aerial; C=chemigation; AB=airblast; G=ground; ai=active ingredient; CC=crop cycle; d=day; All=indicates that the product may be applied during any crop status. Typically, this occurs when the product is applied based on pest pressure; () Maximum values per crop cycle

* Information is provided on an annual basis, unless otherwise specified.

[1] "Turf" includes golf courses, sod farms, and institutional areas where fine turf is grown. Ornamentals include fields, landscapes, nurseries, greenhouses, and conifer nurseries.

[2] Seeding rate calculated from estimated 175,000 seeds per pound and 1,300,000 seeds planted per acre based on Nunez, J. T. Hartz, T. Suslow, M. McGiffen, and E.T. Natwick. 2008. *Carrot Production in California. University of California*, Division of Agriculture and Natural Resources, Publication Number 7226.

### 3.2.2 Usage Summary

Based on market usage data from 2006-2016, usage of iprodione averaged approximately 440,000 lbs a.i./year on agricultural crops. The Screening-Level Usage Analysis (SLUA) estimate, which only considers agricultural usage, indicates that on average 200,000 lbs of iprodione are applied to almonds a year. On average 20,000 to 50,000 lbs of iprodione are applied to lettuce, stone fruit, carrots, beans, and onion each year. Iprodione is also extensively used as a fungicide on golf course and institutional turf. The Science Information & Analysis Branch (SIAB) Use and Usage Matrix (SUUM) report, reflecting iprodione data from 2012, indicates that 341,000 lbs ai were applied to golf courses, 22,000 lbs ai were applied to institutional turf, and 12,000 lbs ai were applied by lawn care professionals.[5] The complete SLUA and the SUUM can be found in the iprodione docket.[6]

BEAD provided data on average application rate (*i.e.*, total amount applied divided by the area treated) and application timing data for a number of agricultural crops based on available usage information and agronomic practices. The data were provided for almonds, carrots, lettuce, broccoli, and onions. These data informed the development of average application rate modeling scenarios found in **Section 8.1.1**

### 3.2.3 Label Uncertainties

The registered labels frequently do not provide a maximum annual application rate for iprodione. Instead, they only list the maximum application rate per crop cycle. This could lead to different maximum annual application rates in different portions of the country based on weather and cropping patterns. The maximum per crop cycle application rate is provided for use patterns in **Table 3-1** without a listed maximum annual application.

# 4 Residues of Concern

In this risk assessment, the stressors of concern are those chemicals that may exert adverse effects on non-target organisms, and collectively are known as the Residues of Concern (ROC). The ROC usually includes the active ingredient, or parent chemical, and may include one or more degradates that are observed in laboratory or field environmental fate studies. Degradates may be included in, or excluded from, the ROC based on submitted toxicity data, percent formation relative to the application rate of the parent compound, modeled exposure, and structure-activity relationships (SARs). Structure-activity analysis may be qualitative, based on retention of functional groups in the degradate, or they may be quantitative, using programs

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[5] Kline and Company. 2012. Professional Turf and Ornamental Markets for Pesticides and Fertilizers 2011: U.S. Market Analysis and Opportunities. (Accessed 6/2019).

[6] https://www.regulations.gov/docket?D=EPA-HQ-OPP-2012-0392 (Accessed 1/27/2020)

such as the Ecological Structure Activity Relationships (ECOSAR[7]), the Organization for Economic Cooperation and Development (OECD) Toolbox[8], or others.

A table summarizing the maximum amounts of degradates formed in different studies and the structures is available in **Appendix C**. The 2009 assessment for iprodione identified RP30228 (*i.e*., 3-(1-methylethyl)-N-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide) and 3,5-DCA as residues of concern for aquatic animals (USEPA, 2009b). Limited environmental fate data on RP30228 suggest that degradation of RP30228 is much slower than that of the parent (*i.e*., the degradate is more likely to persist in the environment). The RP30228 was present at a maximum concentration of 30.8% in aerobic soil metabolism studies and at 89.4% in aerobic aquatic metabolism studies. It reached maximum concentrations at the end of the aerobic aquatic metabolism study, indicating that it can persist in aquatic environments.

The ROC for ecological risk were the parent compound and all the major (>10% formed) degradates that contained the 3,5-dichloroaniline moiety: RP30228, RP32490, RP35606, and 3,5-DCA. The EECs were calculated for iprodione plus the four degradates, as well as for 3,5-DCA alone. Since the 2009 assessment, new guidance on identifying ROCs for ecological effects using ECOSAR was developed (USEPA, 2018).

Based on this new guidance, the ROC for this assessment now only include the parent iprodione, and degradates RP30228 and 3,5-DCA. Iprodione and RP30228 are structural isomers of each other and based on the structural similarity they are assumed to have a similar mode of action and toxicity. Due to the differences in proposed mechanism of action and measured toxicity values between iprodione and 3,5-DCA, the EECs for iprodione and RP30228 are assessed separately from 3,5-DCA (USEPA, 2011, DP Barcode 393960).

The two other major degradates of iprodione: RP32490 (3-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide) and RP35606 ([(dichloro-3,5-phenyl)-1-isopropylcarbamoyl-3]-2-acetic acid) were included in an ECOSAR analysis (**Appendix B**) along with the parent iprodione, 3,5-DCA and RP30228, but were excluded from the residues of concern for ecological effects based on the maximum amounts observed in fate studies.

Degradate RP32490 had two chemical classes in common with the parent material (amides and imides) which predicted some toxicity endpoints within 10x of the parent measured values. The predicted toxicity endpoints for RP2490 were lower than those of the parent.  Additionally, RP32490 was present in an aerobic aquatic metabolism study at a maximum of 15% of applied. Degradate RP35606 had only one chemical class in common with the parent material (substituted ureas); however, the SAR based on substituted urea for the parent compound was not a good match compared to measured (empirical data); therefore, the SAR was not considered predictive. Degradate RP35606 was only present at a maximum of 12% of the

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[7] https://www.epa.gov/tsca-screening-tools/ecological-structure-activity-relationships-ecosar-predictive-model
[8] https://www.oecd.org/chemicalsafety/risk-assessment/oecd-qsar-toolbox.htm

applied radioactivity (AR). It was present at a maximum of 8.9% AR in metabolism studies, indicating the likelihood of exposure is low. Exposure estimates with and without RP32490 and 35606 were virtually identical; therefore, RP32490 and 35606 are not ROC.

At this time, the default 35-day foliar dissipation half-life is expected to account for iprodione and its residues of concern for the terrestrial exposure assessment. If empirical half-life is considered in the future, the residue data needs to account for the residues of concern in plants.

# 5 Environmental Fate Summary

The following sections describe the suite of physical-chemical and environmental fate data available for iprodione and degradates RP30228 and 3,5-DCA. The first section describes the data for iprodione and RP30228. The second describes the available data for 3,5-DCA. The final section summarizes the available field dissipation data for iprodione.

## 5.1 Physical-Chemical and Fate Data for Iprodione and RP30228.

**Table 5-1** summarizes the physical chemical properties of iprodione as well as the mobility data for degradate RP30228. Iprodione is not expected to ionize in water at environmentally relevant pH values and is classified as non-volatile from water and dry, non-absorbing surfaces (USEPA, 2010a). Iprodione is classified as moderately mobile on soil based on measured organic carbon-normalized Freundlich soil-water distribution coefficient ($K_{FOC}$) values and the United Nations Food and Agriculture Organization (FAO) classification system (FAO, 2000). Data indicate that RP30228 is slightly to hardly mobile on soil. Iprodione and RP30228 may be transported to surface water via spray drift, runoff, and/or erosion (*i.e.*, transport of sediment-bound residues), or to groundwater via leaching.

**Table 5-1. Summary of Physical-Chemical, Sorption, and Bioconcentration Properties of Iprodione.**

| Parameter | Value[1] | Source/ Study Classification/ Comment |
|---|---|---|
| Molecular Weight (g/mole) | 330.2 | Based on chemical structure |
| Water Solubility at 20°C mg/L | 13 | MRID 47778802 |
| Vapor Pressure at 25 °C(Torr) | $2.7 \times 10^{-7}$ | MRID 47778802.<br>Non-volatile under field conditions |
| Henry's Law constant at 20°C (atm-m$^3$/mole) | $9.0 \times 10^{-9}$ | Estimated[1] from vapor pressure and water solubility at 20°C. |
| Log Dissociation Constant ($pK_a$) | No dissociation between pH 1 -12 | -- |
| Log Octanol-water partition coefficient ($K_{ow}$) at 25°C (unitless) | 3.1 | MRID 47778802 |

<table>
<tr><th>Parameter</th><th colspan="3">Value[1]</th><th>Source/<br>Study Classification/<br>Comment</th></tr>
<tr><td>Air-water partition coefficient ($K_{AW}$) (unitless)</td><td colspan="3">$3.74 \times 10^{-7}$</td><td>Estimated[1] from vapor pressure and water solubility at 20°C.<br>Nonvolatile from water.</td></tr>
<tr><td rowspan="8">Soil-Water Freundlich Distribution Coefficients ($K_F$ in $(\mu g/g\text{-soil})/(\mu g/mL)^{1/n}$)<br><br>Organic carbon normalized Freundlich distribution coefficients ($K_{FOC}$ in $(\mu g/g\text{-organic carbon})/(\mu g/mL)^{1/n}$)</td><td>Soil/Sediment</td><td>$K_F$</td><td>$K_{FOC}$</td><td rowspan="8">MRID 43349202.<br>Acceptable.<br>Moderately mobile<br>(FAO classification system);<br>$K_{FOC}$ better predictor of sorption based on lower CV. Low values from study were excluded because the measured $K_d$ was <0.3 and concentrations were not measured in both soil and water.</td></tr>
<tr><td colspan="3">Parent</td></tr>
<tr><td>sandy loam</td><td>2.45</td><td>223</td></tr>
<tr><td>loamy sand</td><td>2.16</td><td>431</td></tr>
<tr><td>loam</td><td>43.09</td><td>507</td></tr>
<tr><td>clay</td><td>6.52</td><td>543</td></tr>
<tr><td>Mean</td><td>13.6</td><td>426</td></tr>
<tr><td>CV</td><td>1.46</td><td>0.34</td></tr>
<tr><td rowspan="9">Soil-Water Distribution Coefficients ($K_d$ in L/kg-soil or sediment)<br><br>Organic carbon normalized distribution coefficients ($K_{oc}$ in L/kg-organic carbon)</td><td>Soil/Sediment</td><td>$K_d$</td><td>$K_{OC}$</td><td rowspan="9">MRID 50586101.<br>Acceptable<br>Slightly to hardly mobile</td></tr>
<tr><td colspan="3">Degradate RP30228[2]</td></tr>
<tr><td>Sand pH 5.2,</td><td>24.17</td><td>4648</td></tr>
<tr><td>Sandy Loam pH 6.9,</td><td>54.04</td><td>4958</td></tr>
<tr><td>Loamy Sand, pH 5.9</td><td>50.21</td><td>5706</td></tr>
<tr><td>Silt Loam, pH 6.5</td><td>171.29</td><td>10509</td></tr>
<tr><td>Silty Clay Loam, pH 7.5</td><td>91.23</td><td>2376</td></tr>
<tr><td>Mean</td><td>78.2</td><td>5639</td></tr>
<tr><td>CV</td><td>0.73</td><td>0.53</td></tr>
<tr><td rowspan="2">Steady State Bioconcentration Factor (BCF) L/kg-wet weight fish at 23 °C</td><td>Species</td><td>BCF</td><td>Depuration</td><td rowspan="2">MRID 43091001.<br>Acceptable. Steady state BCF based on the mean measured values of the final three sampling intervals in the BCF study. Values reported for total radioactive residues and is not specific to iprodione. Iprodione, RP25040, RP30228, RP32490, and RP36119 were detected in fish.</td></tr>
<tr><td>Bluegill sunfish<br>Lepomis macrochirus</td><td>46.8<br>whole fish</td><td>93% in edible tissue and 76% in inedible tissue after 24 h</td></tr>
</table>

CV=Coefficient of Variation

[1]All estimated values were calculated according to "*Guidance for Reporting on the Environmental Fate and Transport of the Stressors of Concern in Problem Formulations for Registration Review, Registration Review Risk Assessments, Listed Species Litigation Assessments, New Chemical Risk Assessments, and Other Relevant Risk Assessments*" (USEPA, 2010a)

[2] Degradate RP30228: 3-(1-methylethyl)-N-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide

Based on terrestrial field dissipation data, iprodione parent dissipates within days in soil, with $DT_{50}$ values <7 days, but RP30228 tends to be more persistent, leading to biphasic dissipation curves and $DT_{90}$ values >1 year for iprodione SSD. Iprodione and RP30228 were detected up to but not below 60 cm in terrestrial field dissipation studies, indicating that leaching and movement into groundwater may occur. Based on aquatic field dissipation studies, iprodione dissipates in days from the water column in aquatic environments to form RP30228 with $DT_{50}$ values <7 days, but the parent is more persistent in sediment, with $DT_{50}$ values of 3-4 months.

Based on the logarithm of octanol-water partition coefficient (log $K_{OW}$) of 3.1, iprodione is expected to partition to sediment, triggering the need for a separate sediment exposure assessment (40 CFR Part 158.630).[9] Compounds with a log $K_{OW}$ of three and above are generally considered to have the potential to bioconcentrate in aquatic organisms. However, the potential for bioconcentration of iprodione in organisms is considered low given the measured bioconcentration factor (BCF) of 46.8 L/kg-wet weight for total iprodione residues in freshwater fish and depuration values >76% in 24h once fish were transferred to untreated water (MRID 43091001). Since the BCF value was calculated for the total radioactive residues, it may overestimate the BCF value for iprodione alone. The study utilized a flow through system to maintain constant iprodione concentrations in the water and thus the measured BCF does not reflect potential exposure to residues of RP30288, the major residue expected to occur in aquatic environments. An open literature study does report a higher average BCF value of 360 (no units specified) specific to iprodione in carp (*Cyprinus carpo L*); however, the study exposed fish to more than one pesticide at the same time, and there is uncertainty in the BCF value (Taizo *et al.*, 1992).

Based on the laboratory and field studies, iprodione is converted to the more persistent degradate RP30228 in aquatic environments; therefore, aquatic animals may be exposed to more RP30228 than iprodione over time. The estimated log octanol-water partition coefficient (log $K_{OW}$) of RP30228 of 3.24 (Estimation Program Interface (EPI)Web Version 4.1), is similar to the measured log $K_{OW}$ of iprodione of 3.1 (the two compounds are structural isomers); therefore, the bioconcentration potential of iprodione SSD is expected to be similar to iprodione parent and therefore not a significant source of uncertainty.

summarizes the degradation rates and representative model input half-lives from environmental fate laboratory data for iprodione and iprodione SSD. The representative model input half-life values are often different from the actual time to 50 percent decline of the residues as degradation kinetics were often biphasic with the rate of degradation slowing over time. The representative degradation half-life is designed to provide an estimate of degradation for biphasic degradation curves that will not overestimate degradation when assuming a single first-order (SFO) decline curve in modeling. The $DT_{50}$ and $DT_{90}$ describe the actual kinetic fit of the models to the data and the representative model inputs show how the measured kinetics relate to what is assumed to develop the model input.

**Table 5-2. Summary of Environmental Degradation Data for Iprodione and Iprodione SSD (Iprodione plus RP 30228)**

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[9] Sediment data may be required if the soil-water distribution coefficient ($K_d$) is ≥50 L/kg, $K_{OC}$s are ≥1000 L/kg-organic carbon, or the log $K_{OW}$ is ≥3 (40 CFR Part 158.630). Sediment data may also be requested if there may be a toxicity concern.

| Study | System Details | Degradation Rates (d) (kinetic model)[1] | | | | Representative Model Input Half-Lives[2] (d) | | Source/Study Classification/Comment |
|---|---|---|---|---|---|---|---|---|
| | | Iprodione | | Iprodione SSD | | | | |
| | | $DT_{50}$ | $DT_{90}$ | $DT_{50}$ | $DT_{90}$ | Parent | ROC | |
| Abiotic Hydrolysis | pH 5, 25 °C | 722 (SFO) | 2565 (SFO) | Stable | Stable | - | - | MRID 41885401. Acceptable |
| | pH 7, 25 °C | 4.2 (SFO) | 14 (SFO) | 49 (SFO) | 163 (SFO) | 4.2 | 266 | |
| | pH 9, 25 °C | 0.016 (SFO) | 0.053 (SFO) | Stable | Stable | - | - | |
| Atmospheric Degradation | Hydroxyl Radical | 0.271 (SFO) | | | | - | - | Estimated value Estimation Program Interface (EPI)Web Version 4.1, based on parent only |
| Aqueous Photolysis | pH 5, 25°C 28 °N sunlight (Florida) | 64 | 213 | 64 | 213 | 64 | 64 | MRID 41861901. Acceptable |
| Soil Photolysis | sandy loam, 25°C, pH 6.92 40°N sunlight | Stable | Stable | Stable | Stable | - | - | |
| Aerobic Soil Metabolism | Sandy loam, pH 5.75, 25°C | 16.3 (SFO) | 54 (SFO) | 19.1 (SFO) | 63.4 (SFO) | 16.3 | 19.1 | MRID 43091002. Acceptable |
| | Sandy loam, pH 6.9, 20 °C | 7.96 (SFO) | 26.4 (SFO) | - | - | 7.96 | - | MRID 49726502[N]. Supplemental Material balance ranged from 61.2-90.6% in the sandy loam soil from day 60 onward, insufficient to assess persistence of iprodione SSD. |
| | Clay loam, pH 7.3, 20 °C | 9.00 (IORE) | 107 (IORE) | 45.3 (DFOP) | 251 (DFOP) | 32.1 | 88.7 | |
| | Loam, pH 4.2, 20 °C | 103 (IORE) | 1280 (IORE) | 119 (IORE) | 1677 (IORE) | 385 | 505 | |
| Anaerobic Soil Metabolism | - | - | - | - | - | - | - | MRID 41758801. Unacceptable |
| Aerobic Aquatic Metabolism | Silt loam sediment, pH 6.3, 20 °C | 9 (SFO-LN) | - | - | - | 9 | - | MRID 41927601/42503801. Supplemental. The study duration was only 30 day, insufficient to assess the persistence of the iprodione SSD. |
| | Sandy clay loam sediment, pH 7.5, 20 °C | 2.51 (IORE) | 32.3 (IORE) | 2098 (SFO) | 6968 (SFO) | 9.73 | 2098 | MRID 49726503[N]. Supplemental |
| | Clay loam sediment, pH 8.3, 20 °C | 2.74 (IORE) | 39 (IORE) | 263 (DFOP) | 1108 (DFOP) | 11.7 | 364 | |
| Anaerobic Aquatic Metabolism[3] | Sandy clay loam sediment pH 6.7, 20 °C | 7.27 (IORE) | 39.0 (IORE) | 672 (SFO) | 2232 (SFO) | 11.7 | 672 | MRID 49726505[N]. Supplemental |
| | Clay loam sediment, pH 7.6, 20 °C | 5.38 (IORE) | 25.2 (IORE) | 456 (SFO) | 1514 (SFO) | 7.59 | 456 | |
| | Silt loam, pH 7.4, 25 °C | - | - | - | - | - | - | MRID 41755801 Unacceptable |

d=days; SFO=single first order; DFOP=double first order in parallel; IORE=indeterminate order (IORE); SFO $DT_{50}$=single first order half-life; $T_{IORE}$=the half-life of a SFO model that passes through a hypothetical $DT_{90}$ of the

IORE fit; DFOP slow $DT_{50}$=slow rate half-life of the DFOP fit, --=not available or applicable; SFO-LN=SFO calculated using natural log transformed data

[N] Studies submitted since the problem formulation was completed are designated with an N associated with the MRID number.

[1] The value used to estimate a model input value is the calculated SFO $DT_{50}$, $T_{IORE}$, or the DFOP slow $DT_{50}$ from the DFOP equation. The model chosen is consistent with that recommended using the, *Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media* (NAFTA, 2012).

[2] The calculated half-live values represent residues of iprodione plus RP30228 (abbreviated as Iprodione SSD).

[3] For MRID 41755801, an anaerobic aquatic metabolism study, data are not suitable for use in model input calculations. Material balance ranged from 67.3- 98.3% from day 94 onward. Degradation pattern was inconsistent throughout the course of the study

Iprodione undergoes pH-dependent hydrolysis, degrading slower at low pH ($t_{1/2}$ = 127 d at pH 5, 25 °C), and faster in neutral ($t_{1/2}$ = 4.2 d at pH 7, 25 °C) and basic pH ($t_{1/2}$ = 0.016 d at pH 9, 25 °C) systems. Aqueous photolysis is not a major pathway of degradation for iprodione in most systems ($t_{1/2}$ = 64 d at pH 5, 25 °C, 28 °N sunlight) and iprodione is stable to photolysis on dry soil.

Iprodione degrades under biotic conditions with aerobic soil and aquatic metabolism study $DT_{50}$ values ranging from 7.96 to 103 and 2.51 to 9 days, respectively. In the aerobic soil metabolism study, iprodione degraded slower at lower pH, which could be the result of pH-dependent hydrolysis rather than biotic degradation, but the study did not utilize sterile controls. Iprodione parent is classified as non-persistent to moderately persistent on soil based on the Goring scale.[10] Anaerobic aquatic metabolism study $DT_{50}$ values range from 5.38 to 7.27 days. No acceptable anaerobic soil metabolism data have been submitted for iprodione.

Calculated degradation rates of iprodione SSD are slower than the degradation rates for the parent compound in all studies except the aqueous photolysis study in which RP30228 was not detected. Three studies had issues that precluded the use of the data to calculate the iprodione SSD degradation rates and model input half-lives. In an aerobic soil metabolism study (MRID 49726502), material balances in the sandy loam soil test system fell outside the guideline material balance threshold of 90-110% of the applied from Day 60 onward. Although the degradation rate for the parent could be calculated because the parent compound had largely degraded by that time point, reliable degradation kinetics for iprodione SSD could not be calculated. In an aerobic aquatic metabolism study (MRID 42503801), the total duration of the study was only 30 days, which was sufficient to follow the degradation of the parent but did not adequately capture the persistence of RP30228. This could lead to a significant underestimation of the degradation rate and model input half-life for iprodione SSD. Therefore, these aerobic soil and aerobic aquatic studies were not included in degradation rate calculations for iprodione

[10] Goring *et al*. (1975) provides the following persistence scale for aerobic soil metabolism half-lives:

- Non-persistent less than 15 days
- Slightly persistent for 15-45 days
- Moderately persistent for 45-180 days, and
- Persistent for greater than 180 days.

SSD model input half-life calculations. In an anaerobic aquatic metabolism study (MRID 41755801) the measured material balance decreased over the course of the study to as low as 67.3% of the applied, and the pattern of formation of RP30228 was erratic at the later time points. Therefore, these aerobic soil and aerobic aquatic studies were not included in degradation rate calculations for modeling and the anaerobic aquatic metabolism study was not included in iprodione Formation-Decline model input half-life calculations.

Iprodione SSD degrades slowly under biotic conditions with aerobic soil and aquatic metabolism study $DT_{50}$ values ranging from 19.1 to 119 and 263 to 2,098 days, respectively. Anaerobic aquatic metabolism study $DT_{50}$ values range from 456 to 672 days. Iprodione SSD is stable to hydrolysis at pH 5 to 9. Aqueous photolysis is not a major degradation pathway for iprodione plus RP30228 ($t_{1/2}$ = 64 d at pH 5, 25 °C, 28 °N sunlight) and the iprodione SSD is stable to photolysis on dry soil surface. The estimated atmospheric degradation rate and low vapor pressure suggests that the chemical would not be prone to long range atmospheric transport.

Major transformation products resulting from the environmental degradation of iprodione are:

- 3,5-dichloroaniline (3,5-DCA)
- 3-(1-methylethyl)-N-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide (RP30228)
- 3-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide (RP32490)
- [(dichloro-3,5-phenyl)-1-isopropylcarbamoyl-3]-2-acetic acid (RP35606)
- 1-(3,5-dichlorophenyl)-5-isopropyl biuret (RP36221)

## 5.2 Physical-Chemical and Fate Data for 3,5-Dichloroaniline

**Table 5-3.** summarizes the physical chemical properties of 3,5-DCA. The degradate 3,5-DCA is classified as slightly mobile on soil based on an average $K_{OC}$ value of 664 L/kg-organic carbon and the FAO classification system. It is not expected to ionize over the naturally occurring range of pH values. Based on the log $K_{OW}$ value of 2.9, the degradate 3,5-DCA is not expected to bioconcentrate and does not trigger the need for a separate sediment toxicity study. No BCF data are available for 3,5-DCA. It is classified as intermediately to highly volatile under field conditions and slightly volatile from water. The terrestrial field dissipation studies did not monitor for 3,5-DCA, which was not stable during storage in the aquatic field dissipation samples; therefore, 3,5-DCA concentrations could not be quantified.

**Table 5-3. Summary of Physical-Chemical, Sorption, and Bioconcentration Properties of the Iprodione Degradate 3,5-Dichloroaniline (3,5-DCA).**

| Parameter | Value[1] | Source/ Study Classification/ Comment |
|---|---|---|
| Molecular Weight (g/mole) | 162.01 | Based on chemical structure |

<table>
<tr><th>Parameter</th><th colspan="3">Value[1]</th><th>Source/<br>Study Classification/<br>Comment</th></tr>
<tr><td>Water Solubility at 23°C mg/L</td><td colspan="3">759</td><td>PubChem Database[11]</td></tr>
<tr><td>Vapor Pressure (Torr, 25 °C)</td><td colspan="3">$8.51 \times 10^{-3}$</td><td>Estimated value<br>Estimation Program Interface (EPI)Web Version 4.1. Intermediate to high volatility under field conditions.</td></tr>
<tr><td>Henry's Law constant at 20°C (atm-m$^3$/mole)</td><td colspan="3">$2.39 \times 10^{-6}$</td><td>Calculated from vapor pressure, solubility, and molecular weight.</td></tr>
<tr><td>Log Dissociation Constant (pKa)</td><td colspan="3">No dissociation between pH 1-12</td><td>PubChem Database</td></tr>
<tr><td>Log Octanol-water partition coefficient ($K_{ow}$) at 25°C (unitless)</td><td colspan="3">2.90</td><td>PubChem Database</td></tr>
<tr><td>Air-water partition coefficient ($K_{AW}$) (unitless)</td><td colspan="3">$9.94 \times 10^{-5}$</td><td>Calculated from vapor pressure, solubility, and molecular weight. Slightly volatile from a water surface.</td></tr>
<tr><td rowspan="8">Soil-Water Distribution Coefficients ($K_d$ in L/kg-soil or sediment)<br><br>Organic carbon normalized distribution coefficients (Koc in L/kg-organic carbon)</td><td>Soil/Sediment (%OC)</td><td>$K_d$</td><td>$K_{OC}$</td><td></td></tr>
<tr><td>sandy loam (0.59)</td><td>2.03</td><td>593</td><td rowspan="7">MRID 45114101. Supplemental<br>Based on CV. $K_{OC}$ is a better predictor of sorption than $K_d$.</td></tr>
<tr><td>loamy sand (2.05)</td><td>7.45</td><td>626</td></tr>
<tr><td>silt loam (4.49)</td><td>9.91</td><td>380</td></tr>
<tr><td>clay (1.89)</td><td>10.22</td><td>932</td></tr>
<tr><td>pond sediment (1.05)</td><td>4.93</td><td>788</td></tr>
<tr><td>Average</td><td>6.91</td><td>664</td></tr>
<tr><td>CV</td><td>0.50</td><td>0.31</td></tr>
</table>

CV=coefficient of variation

**Material balances** in the newly submitted aerobic aquatic and anaerobic aquatic metabolism studies (MRIDs 49726504 and 49726506, respectively) were below the guideline recommended 90-110% applied radioactively threshold for the majority of the sampling time points. The registrant proposed that this is due to loss of volatile degradates, such as monochloroanilines and other benzene derivatives, but did not provide any conclusive evidence to support that claim. To characterize this deficiency in the studies and to generate an upper-end bounding case estimate for the degradation rates, EFED calculated degradation kinetics for 3,5-DCA that incorporate the missing material balances. For any sample that was outside the guideline material balance threshold, EFED assumed 100% material balance for each sample and that the missing material was exclusively 3,5-DCA. For example, if a sample had an 85% material balance, the missing material balance would be 15% (100%-85%=15%). That 15% balance is assumed to be 3,5-DCA and was added to the observed concentration of 3,5-DCA in the study and used to calculate the 3,5-DCA+Material Balances degradation kinetics. Without including the additional material balanced, DT50 values for aerobic and anaerobic aquatic metabolism

[11] National Center for Biotechnology Information. PubChem Database. 3,5-Dichloroaniline, CID=12281, https://pubchem.ncbi.nlm.nih.gov/compound/3_5-Dichloroaniline (accessed on Nov. 12, 2019)

ranged from 12.3 to 26.1 and 91.2 to 103 days, respectively. Including the additional material balance increased the DT50 value ranges to from 78.6 to 113 and 192 to 197 days for aerobic and anaerobic aquatic metabolism, respectively.

Table 5-4 summarizes the degradation rates and representative model input half-lives from laboratory degradation data for 3,5-DCA. The 3,5-DCA degrades under biotic conditions, with aerobic soil $DT_{50}$ values ranging from 7.9 to 107; the 3,5-DCA is classified as non-persistent to moderately persistent based on the Goring scale.[12] Anaerobic aquatic metabolism study $DT_{50}$ values range from 91.2 to 103 days. The registrant did not submit any anaerobic soil metabolism studies. The 3,5-DCA is stable to hydrolysis and degrades rapidly under aqueous photolysis conditions ($t_{1/2}$ = 0.18 d at 33 °N sunlight). There are no acceptable soil photolysis data submitted for 3,5-DCA.

Material balances in the newly submitted aerobic aquatic and anaerobic aquatic metabolism studies (MRIDs 49726504 and 49726506, respectively) were below the guideline recommended 90-110% applied radioactively threshold for the majority of the sampling time points. The registrant proposed that this is due to loss of volatile degradates, such as monochloroanilines and other benzene derivatives, but did not provide any conclusive evidence to support that claim. To characterize this deficiency in the studies and to generate an upper-end bounding case estimate for the degradation rates, EFED calculated degradation kinetics for 3,5-DCA that incorporate the missing material balances. For any sample that was outside the guideline material balance threshold, EFED assumed 100% material balance for each sample and that the missing material was exclusively 3,5-DCA. For example, if a sample had an 85% material balance, the missing material balance would be 15% (100%-85%=15%). That 15% balance is assumed to be 3,5-DCA and was added to the observed concentration of 3,5-DCA in the study and used to calculate the 3,5-DCA+Material Balances degradation kinetics. Without including the additional material balanced, $DT_{50}$ values for aerobic and anaerobic aquatic metabolism ranged from 12.3 to 26.1 and 91.2 to 103 days, respectively. Including the additional material balance increased the $DT_{50}$ value ranges to from 78.6 to 113 and 192 to 197 days for aerobic and anaerobic aquatic metabolism, respectively.

**Table 5-4 Summary of Environmental Degradation Data for the Iprodione Degradate 3,5-Dichloroaniline (3,5-DCA).**

[12] Goring *et al*. (1975) provides the following persistence scale for aerobic soil metabolism half-lives:

- Non-persistent less than 15 days
- Slightly persistent for 15-45 days
- Moderately persistent for 45-180 days, and
- Persistent for greater than 180 days.

| Study | System Details | Degradation Rates (d) (kinetic model)[1] | | | | Representative Model Input Half-Lives[2] (d) | | Source/Study Classification/Comment |
|---|---|---|---|---|---|---|---|---|
| | | Parent | | Parent+Material Balance | | | | |
| | | $DT_{50}$ | $DT_{90}$ | $DT_{50}$ | $DT_{90}$ | Parent | Parent+ Material Balance | |
| Abiotic Hydrolysis | pH 5, 25 °C | Stable | Stable | - | - | - | - | MRID 49526513[N]. Acceptable |
| | pH 7, 25 °C | Stable | Stable | - | - | Stable (0) | N/D | |
| | pH 9, 25 °C | Stable | Stable | - | - | - | - | |
| Atmospheric Degradation | Hydroxyl Radical | 0.201 | | | | - | - | Estimated value Estimation Program Interface (EPI)Web Version 4.1 |
| Aqueous Photolysis | 33 °N sunlight | 0.18 | 0.18 | - | - | 0.18 | N/D | MRID 49664101[N]. Acceptable |
| Soil Photolysis | - | - | - | - | - | - | N/D | No acceptable soil photolysis study submitted |
| Aerobic Soil Metabolism | Sandy loam, pH 5.75, 25 °C | 50.2 (SFO) | - | - | - | 50.2 | N/D | MRID 43091002 |
| | Silt Loam, pH 6.9, 25 °C | 17.6 (SFO) | - | - | - | 17.6 | N/D | MRID 45239201. Supplemental |
| | Sandy Loam, pH 7.3, 25 °C | 7.9 (SFO) | - | - | - | 7.9 | N/D | |
| | silt loam, pH 6.7, 1.5 mg/kg application rate, 20 °C | 39.6 (SFO) | - | - | - | -- | N/D | MRID 48219201. For soils with multiple application rates, only the highest representative half-life was used to calculate model input half-life. |
| | silt loam, pH 6.7, 8.3 mg/kg application rate, 20 °C | 48.8 (SFO) | - | - | - | 48.8 | N/D | |
| | sand, pH 5.7, 1.5 mg/kg application rate, 20 °C | 59 (SFO) | - | - | - | -- | N/D | |
| | sand, pH 5.7, 8.3 mg/kg application rate, 20 °C | 107 (SFO) | - | - | - | 107 | N/D | |
| Anaerobic Soil Metabolism | - | - | - | - | - | - | - | No data submitted. |
| Aerobic Aquatic Metabolism | Rio Linda water:sandy loam, pH 6.3, 20 °C | 26.1 (SFO) | 86.7 (SFO) | 78.6 (DFOP) | 341 (DFOP) | 26.1 | 113 | MRID 49726504[N]. Supplemental Material balance ranged from 56.5-100.9 from 14 |

| Study | System Details | Degradation Rates (d) (kinetic model)[1] | | | | Representative Model Input Half-Lives[2] (d) | | Source/Study Classification/Comment |
|---|---|---|---|---|---|---|---|---|
| | | Parent | | Parent+Material Balance | | | | |
| | | $DT_{50}$ | $DT_{90}$ | $DT_{50}$ | $DT_{90}$ | Parent | Parent+ Material Balance | |
| | Goose River water:clay loam, pH 7.6, 20 °C | 12.3 (IORE) | 355 (IORE) | 113 (DFOP) | 767 (DFOP) | 107 | 282 | days after treatment (DAT) onward. Extraction protocol did not utilize multiple solvents with different dielectric constants. |
| Anaerobic Aquatic Metabolism | Rio Linda water:sandy loam, pH 6.3, 20 °C | 103 (IORE) | 1107 (IORE) | 197 (SFO) | 655 (SFO) | 333 | -[3] | MRID 49726506[N]. Supplemental Material balance ranged from 75.6-101.6% from 14 days after treatment onward. Extraction protocol did not utilize multiple solvents with different dielectric constants. |
| | Goose River water:clay loam, pH 7.6, 20 °C | 91.2 (IORE) | 2525 (IORE) | 192 (SFO) | 636 (SFO) | 760 | -[3] | |

d=days; SFO=single first order; DFOP=double first order in parallel; IORE=indeterminate order (IORE); SFO $DT_{50}$=single first order half-life; $T_{IORE}$=the half-life of a SFO model that passes through a hypothetical $DT_{90}$ of the IORE fit; DFOP slow $DT_{50}$=slow rate half-life of the DFOP fit, -=not available or applicable; SFO-LN=SFO calculated using natural log transformed data; N/D = parent+material balance kinetics not calculated for this study

[N] Studies submitted since the problem formulation was completed are designated with an N associated with the MRID number.

[1] The value used to estimate a model input value is the calculated SFO $DT_{50}$, $T_{IORE}$, or the DFOP slow $DT_{50}$ from the DFOP equation. The model chosen is consistent with that recommended using the, *Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media* (NAFTA, 2012).

[2] The calculated half-live values represent residues of 3,5-DCA plus the estimated missing material balance that is assumed to be 3,5-DCA.

[3] Representative model input half-lives for parent+material balance were less than for parent alone due to differences in kinetic model fit. The more conservative parent-only values were used in all aquatic modeling.

## 5.3 Field Dissipation Studies

### 5.3.1 Terrestrial Field Dissipation

Two terrestrial field dissipation studies are available for iprodione (both described in MRID 41877401). The studies were conducted on cropped plots in California and North Carolina. Both studies analyzed for iprodione and its degradate RP30228 but neither study monitored for the degradate 3,5-DCA. The results are summarized in **Table 5-5.**. The degradation kinetics for the terrestrial field dissipation studies were recalculated using PestDF software (v. 0.8.13) to examine the biphasic nature of the degradation. The values from laboratory studies are not directly comparable to the values from the field studies; however, it is informative to have some understanding of how the laboratory data compare to the loss rates in the field dissipation studies.

In the California study, iprodione was applied 8 times at 1 lb a.i/A to carrots with a 7-day retreatment interval. The field was monitored for 538 days after the final application. The maximum iprodione concentration in soil was 660 µg/kg-soil at 0 days after the final treatment and concentrations had decreased below the limit of detection (10 µg/kg-soil) from 299 days after treatment onward. Times to 50% and 90% dissipation of iprodione were 6.38 and 13.7 days, respectively. Iprodione was detected at 0-15 and 15-30 cm soil depths. Degradate RP30228 reached a maximum concentration of 470 µg/kg-soil at 28 days after the final treatment and was present at 160 µg/kg-soil at the study termination. The degradate RP30228 was detected at 0-15 and 15-30 cm, and 30-60 cm soil depths. The time to 50% and 90% dissipation for iprodione ROC were 43 and 702 days, respectively. This indicates that the degradation has significant biphasic character. This biphasic character is due to the persistence of RP30228, which was detected at concentrations of 160 µg/kg-soil from 414 days after treatment to the termination of the study at 538 days after treatment. This is consistent with laboratory studies, which found that iprodione can be rapidly converted to RP30228, which tends to be more persistent in both soil and aquatic systems.

In the North Carolina study, iprodione was applied 8 times at 1 lb a.i/A to carrots with a 7-day retreatment interval. The field was monitored for 539 days after the final application. The maximum iprodione concentration in soil was 220 µg/kg-soil at 0 days after the final treatment and concentrations had decreased below the limit of detection (10 µg/kg-soil) from 310 days after treatment onward. Times to 50% and 90% dissipation of iprodione were 0.35 and 75.3 days, respectively. Iprodione was not detected below 15 cm. Degradate RP30228 reached a maximum concentration of 50 µg/kg-soil at 7 days after the final treatment and concentrations had decreased below the limit of detection (10 µg/kg-soil) by 310 days after treatment onward. RP30228 was detected at 0-15 and 15-30 cm soil depths. The time to 50% and 90% dissipation for iprodione ROC were 3.13 and 659 days, respectively. This indicates that the degradation has significant biphasic character. Unlike in the California study where the concentration of RP30228 stayed constant during the latter portions of the study, the concentrations of RP30228 in the North Carolina study decreased over time, ultimately decreasing below the limit of detection before the end of the study. In both studies, the less mobile degradate RP30228 was detected at lower sampling depth than iprodione. It is unclear whether this was due to RP30228 leaching through the soil column or the degradation of iprodione to RP30228 at a lower sampling depth.

**Table 5-5. Summary of Terrestrial Field Dissipation Data for Iprodione and Iprodione plus the degradate RP30228.**

| System Details | $DT_{50}$ and $DT_{90}$ (days) (kinetic model) | | Deepest Core in Which ROC Found (cm) | Source/Study Classification/Comment |
|---|---|---|---|---|
| | Iprodione | Iprodione plus RP30228 | | |
| CA, San Juan Bautista Silt Loam, | $DT_{50}$ = 6.36<br>$DT_{90}$ = 45.5<br>(IORE) | $DT_{50}$ = 43<br>$DT_{90}$ = 702<br>(DFOP) | 30-60 | MRID 41877401. Acceptable. |

| System Details | $DT_{50}$ and $DT_{90}$ (days) (kinetic model) | | Deepest Core in Which ROC Found (cm) | Source/Study Classification/Comment |
|---|---|---|---|---|
| | Iprodione | Iprodione plus RP30228 | | |
| carrots, 0.5-0.9 %OM, pH 7-9-8.0 | | | | Degradation kinetics recalculated using PestDF |
| NC, Clayton loamy Sand, carrots , 0.5-0.8% OM, pH 6.2-6.8 | $DT_{50}$ = 0.345<br>$DT_{90}$ = 75.3<br>(IORE) | $DT_{50}$ = 3.13<br>$DT_{90}$ = 659<br>(IORE) | 15-30 | |

ROC=Residues of Concern
OM = Organic Matter

### 5.3.2 Aquatic Field Dissipation

Two aquatic field dissipation studies are available for iprodione (both described in MRID 43718301). The studies were conducted on rice paddies in Texas and Mississippi. The two sites were flooded for ~1 month before applications. Iprodione was applied twice to flooded rice paddies at 0.5 lb/acre at a 15-day interval at two sites (*i.e.*, 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 pH of the floodwaters 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, consistent with observed degradation rates of iprodione in aquatic metabolism studies. Sediment half-lives however were on the order of months. (**Table 5-6.**). The maximum iprodione concentrations detected in water were 489 and 550 µg/L in Texas and Mississippi, respectively. Maximum water concentrations of iprodione occurred day of the first application in Texas and on the day of the second application in Mississippi. Maximum sediment concentrations of iprodione observed in both studies were 42 and 49 µg/L in Texas and Mississippi, respectively. Maximum sediment iprodione concentrations were detected at two months and at two weeks after the second treatment in in Texas and Mississippi, respectively.

The maximum RP30228 concentrations detected in water were 57 and 35 µg/L in Texas and Mississippi, respectively. Maximum water concentrations of RP30228 occurred at two days after the first application in Texas and one week after the second application in Mississippi. Maximum sediment concentrations of RP30228 observed in both studies were 52 and 104 µg/L in Texas and Mississippi, respectively. Maximum sediment iprodione concentrations were detected at four months and at two months after the second treatment in in Texas and Mississippi, respectively. Based on these data, iprodione dissipated faster than RP30228, but there is some uncertainty as to whether that was due to RP30228 degrading more slowly than iprodione or due to iprodione degrading to form RP30228 over time. Degradate RP30228 also dissipated faster in field studies than in the aerobic aquatic metabolism.

Storage sample recoveries for 3,5-DCA were only 18%; therefore, this study is not suitable for characterizing the formation or persistence of 3,5-DCA. The major degradates observed at both sites were RP30228 and RP37176.

**Table 5-6. Summary of Aquatic Field Dissipation Data for Iprodione**

| System Details | $DT_{50}$ | | Source/Study Classification/Comment |
|---|---|---|---|
| | Iprodione | | |
| | Water | Sediment | |
| TX, Katy Fine Sandy Loam, Rice, pH 7.9 | 3.7 days | 3.4 months | MRID 43718301. Supplemental. Values reported for iprodione |
| MS, Sharkry Silty Clay Loam, Rice, pH 7.6 | 2.9 days | 4.1 months | |

# 6 Ecotoxicity Summary

Ecological effects data are used to estimate the toxicity of iprodione to surrogate species. The ecotoxicity data for iprodione and its associated products were reviewed previously in an ecological risk assessment for the California Red-Legged Frog (*Rana draytonii*; USEPA, 2009) and in a preliminary Problem Formulation for Registration Review (USEPA, 2012, DP Barcode 402502). Studies representing the most sensitive endpoints are summarized in **Section 6.1** and **Section 6.2**, and the remainder of the data are presented in **Appendix D**Appendix D**.** Various studies with terrestrial and aquatic plants, birds, and aquatic animals exposed to either technical grade active ingredient (TGAI) or the degradate 3,5-DCA were received since the preliminary Problem Formulation was issued in 2012, and the results of these newly received studies are also described briefly in this section**.**

A search of the public ECOTOXicology Knowledgebase in September 2019 yielded no new data from suitable studies with more sensitive (*i.e.*, lower) toxicity endpoints than those previously used in risk assessments.[13] For additional information on the Endocrine Disruptor Screening Program and its potential impact on toxicity endpoints see **Appendix A**.

**Table 6-1** and **Table 6-2** summarize the most sensitive measured toxicity endpoints available across aquatic and terrestrial taxa, respectively. These endpoints are not likely to capture the most sensitive toxicity endpoint for a particular taxon but capture the most sensitive endpoint across tested species for each taxon. All studies in these tables are classified as acceptable or supplemental. Non-definitive endpoints are designated with a greater than (‘>’) or less than (‘<’) symbol. Endpoints from newly submitted studies are designated with an ‘N’ superscript associated with EPA’s master record identification (MRID) number.

## 6.1 Aquatic Toxicity

[13] There were some endpoints that were lower in the ECOTOX report; however, the endpoints were not considered reliable for use in risk assessment.

The available data indicate that iprodione TGAI is moderately toxic to freshwater and estuarine/marine fish, and to estuarine/marine invertebrates (represented by *Americamysis bahia* and Eastern oyster) on an acute exposure basis. Iprodione is highly toxic to freshwater invertebrates on an acute exposure basis.

An acute toxicity study (MRID 49526509) with the freshwater fish Fathead Minnow (*Pimephales promelas*) was submitted, in which there was 60% mortality in the 6,930 µg a.i./L treatment group (the highest concentration tested), resulting in an $LC_{50}$ of 6,160 µg a.i./L. An acute static-renewal toxicity test (MRID 49526508) with Rainbow Trout (*Oncorhynchus mykiss*) was submitted since the preliminary Problem Formulation, in which there were no significant ($p < 0.05$) adverse effects on survival, resulting in an $LC_{50}$ greater than the highest concentration tested (>9,460 µg a.i./L).

In a 30-wk chronic toxicity study (MRID 49767901) with Fathead Minnow there were no significant ($p < 0.05$) adverse effects up to the highest tested concentration, resulting in a NOAEC of 85 µg a.i./L. A previously submitted early life stage study (ELS) with the Fathead Minnow (MRID 40550801) had a NOAEC/LOAEC of 260/550 µg a.i./L, based on a 10% reduction in larval survival at the LOAEC and a 42% reduction at the next highest concentration (1,100 µg a.i./L).

An acute estuarine/marine fish study with Sheepshead Minnow (*Cyprinodon variegatus*), had an $EC_{50}$ of >8,140 µg a.i./L (MRID 49526510) due to lack of mortality during the 96-h exposure. The 36-d chronic study with the Sheepshead Minnow used in previous assessments demonstrated no treatment-related effects on any parameter up to the highest concentration tested, resulting in a NOAEC of 57 µg a.i./L (MRID 49664102). There is some uncertainty associated with the chronic endpoints since both Sheepshead Minnow studies are based on unbounded endpoints (i.e., studies did not demonstrate definitive LOAEC values).

Two new chronic studies with the freshwater invertebrate waterflea (*Daphnia magna*) were submitted, one with parent iprodione (MRID 49653701) and the other with the degradate 3,5-DCA (MRID 49526511). The study conducted with parent iprodione resulted in a NOAEC of 288 µg a.i./L, with a statistically significant difference from the control noted at the LOAEC (557 µg a.i./L) for an 11% reduction in the number of young per adult and a 17% reduction in dry weight.

The chronic freshwater invertebrate study conducted with 3,5-DCA resulted in a NOAEC of 22 µg a.i./L[14], with a statistical difference from the control noted at the LOAEC (46 µg a.i./L) for a 25% reduction in dry weight and a 15% reduction in the number of young per adult per reproductive day. Based on available data, the degradate 3,5-DCA is 6 times more toxic than

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[14] The toxicity estimate for 3,5-DCA was normalized to the molecular weight of the parent compound by multiply the 3,5-DCA NOAEC of 22 µg a.i./L by the ratio of the molecular weight of parent (iprodione = 330.2 g/mol) divided by the molecular weight of 3,5-DCA (162.01 g/mol); ratio = 2.04.

the parent compound. Therefore, the converted NOAEC for the invertebrate study with 3,5-DCA is 45 µg a.i./L. .

A 96-hour static-renewal test with saltwater mysid (*Americamysis bahia*; MRID 49526507) was also submitted since the preliminary Problem Formulation. There was 70 and 100% mortality observed in the 2,720 and 5,680 µg a.i./L treatment groups, respectively resulting in an $LC_{50}$ of 2,240 µg a.i./L.

With a non-definitive $IC_{50}$ value of >12,640, the aquatic vascular plant duckweed (*Lemna gibba*; MRID 45741301) is less sensitive to iprodione than aquatic non-vascular plants. Toxicity studies with three non-vascular aquatic plant species (*i.e.*, the blue-green algae *Anabaena flos-aquae* (MRID 49526506); the freshwater diatom *Navicula pelliculosa* (MRID 49526505); and, the green algae *Raphidocelis subcapitata* (formerly *Pseudokirchneriella subcapitata*; MRID 49526504) were also submitted since the preliminary Problem Formulation (see **Appendix D**). The $IC_{50}$ and NOAEC values for the freshwater diatom were 2,864 µg a.i./L and 23 µg a.i./L, respectively; the $IC_{50}$ and NOAEC values for the green algae were >5,170 and 568 µg a.i./L, respectively; and the $IC_{50}$ and NOAEC for the blue-green algae were 5,548 and 641 µg a.i./L, respectively. According to available data and based on the $IC_{50}$, the saltwater diatom *Skeletonema costatum* (MRID 41604109) is the most sensitive of the aquatic vascular and non-vascular plants tested to date with an $IC_{50}$ and NOAEC of 330 and 30 µg a.i./L, respectively.

**Table 6-1 Acute and Chronic Aquatic Toxicity Endpoints Selected for Risk Estimation for Iprodione**

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value in µg a.i./L (unless otherwise specified) | MRID or ECOTOX No./ Classification | Comments |
|---|---|---|---|---|---|
| **Freshwater Fish (Surrogates for aquatic phase amphibians)** | | | | | |
| Acute | TGAI | Fathead Minnow *(Pimephales promelas)* | 96-h $LC_{50}$ = 6,160 | 49526509[N] Acceptable | Moderately toxic |
| Chronic | | | 30-w NOAEC = 84.9 LOAEC >84.9 | 49767901[N] Acceptable | No effects on growth or reproduction up the highest tested concentration. |
| | | | 34-d NOAEC = 260 LOAEC = 550 | 40550801 Supplemental | 10% reduction in larval survival at LOAEC, 42% reduction at next highest level (1,100 µg a.i./L) |
| **Estuarine/Marine Fish** | | | | | |
| Acute | TGAI | Sheepshead Minnow *(Cyprinodon variegatus)* | 96-h $LC_{50}$ >8,140 | 49526510[N] Supplemental | Moderately toxic due to 30% mortality at highest tested concentration |
| Chronic | | | 36-d NOAEC = 57.4 LOAEC >57.4 | 49664102 Acceptable | No effects on growth or reproduction up the highest tested concentration. |
| **Freshwater Invertebrates (Water-Column Exposure)** | | | | | |

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value in µg a.i./L (unless otherwise specified) | MRID or ECOTOX No./ Classification | Comments |
|---|---|---|---|---|---|
| Acute | TGAI | Water Flea (*Daphnia magna*) | 48-h $EC_{50}$ = 240 | 41642001 Supplemental | Highly toxic |
| Chronic | 3,5-DCA | | 21-d NOAEC = 22 LOAEC = 46 | 49526511[N] Acceptable | 25% reduction in dry weight and 15% reduction in number of young per adult per reproductive day |
| | TGAI | | 21-d NOAEC = 288 LOAEC = 557 | 49653701[N] Acceptable | 11% reduction in number of young per adult per reproductive day and 17% reduction in dry weight |
| **Estuarine/Marine Invertebrates (Water-Column Exposure)** | | | | | |
| Acute | TGAI | Mysid Shrimp (Americamysis bahia) | 96-h $LC_{50}$ = 2,240 | 49526507[N] Acceptable | Moderately toxic |
| Chronic | | | 28-d NOAEC = 7.5 LOAEC = 14 | 40832201 Supplemental | 29% reduction in number of offspring per female per reproductive day |
| **Freshwater Invertebrate (Sediment Exposure)** | | | | | |
| No data available. | | | | | |
| **Estuarine/ Marine Invertebrates (Sediment Exposure)** | | | | | |
| No data available. | | | | | |
| **Mollusks (Water Column Exposure)** | | | | | |
| Acute Shell Deposition | TGAI | Eastern Oyster *(Crassostrea virginica)* | 96-h $EC_{50}$ = 2,300 | 40489202 Supplemental | Moderately toxic |
| **Aquatic Vascular and Non-vascular Plants** | | | | | |
| Vascular | TGAI | Duckweed *(Lemna gibba)* | $IC_{50}$ >12,640 NOAEC = 12,640 LOAEC >12,640 | 45741301 Supplemental | 7-d duration; no effect study |
| Non-Vascular | TGAI | Marine Diatom (*Skeletonema costatum*) | $IC_{50}$ = 330 NOAEC = 30 | 41604109 Acceptable | 120-hour duration; 15% reduction in cell growth at LOAEC |

TGAI=Technical Grade Active Ingredient; a.i.=active ingredient; d=days; w=weeks

[N] Studies submitted since the Problem Formulation was completed are designated with an N associated with the MRID number.

>Greater than values designate non-definitive endpoints where no effects were observed at the highest level tested, or effects did not reach 50% at the highest concentration tested (USEPA, 2011).

## 6.2 Terrestrial Toxicity

Iprodione is slightly toxic to birds on both an acute oral and sub-acute dietary exposure basis; iprodione is also slightly toxic to mammals on an acute oral exposure basis. No data are currently available to assess the toxicity of iprodione to larval honey bees on an acute oral exposure basis. Iprodione is practically nontoxic to adult honey bees on an acute contact and oral exposure basis.

In a newly submitted 11-day sub-acute dietary toxicity study with the Zebra Finch (*Taeniopygia guttata*) resulted in an $LC_{50}$ value of 1,800 mg a.i./kg-diet (MRID 49526512). Preliminary work showed that finches regurgitated single oral doses; therefore, a subacute dietary toxicity study was conducted. In a chronic, 18-week, reproductive toxicity test with the Bobwhite Quail (Accession Number 00099126) there was a 27% ($p < 0.05$) decrease in the number of normal hatchlings of eggs set, a 24% reduction in the number of eggs laid and a 5% reduction in hatching body weight at the LOAEC of 1,000 mg a.i./kg-diet.

No new mammalian data have been submitted since the preliminary Problem Formulation. The most sensitive chronic endpoint is from a 2-generation reproductive toxicity test, in which parental body weight gain (6-7% reductions) and food consumption in both sexes (8% reduction) were significantly different from controls ($p < 0.05$). General conclusions from the study report were that the overall NOAEC for systemic toxicity was 300 mg/kg, 1000 mg/kg for effects on offspring (viability and growth) and 3000 mg/kg for reproductive toxicity (MRID 41871601). A 2-year carcinogenicity test had a lower endpoint (NOAEC 150 mg/kg) but was based on non-apical endpoints and was therefore not used to estimate chronic risk levels of concern.

A combination acute oral and contact study with adult honey bees (*Apis mellifera*) has been submitted (MRID 50586102) and is currently under review. An initial cursory review of the data indicated that there were no adverse effects on adult honey bees from either acute oral or contact exposure up to a dose of 100 µg a.i./bee. In a newly submitted chronic toxicity test (21-d) with larval honey bees adult emergence was reduced by 67-100% in the two highest concentration treatment groups (43 and 150 µg a.i./bee), resulting in a NOAEL and LOAEL of 30 and 43 µg a.i./bee, respectively (MRID 49526514). A surrogate 8-day $LC_{50}$ was unable to be calculated from the 21-day chronic honey bee larval toxicity test due to lack of mortality at the highest tested concentration on Day 8.

Finally, no adverse effects on growth or survival were observed in two new terrestrial plant toxicity studies from either exposure by germinating seeds in treated soil (MRID 49526502) or foliar exposure by young plants (MRID 49526503) to the typical end-use product Rovral™ Flowable Fungicide (41.8% a.i.) up to a rate of 7.62 lb a.i./A.

**Table 6-2. Acute and Chronic Terrestrial Toxicity Endpoints Selected for Risk Estimation for Iprodione.**

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value[1] | MRID/Accession No. & Classification | Comments |
|---|---|---|---|---|---|
| **Birds (Surrogates for Terrestrial Amphibians and Reptiles)** | | | | | |

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value[1] | MRID/Accession No. & Classification | Comments |
|---|---|---|---|---|---|
| Acute Oral | TGAI | Northern Bobwhite Quail *(Colinus virginianus)* | 6-d $LD_{50}$ = 930 mg a.i./kg-bw | Acc. No. 00232703 Supplemental | Slightly toxic |
| Sub-acute dietary | TGAI | Zebra Finch (*Taeniopygia guttata*) | 11-d $LC_{50}$ = 1,800 mg ai/kg-diet | 49526512[N] Acceptable | Slightly toxic; preliminary work showed that finches regurgitated single oral doses; therefore requiring a dietary study. |
| Chronic | TGAI | Northern Bobwhite Quail *(Colinus virginianus)* | 18-w NOAEC = 300 LOAEC = 1000 mg ai/kg-diet | Acc. No. 00099126[N] Acceptable | Reductions in normal hatchlings of eggs set (27%), number of eggs laid (24%) and body weights (5%) of hatchlings at the LOAEC. |
| **Mammals** | | | | | |
| Acute Oral | TGAI | Laboratory Rat (*Rattus norvegicus*) | $LD_{50}$ = 1,160 mg ai/kg-bw | Acc. No. 00236497 | Slightly toxic |
| 2-generation Reproductive Toxicity | TGAI | | 12-m NOAEC = 300 LOAEC = 1,000 mg ai/kg-diet | 41871601 Acceptable | Decreased parental body weight gain (10-19%) and food consumption (2-11%) in both sexes |
| **Terrestrial Invertebrates** | | | | | |
| Acute contact (adult) | TGAI | Honey Bee *(Apis mellifera)* | $LD_{50}$ >100 | 50586102[N] (Under review) | 8% mortality observed in 100 µg a.i./bee treatment; practically nontoxic |
| Acute oral (adult) | TGAI | | $LD_{50}$ >100 | 50586102[N] (Under review) | 6% mortality observed in 100 µg a.i./bee treatment; practically non-toxic |
| Chronic oral (adult) | No data available. | | | | |
| Acute oral (larval) | No data available. | | | | |

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value[1] | MRID/Accession No. & Classification | Comments |
|---|---|---|---|---|---|
| Chronic oral (larval) | TGAI | Honey Bee *(Apis mellifera)* | 21-d NOAEL = 7.5 LOAEL = 11 µg ai/larva/day | 49526514[N] Supplemental | 67% reduction in adult emergence at the LOAEL |
| Foliage Residue | No data available. | | | | |
| Semi-field study or full field study) | No data available. | | | | |
| **Terrestrial Plants** | | | | | |
| Seedling Emergence | Rovral™ Flowable (41.8% iprodione) | Various | 21-d<br><br>Dicots (all): $IC_{25}$ ≥7.62 lb a.i./A; NOAEC = 7.62 lb a.i./A (oilseed rape), 8.61 lb a.i./A (all other dicots)<br><br>Monocots (all): $IC_{25}$ ≥7.62 lb a.i./A; NOAEC = 7.62 lb a.i./A (onion), 8.61 lb a.i./A (all other monocots) | 49526502[N] Acceptable | There were no significant adverse effects on growth or survival. |
| Vegetative Vigor | Rovral™ Flowable (41.8% iprodione) | Various | 21-d<br><br>Monocot/Dicot: $IC_{25}$ ≥7.62 lb a.i./A; NOAEC = 7.62 lb a.i./A | 49526503[N] Acceptable | There were no significant adverse effects on growth. |

TGAI=Technical Grade Active Ingredient; a.i.=active ingredient; d = day; w = week; m = month

[N] Studies submitted since the Problem Formulation was completed are designated with an N associated with the MRID number.

[1] NOAEC and LOAEC are reported in the same units.

>Greater than values designate non-definitive endpoints where no effects were observed at the highest level tested, or effects did not reach 50% at the highest concentration tested (USEPA, 2011).

< Less than values designate non-definitive endpoints where growth, reproductive, and/or mortality effects are observed at the lowest tested concentration.

### 6.3 ECOSAR Analysis

Because there was limited empirical data submitted for degradates of iprodione, a QSAR analysis was conducted using the Ecological Structure Activity Relationships (ECOSAR; https://www.epa.gov/tsca-screening-tools/ecological-structure-activity-relationships-ecosar-predictive-model) predictive model to estimate toxicity values for parent iprodione and the following degradates that were present at 10% or greater in one of the available environmental metabolism studies: 3,5-DCA, RP30228, RP32490 and RP35606. The ECOSAR analyses (see **Appendix B**) revealed four structurally similar chemical classes for parent iprodione, namely amides, imides, substituted ureas and neutral organics. The neutral organics were shared by the parent and 3,5-DCA, RP30228 and RP32490, while amides and imides were shared by the parent, RP32490 and RP30228 only; anilines were shared by the parent and 3,5-DCA only; and, substituted ureas were shared by the parent and RP30228, RP32490 and RP35606. The degradate RP35606 also contained amide-acids and imide-acids, but these chemical classes were not shared with parent iprodione (**Appendix B**).

Following EFED's standard toxicity comparison procedure for the use of ECOSAR (USEPA, 2018), all four degradates had estimated toxicity endpoints within 10x of the parent. However, based on the ECOSAR-based estimated toxicity values, RP30228 is the only degradate with roughly equivalent toxicity to parent iprodione and is the only degradate included with parent iprodione in the estimation of toxicity for total residues. Iprodione and RP30228 are structural isomers of each other; and based on their structural similarity they are assumed to have similar mode of action and toxicity. Due to the differences in proposed mechanism of action and measured toxicity values between iprodione and 3,5-DCA, the exposure risks for iprodione and RP30228 are assessed separately from 3,5-DCA. Two other degradates of iprodione: RP32490 (*i.e*., 3-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide and RP35606 (*i.e*., [(dichloro-3,5-phenyl)-1-isopropylcarbamoyl-3]-2-acetic acid) were included in an ECOSAR analysis (**Appendix B**) along with the parent iprodione, 3,5-DCA and RP30228, but were excluded from the residues of concern. The degradates RP32490 and RP35606 were not predictive of measured parent toxicity endpoints, and the maximum concentrations observed in fate studies were typically <10% AR, therefore the exposure risk for RP32490 and RP35606 is low.

### 6.4 Incident Data

The Incident Data System (IDS) provides information on available ecological incidents associated with the use of pesticides, including those incidents that have been aggregately reported to the EPA between the time of initial registration to when the database was searched in October 2019. **Table 6-3** provides a summary of the available incident data, which are also discussed in more detail in the risk assessment sections below.

A review of the Incident Data System (IDS) indicated a total of 28 ecological incidents (occurring between 1992-2017) associated with the use of iprodione; however, this total includes incidents classified as 'unlikely.' Only 20 incidents with a certainty category ranging from 'possible' to 'highly probable' are summarized in **Table 6-3.** One incident involved aquatic animals, 16 incidents involved terrestrial plants, and three incidents involved terrestrial organisms (*i.e*., honey bees). Of the 20 reported incidents, 17 of the incidents were considered to reflect registered uses at the time of the incident, and the legality of use was undetermined in 3 of the incidents. Two of the incidents involved additional chemicals besides iprodione.

Although risks of iprodione to terrestrial plants are not expected based on the available toxicity data and exposure models, there are 16 plant incidents associated with iprodione in the IDS database. The reported incidents occurred between 2002 and 2010 and impacted anywhere from a portion of one acre to a total of 80 acres of plants (*i.e.,* tulips, blueberries, non-specified plants). In one incident (I013636-027, 2002), 6 acres of tulips were damaged (twisting of leaves); however, the incident reported that in addition to Chipco™ 26019 (50% iprodione), Gallery™ 75DF® (75% isoxaben; CAS No. 82558-50-7 ) was used along with Roundup™ (2% glyphosate; CAS No. 1071-83-6), Elevate™ (50% fenhexamid; CAS No. 126833-17-8), Awaken™ (20% Nitrogen) and Hoelon™ (34.7% diclofop-methyl; CAS No. 51338-27-3). There were 14 incidents in 2003 (I014027-001 through I014027-014) involving blueberries, specifically Rabbiteye blueberry plants, a hybrid variety of blueberry. The plants were damaged (with a primary symptom of leaf burn) after being treated with Rovral™ 4F (41.6% iprodione), which was, at the time, approved for highbush and lowbush varieties of blueberries. As a result of the 14 incidents, Bayer issued a label amendment to restrict the use of Rovral™ 4F on variety of blueberries. At the present time, this product (EPA Reg. #264-482) is not registered for use on any variety of blueberry. Additionally, one incident in 2010 (I021913) involved phytotoxicity (*i.e.*, plant bleaching, veining, necrosis and death) to various horticultural nursery plants following field and greenhouse application of Chipco™ 26019 (50% iprodione).

A single incident involving fish occurred in 1992 (I000910), in which a fish kill was reported in a subdivision located near a golf course that had emptied its culverts into a drainage canal feeding into the affected lake adjacent to the subdivision. The number of affected fish was not reported, other than to note that bream and other sunfish, perch, minnow, catfish and gars were killed.

There were three reported incidents involving honey bees (I020302, I023830 and I029770). In the first reported incident, brood (bee eggs, larvae and pupae) losses followed applications of Rovral™ (41.6% iprodione) to blooming almond orchards. The magnitude of the effect to the brood near the orchards was not reported. In the second incident, a 20% loss in 80 colonies was reported after adult honey bees that were reportedly “bearding” the outside of the colonies and were indirectly sprayed during an application of Rovral™ (41.6% iprodione) to a cherry orchard. The third incident was a follow up to a report of dying hives in California. The report indicated that “thousands of bees” were incapacitated or dead. Samples were taken in hives <0.5 to 3 miles from a nectarine orchard where Rovral™ had been applied. Within the samples, 23 pesticides were detected including 10 fungicides, 4 insecticides, 4 herbicides, 2 acaracides, 2 insect growth regulators and 1 synergist. Within the bee samples, chemicals detected with the highest frequency included the amitraz (CAS No. 33089-61-1) degradate N-(2,4-dimethylphenyl)formamidine (DMPF; CAS No. 33089-74-6), chlorpyrifos (CAS No. 2921-88-2), iprodione, oxyflurofen (CAS No. 42874-03-3), pendimethalin (CAS No. 40487-42-1), tebuconazole (CAS No. 107543-96-3), and propiconazole (CAS No. 60207-90-1). Iprodione was measured in the bee bread samples from symptomatic colonies (<0.5 miles from the treated orchard) at concentrations of 54,200 µg/kg and was detected in the second highest quantity compared to the other chemicals (tebuconazole was detected at the highest concentration of

85,581 µg/kg). The bee-related incidents provide evidence that mortality has been observed in the field with some probability of being associated with the application of iprodione in close proximity (≤0.5 miles) to bee hives. One incident appears to have involved the loss of adult bees; however, there are empirical data available on chronic toxicity of iprodione to adult bees with which to make comparisons.

In addition to the incidents recorded in the IDS, additional incidents have been reported to the Agency in aggregated incident reports (**Table 6-4**). Pesticide registrants report certain types of incidents to the Agency as aggregate counts of incidents occurring per product quarter. Ecological incidents reported in aggregate reports include those categorized as 'minor fish and wildlife' (W-B), 'minor plant' (P-B), and 'other non-target' (ONT) incidents. 'Other non-target' incidents include reports of adverse effects to insects and other terrestrial invertebrates. For iprodione, registrants have reported no minor fish and wildlife incidents, 11 minor plant incidents and no other non-target incidents. Unless additional information on these aggregated incidents becomes available, they will be assumed to be representative of registered uses of iprodione.

**Table 6-3 Iprodione Incidents from the Incident Data System (IDS)**

| Incident Number | Year | State | Product and Additional Active Ingredients | Legality | Certainty Index | Use Site | Species | Magnitude/Other Notes |
|---|---|---|---|---|---|---|---|---|
| **Plant** | | | | | | | | |
| I013636-027 | 2002 | OR | Chipco™ 26019 | Registered Use | Possible | Ornamental | Tulips | 6 acres |
| I014027-001, 002 and 003 | 2003 | GA | Rovral™ 4F | Registered Use | Highly Probable | Blueberry | Blueberry | 001: 64% of 16 acres; 002: 64% of 35 acres; 003: 50% of 30 acres |
| I014027-004 | 2003 | MS | Rovral™ 4F | Registered Use | Highly Probable | Blueberry | Blueberry | 80 acres |
| I014027-005-014 | 2003 | GA | Rovral™ 4F | Registered Use | Highly Probable | Blueberry | Blueberry | 005: 47% of 7 acres<br>006: 40% of 40 acres<br>007: 33% of 20 acres<br>008: 33% of 8 acres<br>009: 33% of 2 acres<br>010: 30% of 30 acres<br>011: 31% of 22 acres<br>012: 25% of 25 acres<br>013: 13% of 2 acres<br>014: 40% of 1 acre |
| I021913-013 | 2010 | CA | Chipco™ 26019 | Undetermined | Possible | Nursery | Unknown | Adverse effects noted for an unknown number of plants in a greenhouse and on a field. |
| **Bee** | | | | | | | | |
| I020302-002 | 2016 | CA | Rovral™ | Undetermined | Probable | Agricultural area | Honey Bee | Brood loss observed after application of Rovral to blooming almonds |
| I023830-001 | 2012 | CA | Rovral™ | Registered Use | Highly Probable | Orchard | Honey Bee | 20% of 80 colonies |
| I029770-000 | 2017 | CA | Iprodione detected in bee bread (54,200 µg/kg), along with many other pesticides | Undetermined | Possible | Agricultural area | Honey Bee | Thousands |

| Incident Number | Year | State | Product and Additional Active Ingredients | Legality | Certainty Index | Use Site | Species | Magnitude/Other Notes |
|---|---|---|---|---|---|---|---|---|
| **Fish** | | | | | | | | |
| I000910-001 | 1992 | LA | Chipco™ 26019 | Registered Use | Possible | Turf, Golf Course | Minnow, bream and other sunfish, gar, perch, catfish | Fish killed. Culverts from nearby golf course were drained into a drainage canal which fed into Lake Pontchartrain, not reported how many fish were impacted |

**Table 6-4 Iprodione Aggregate Incidents from the Incident Data System (IDS)**

| Taxa | Number of Incidents |
|---|---|
| Vertebrate Wildlife (W-B) | 0 |
| Plant (P-B) | 11 |
| Non-vertebrate (ONT) | 0 |

Aggregated Incident Types: W-B= minor fish and wildlife; P-B= minor plant; ONT=Other Non-target

[1] Aggregated incidents are only reported as a count based measure.

# 7 Analysis Plan

## 7.1 Overall Process

This assessment uses a weight-of-evidence approach that relies heavily, but not exclusively, on a risk quotient (RQ) method. The RQs are calculated by dividing an estimated environmental concentration (EEC) by a toxicity endpoint (*i.*e., EEC/toxicity endpoint). This is a way to determine if an estimated concentration is expected to be above or below the concentration associated with the toxicity endpoint. The RQs are compared to regulatory levels of concern (LOCs). The LOCs for non-listed species are meant to be protective of community-level effects. For acute and chronic risks to terrestrial and aquatic vertebrates, the LOCs are 0.5 and 1.0, respectively, and for terrestrial and aquatic plants, the LOC is 1.0. The acute and chronic risk LOCs for bees are 0.4 and 1.0, respectively. In addition to RQs, other available data (*e.g.*, incident data) can be used to help characterize the potential risks associated with the use of the pesticide.

Representative use patterns were selected for the risk assessment to present the range of potential risk and to provide an understanding of potential risk for unique use patterns. Selection of uses evaluated are described in **Section 3.2**.

## 7.2 Modeling

Various models are used to calculate aquatic and terrestrial EECs (see **Table 7-1** for the specific models used in this assessment are discussed further below.

**Table 7-1. List of the Models Used to Assess Environmental Risk**

| Environment | Taxa of Concern | Exposure Media | Exposure Pathway | Model(s) or Pathway |
|---|---|---|---|---|
| Aquatic | Vertebrates/ Invertebrates (including sediment dwelling) | Surface water and sediment | Runoff and spray drift to water and sediment | PWC version 1.52[2] |
| | Aquatic Plants (vascular and nonvascular) | | | |
| Terrestrial | Vertebrate | Dietary items | - Dietary residues from liquid sprays (includes residues on foliage, seeds/pods, arthropods, and soil)<br>- Non specified exposure pathway (*e.g.*, $LD_{50}/ft^2$)<br>- Ingestion of seeds | T-REX version 1.5.2[4]<br>-Kenaga nomogram (for liquid foliar sprays)<br>- $LD_{50}/ft^2$ index<br>- ingestion of treated seeds calculations<br>- ingestion of granules calculations |

| Environment | Taxa of Concern | Exposure Media | Exposure Pathway | Model(s) or Pathway |
|---|---|---|---|---|
| | | | - Ingestion of granules<br><br>-Consumption of aquatic organisms | Refinements for Treated Seed (USEPA, 2016)<br><br>KABAM version 1.0[5] |
| | Plants | Spray drift/runoff | Runoff and spray drift to plants | TERRPLANT version 1.2.2 |
| | Bees and other terrestrial invertebrates | Contact Dietary items | Spray contact and ingestion of residues in/on dietary items as a result of direct application | BeeREX version 1.0 |
| All Environments | All | Movement through air to aquatic and terrestrial media | Spray drift | AgDRIFT™ version 2.1.1 (Spray drift) |

[1] Sediment analysis is recommended when the soil-water distribution coefficient ($K_d$) ≥50-L/kg-soil; the log $K_{OW}$≥3; or the $K_{OC}$ ≥ 1,000 L/kg-organic carbon. Analysis of risk in sediment from exposure in pore water may also occur if aquatic invertebrates are particularly sensitive, as it is expected that risk quotients (RQ) values will exceed Levels of Concern (LOCs) even if the sediment is not the primary exposure media.

[2] The Pesticide in Water Calculator (PWC) is a Graphic User Interface (GUI) that estimates pesticide concentration in water using the Pesticide Root Zone Model (PRZM) and the Variable Volume Water Model (VVWM); collectively PRZM-VVWM.

[3] The Terrestrial Residue Exposure (T-REX) Model is used to estimate pesticide concentration on avian and mammalian food items. For liquid applications to bare soil, arthropod and seed residues estimated from the Kenaga nomogram are possible dietary exposure routes on the field and foliar residues estimate exposure adjacent to the field and that may occur with spray drift.

[4] The $K_{OW}$-based Aquatic Bioaccumulation Model (KABAM) is used to estimate exposure for terrestrial animals that may consume aquatic organisms when a chemical has the potential to bioconcentrate or bioaccumulate. The general triggers for running this model include: the pesticide is a non-ionic, organic chemical; the Log $K_{OW}$ value is between 3 and 8; and, the pesticide has the potential to reach aquatic habitats.

# 8 Aquatic Organisms Risk Assessment

## 8.1 Aquatic Exposure Assessment

### 8.1.1 Modeling Inputs

Surface water aquatic modeling was simulated using the Pesticide in Water Calculator (PWC version 1.52) for terrestrial use patterns (including seed treatment applications to carrot seed). As discussed earlier, separate EECs were developed for iprodione, iprodione plus degradate RP30228 (iprodione SSD), as well as for modeling 3,5-DCA alone. Most of the EECs for iprodione plus RP30228 were calculated using a Total Residue (TR) approach based on information described in **Section 5**. Chemical input parameters used in parent and Total Residues modeling are presented in **Table 8-1** and **Table 8-2**. Input parameters specific to the application scenario are specified in **Table 8-3** based on the use information described in **Section 3.2.** Input parameters were selected in accordance with EFED's guidance documents (USEPA, 2009a, 2010b, 2013a, 2013b, 2014a, 2014b, 2015a; USEPA and Health Canada, 2012). See **Section 3.2.1** of the analysis plan for an explanation of which uses were simulated in aquatic modeling. The Biological and Economic Evaluation Division (BEAD) provided recommended dates for the first day of application simulated use patterns (USEPA, 2019a).

One uncertainty in the Total Residues approach is that it does not account for the difference in mobility between the parent and degradates. The standard Total Residues method uses the mobility of the most mobile residue of concern as the model input value. Since the average $K_{OC}$ of RP30228 is 13x greater than the mobility of the parent, the Total Residues method will overestimate the EECs of Iprodione plus RP30228. To better characterize this uncertainty, EFED calculated upper bound EECs for the turf and the 3 crop cycle lettuce-broccoli-lettuce rotation using the Formation-Decline method described in the 2020 iprodione Drinking Water Assessment (DP Barcode 457547).

Since the previous ecological risk assessment was completed, several new environmental fate studies for iprodione and 3,5-DCA are available; new aerobic soil metabolism, aerobic aquatic metabolism, and anaerobic aquatic metabolism data are available for iprodione and new aqueous hydrolysis, aqueous photolysis, aerobic aquatic metabolism and anaerobic aquatic metabolism data for the degradate 3,5-DCA (USEPA, 2009b). Additionally, new guidance on the selection of residues of concern for ecological effects changed the ROC from iprodione plus all major degradates that contain the 3,5-DCA moiety to only iprodione plus RP30228 and 3,5-DCA (See **Section 4**). The 2009 ecological risk assessment treated iprodione residues of concern (iprodione plus major degradates) as stable to hydrolysis, aerobic soil metabolism, aerobic aquatic metabolism, and anaerobic soil metabolism. The Pesticides in Water (PWC) model inputs (**Table 8-1**) for iprodione and iprodione SSD were recalculated based on these new assumptions. None of the new model input half-lives are stable except for aqueous hydrolysis, which is treated as stable to prevent double counting any hydrolysis that occurred during the aquatic metabolism studies. The available aqueous photolysis study did not specify a reference latitude, instead providing data in terms of Florida sunlight (MRID 41861901). EFED assumed a reference latitude of 28 °N based on the latitude of the midpoint of the state. While there is some uncertainty in this assumption, the magnitude of effect on the modeled EECs is likely to be small due to the long photolysis half-life of iprodione. Additionally, it is now recommended that the daily average value be used to calculate acute risk quotients for aquatic organisms rather than the peak value used in previous risk assessments (USEPA, 2017).

**Table 8-1. Aquatic Modeling Input Parameters for the Pesticide in Water Calculator (PWC) Chemical Tab for Iprodione and Iprodione Total Residues (TR=iprodione + RP30228).**

| Parameter (units) | Value (s) | | Source | Comments |
|---|---|---|---|---|
| | Parent | Iprodione plus RP30228[1] | | |
| $K_{FOC}$ ((µg/g-organic carbon)/(µg/mL)$^{1/n}$) | 426 | 426 | MRID 43349202 | Average organic carbon normalized sorption value. The parent was the most mobile compound. The coefficient of variation for the parent was 34% for $K_{FOC}$ and 146% for $k_F$, indicating that $k_{FOC}$ is a better predictor of the variability in sorption than $k_F$. Linear sorption coefficients were not previously calculated for use in modeling. |
| Water Column Metabolism Half-life (days) at 20°C | 11.7 | 3,900 | MRID 42503801 49726503 | Represents the 90 percent upper confidence bound on the mean of the representative half-life values from aerobic aquatic metabolism studies. MRID 42503801 study data was only used for the parent only simulation. |
| Benthic Metabolism Half-life (days) at 20°C | 16.0 | 896 | MRID 49726505 | Represents the 90 percent upper confidence bound on the mean of 2 representative half-life values from anaerobic aquatic metabolism studies. |
| Aqueous Photolysis Half-life (days)@ pH 7 | 64 | 64 | MRID 41861901 | One measured value for parent. Value provided in equivalent days of Florida (latitude range 24.4-31.0 °N) sunlight without specifying latitude. Assumed 28 °N reference latitude based on midpoint of latitude range of Florida. |
| Hydrolysis Half-life (days) | Stable (0) | Stable (0) | MRID 41885401 | Assumed that the aquatic metabolism studies capture both biotic and abiotic degradation. Therefore, hydrolysis degradation rate was set to 0 (stable) to prevent double counting loss. |
| Soil Half-life (days) at 25 °C | 261 | 490 | MRID 43091002 49726502 | Represents the 90 percent upper confidence bound on the mean of representative half-life values from aerobic soil metabolism studies. Data from the sandy loam soil system of MRID 49726502 excluded from model input calculations due to low material balance. |
| Foliar Half-life (days) | 0 | | - | No data available. Assumed to be stable |
| Molecular Weight (g/mol) | 330.2 | | - | Parent value based on chemical structure |
| Vapor Pressure (Torr) at 25°C | $2.7 \times 10^{-7}$ | | MRID 47778802 | Parent value |
| Solubility in Water (mg/L) | 13 | | MRID 47778802 | Parent value. |
| Unitless Henry's Law Constant | $3.69 \times 10^{-7}$ | | - | Calculated in PWC from the molecular weight, vapor pressure, and water solubility. |

Since the 2009 assessment for iprodione, EFED received new hydrolysis, aqueous photolysis, aerobic aquatic metabolism and anaerobic aquatic metabolism data for the degradate 3,5-DCA. While these data have some uncertainties due to material balance issues in several studies, the 3,5-DCA fate dataset is sufficient to generate surface water EECs for 3,5-DCA without assuming stability. The PWC model input parameters for 3,5-DCA and 3,5-DCA plus material balances are shown in **Table 8-2.**

In an earlier ecological risk assessment, EPA generated bounding case estimates of 3,5-DCA concentrations in water by assuming that 3,5-DCA was the terminal degradate of iprodione (*i.e.* 100% of iprodione was converted to 3,5-DCA) and that it was stable and did not degrade in any system.

Subsequently, EFED refined its assumptions on the maximum percentage of 3,5-DCA that may form in the environment, assuming that only 75% of the applied iprodione was converted to 3,5-DCA (USEPA, 2012, DP Barcode 402502). The 75% conversion assumption was based on the maximum amount of unextracted residues observed in soil metabolism studies and the assumption that the unextracted residues were entirely 3,5-DCA. While the actual conversion rates to 3,5-DCA are dependent on the specific environmental conditions, the 75% conversion rate was selected as a conservative estimate of the maximum amount of 3,5-DCA formed in the environment (USEPA, 2012, DP Barcode D359480, 357471). The 75% value was used to calculate the equivalent application rate of 3,5-DCA for modeling purposes by multiplying the iprodione application rate by 75% and then using a molecular weight conversion factor of 0.49 (molecular weight of 3,5-DCA of 162.01/molecular weight of iprodione of 330.2) to convert pounds of iprodione to pounds of 3,5-DCA, which were used as inputs for surface water modeling.[15] EFED further characterized the 3,5-DCA EDWCs by using a 30% conversion rate based on the maximum amount of 3,5-DCA formed in laboratory metabolism studies.

**Table 8-2. Aquatic Modeling Input Parameters for the Pesticide in Water Calculator (PWC) Chemical Tab for the 3,5-Dichloroaniline (3,5-DCA) and 3,5-DCA plus Material Balances.**

| Parameter (units) | Value (s) | | Source | Comments |
|---|---|---|---|---|
| | 3,5-DCA | 3,5-DCA + Material Balances | | |
| $K_{OC}$ (mL/g-organic carbon) | 664 | 664 | MRID 45114101 | Average organic carbon normalized sorption value. For ROC, the parent was the most mobile compound. The coefficient of variation for the parent was 31% for $K_{OC}$ and 50% for $k_d$, indicating that $k_{OC}$ is a better predictor of the variability in sorption than $k_d$. |
| Water Column Metabolism Half-life (days) at 20°C | 191 | 457 | MRID 49726504 | Represents the 90 percent upper confidence bound on the mean of the representative half-life values from aerobic aquatic metabolism studies. |

[15] Based on the chemical structure of iprodione, a maximum of one molecule of 3,5-DCA could form from every molecule of iprodione. Based on a 1:1 conversion of iprodione to 3,5-DCA, the equivalent maximum application rate of 3,5-DCA would equal the mass of iprodione applied x (molecular weight of 3,5-DCA)/(molecular weight of iprodione) = mass of iprodione x (162.01/330.17) = mass of iprodione x 0.49. Assuming that only 75% of iprodione is converted to DCA, the maximum application for DCA = mass of iprodione × 0.37 (0.49 x 0.75).

| Parameter (units) | Value (s) | | Source | Comments |
|---|---|---|---|---|
| | 3,5-DCA | 3,5-DCA + Material Balances | | |
| Benthic Metabolism Half-life (days) at 20°C | 1204 | 1204 | MRID 49726505 | Represents the 90 percent upper confidence bound on the mean of 2 representative half-life values from anaerobic aquatic metabolism studies. Parent only value was higher than the parent+material balances due to kinetic fitting. Highest value was used to generate conservative pesticide estimates. |
| Aqueous Photolysis Half-life (days)@ pH 7, 33 °N | 0.18 | 0.18 | MRID 41861701 | One measured value for parent. |
| Hydrolysis Half-life (days) | 0 | 0 | MRID 49526513 | Stable to hydrolysis at pH 5-9 |
| Soil Half-life (days) at 20 °C | 78.7 | 78.7 | MRID 43091002 49726502 | Represents the 90 percent upper confidence bound on the mean of five representative half-life values from aerobic soil metabolism studies. For studies with multiple experiments on the same soil, only the highest measured half-life was used to calculate the model input half-life. Half-life values were corrected to 20°C before calculating the 90th percentile upper confidence bound on the mean. |
| Foliar Half-life (days) | 0 | | - | No data available. Assumed to be stable |
| Molecular Weight (g/mol) | 162.01 | | - | Value based on 3,5-DCA chemical structure |
| Vapor Pressure (Torr) at 25°C | $8.51 \times 10^{-3}$ | | MRID 47778802 | 3,5-DCA Value |
| Solubility in Water (mg/L) | 759 | | PubChem Database | 3,5-DCA value |

[1] Other input parameters for the applications tab are shown in **Table G-1**

The PWC scenarios are used to specify soil, climatic, and agronomic inputs in the Pesticide Root Zone Model (PRZM) and are intended to result in high-end water concentrations associated with a particular crop and pesticide within a geographic region. Each standard PWC scenario is specific to a vulnerable area where the crop is commonly grown. Soil and agronomic data specific to the location are built into the scenario, and a specific climatic weather station providing 30 years of daily weather data is associated with the location. Applications to broccoli and crucifers for seed were modeled using the non-standard CAColecropRLF scenario. The California red legged frog (RLF) (*Rana draytonii*) scenarios were developed in support of risk assessments conducted to evaluate potential risks to this listed species in California. Unlike EFED's standard crop scenarios, the RLF scenarios were not developed specifically to represent high-end exposure (*i.e*., vulnerable) sites. Instead, these scenarios were developed to evaluate specific uses of pesticides in California. They may not be representative of vulnerable areas across the United States.

The uses on agricultural crops allow for ground, aerial, airblast, seed treatment, and in-furrow applications. The iprodione labels specify a 25-ft buffer between the treated field and any adjacent waterbody for some use patterns. EFED calculated spray drift parameters for all application types with and without the required buffer distance using the AgDRIFT™ model (ver. 2.1.1). The calculated spray drift parameters for each application type are given in **Table 8-3.**

**Table 8-3. Spray Drift Parameters for Applications to EPA Standard Pond.**

| Application Parameter | Application Type | | | | Source |
|---|---|---|---|---|---|
| | Ground | Aerial | Airblast | Seed Treatment /In-Furrow | |
| 25-foot Buffer Between Field and EPA Pond | | | | | |
| Spray Drift Fraction | 0.0267 | 0.0916 | 0.0150 | 0 | AgDRIFT™ ver 2.1.1, (USEPA, 2013b) |
| Application Efficiency | 0.99 | 0.95 | 0.99 | 1 | |
| No Buffer | | | | | |
| Spray Drift Fraction | 0.062 | 0.125 | 0.042 | 0 | (USEPA, 2013b) |
| Application Efficiency | 0.99 | 0.95 | 0.99 | 1 | (USEPA, 2013b) |

EFED selected a set of use patterns to characterize the range of potential exposure estimates including: use pattern with historically high usage (*i.e.*, almonds, onions, stone fruit), use patterns with high application rates (*i.e.*, turf, ornamentals, crucifers, potatoes), use patterns that historically have resulted in high exposures (*i.e.*, carrots, grapes, lettuce), and use patterns with unique application methods (seed treatment application to carrot seed). In addition, EFED modeled the in-furrow cotton application as a lower-bound estimate of the potential exposure. Planting depths for carrot seed treatment and cotton in-furrow applications were set to 0.25 and 0.5 inches, respectively, based on reported agronomic practices (Aerts *et al.*, 1999) (Whitaker *et al.*, 2018). Seed treatment and in-furrow applications were modeled using the linearly increasing with depth and at-depth application methods in PWC (USEPA, 2019b).

EFED modeled the maximum label application rates and maximum number of applications per year for all representative use patterns, except for applications to turf, which were modeled as 4 applications at the maximum single application rate of 5.51 lb a.i./A/year and one application at 1.96 lb a.i./A/year for a maximum annual application rate of 24 lb a.i./A. EFED also calculated EECs based on the average application rates for almonds, broccoli, lettuce, carrot (broadcast treatment), onions, potatoes, and stone fruit using available usage data provided by BEAD. No average application rate data were available for turf, ornamentals, crucifers grown for seed, carrot seed treatment, or cotton in-furrow applications.

BEAD provided the initial pesticide application dates based on typical agronomic practices (USEPA, 2019a). Pesticide applications were made at the minimum retreatment interval (RTI) specified on the label. For crops where the number of days between applications was not specified (*i.e.*, almonds, crucifers for seed, broccoli and grapes) a five-day interval was modeled, consistent with the lowest interval identified on the Rovral™ 4 label for use on beans. When generating EECs for 3,5-DCA, application dates were offset 28 days from the initial iprodione application date to simulate the time to the formation of the maximum concentration of 3,5-DCA in the recent aerobic soil metabolism study (MRID 49726502)

Several of the target crops can be grown for multiple crop cycles per year, grow as part of a crop rotation (lettuce and broccoli), or have a unique application pattern (turf). Initial application dates for each crop cycle were provided by BEAD. In the case of turf, while up to two crop cycles can be grown per year for sod farms, the maximum annual application rate remains 24 lbs a.i./A/year; therefore, a maximum of 12 lbs of iprodione was applied in each crop cycle as two applications of 5.51 lbs a.i./A and one application at 0.98 lb a.i./A. Additionally, for ornamental drench applications, while the label indicates that the maximum single application rate is 22.1 lbs a.i./A and a maximum annual application rate of 24 lbs a.i./A, BEAD recommended modeling the use as six applications of 4 lbs a.i./A to better match agronomic practices.

The EECs for broadcast aerial, airblast (for tree and orchard crops), and ground spray applications were generated using a batch processing input file. The application parameters for selected uses relevant to the risk characterization are shown in **Table 8-4** and **Table 8-5** in this section.  The complete list of modeling parameters for all modeled scenarios can be found in **Appendix E**.

**Table 8-4. Selected Model Input Parameters Based on Maximum Label Application Rate for Iprodione and its Degradate 3,5-Dichloroaniline (3,5-DCA) (Applications Tab and Crop/Land Tab).**

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1,2] | Number of Apps x App. Rate in lbs a.i./A (kg a.i./ha) | | App. Type[3] | App Method[4] (depth) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Iprodione | 3,5-DCA | | |
| 1 | 1CC_4x0.50_aerial_2_CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | 4x0.18 (0.21) | aerial | Above Crop |
| 45 | 2CC_2x1.0_ground_2_CAColeCropRLF_V2 | 2CC Broccoli Rotation | CAColeCropRLF_V2.scn | 1/16, 1/21, 6/16, 6/21 | 4x1.00 (1.12) | 4x0.37 (0.41) | ground | Above Crop |
| 43 | 3CC_rotation_3x1.0+2x1+3x1.0_air_ground_2_CAlettuceSTD | 3CC Let Broc Let Rotation | CAlettuceSTD.scn | 1/15, 1/25, 2/4, 4/26, 5/3, 9/1, 9/11, 9/21 | 8x1.00 (1.12) | 8x0.37 (0.41) | 1xaerial+ 2xground, 2xground, 1xaerial+ 2xground[5] | Above Crop |
| 5 | 1CC_4x1.0_aerial_2_FLcarrotSTD | Carrots Broadcast | FLcarrotstd.scn | 10/16, 10/23, 10/23, 11/6 | 4x1.00 (1.12) | 4x0.37 (0.41) | aerial | Above Crop |
| 34 | 1CC_1x0.27_In_Furrow_2_MScottonSTD | Cotton | MScottonstd.scn | 4/20 | 0.27 (0.30) | 0.10 (0.11) | in furrow | At depth (1.27 cm) |
| 15 | 1CC_4x0.50_aerial_2_NYGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | aerial | Above Crop |
| 42 | 1CC_3x1.0_1xair_2xground_2_CAlettuceSTD | Lettuce | CAlettuceSTD.scn | 2/16, 2/26, 3/8 | 3x1.00 (1.12) | 3x0.37 (0.41) | 1xair, 2xground | Above Crop |
| 44 | 2CC_3x1.0_aerial_ground_2_CAlettuceSTD | 2CC LettuceRotation | CAlettuceSTD.scn | 2/16, 2/26, 3/8, 7/16, 7/26, 8/5 | 6x1.00 (1.12) | 6x0.37 (0.41) | 1xair, 2xground | Above Crop |
| 53 | 1CC_6x4.00_ground_2_NJnurserySTD_V2 | Ornamentals | NJnurserySTD_V2.scn | 0, 14, 28, 42, 56, 70 | 6x4.00 (4.48) | 6x1.47 (1.65) | ground | Above Crop |
| 13 | 1CC_4x5.51+1x1.96_aerial_2_PAturfSTD | Turf | PAturfstd.scn | 4/16, 4/30, 5/14, 5/28, 6/11 | 4x5.51, 1x1.96 (6.17, 2.20) | 4x2.02, 1x0.72 (2.27, 0.81) | aerial | Above Crop |

cc= crop cycle; PWC=Pesticide in Water Calculator model

[1] All application dates are calendar dates except for ornamentals, which are set relative to the emergence date in the PWC scenario

[2] Iprodione application dates. 3,5-DCA application dates were set to 28 days after the listed application date in the application dates column

[3] Application type determines the spray drift parameters for the modeling run based on **Table 8-3.**

[4] App method indicates to the application method option in PWC Applications tab.

[5] Aerial applications to lettuce are allowed for the first application to the crop per crop cycle. Subsequent applications are made via ground broadcast spray.

**Table 8-5 Selected Model Input Parameters Based on Average Label Application Rate for Iprodione and its Degradate 3,5-Dichloroaniline (3,5-DCA) (Applications Tab and Crop/Land Tab).**

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1,2] | Number of Apps x App. Rate in lbs a.i./A (kg a.i./ha) | | App. Type[3] | App Method[4] (depth) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Iprodione | 3,5-DCA | | |
| 1 | ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | 4x0.18 (0.21) | aerial | Above Crop |
| 45 | ROC_2CC_2x0.75_ground_7_CAColeCropRLF_V2 | 2CC Broccoli Rotation | CAColeCropRLF_V2.scn | 1/16, 1/21, 6/16, 6/21 | 2x0.75 (0.84) | 4x0.37 (0.41) | ground | Above Crop |
| 43 | ROC_3CC_rotation_3x0.96+2x0.75+3x.96_air_ground_7_CAlettuceSTD | 3CC Let Broc Let Rotation | CAlettuceSTD.scn | 1/15, 1/25, 2/4, 4/26, 5/3, 9/1, 9/11, 9/21 | 3x0.96, 2x0.75 3x0.96 (1.08, 0.84) | 3x0.35, 2x0.28 3x0.35 (0.40, 0.31) | 1xaerial+ 2xground, 2xground, 1xaerial +2xground[5] | Above Crop |
| 5 | ROC_1CC_4x0.89_aerial_7_FLcarrotSTD | Carrots Broadcast | FLcarrotstd.scn | 10/16, 10/23, 10/23, 11/6 | 4x0.89 (1.00) | 4x0.37 (0.41) | aerial | Above Crop |
| 15 | ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | aerial | Above Crop |
| 42 | ROC_1CC_3x0.96_1xair_2xground_7_CAlettuceSTD | Lettuce | CAlettuceSTD.scn | 2/16, 2/26, 3/8 | 3x0.96 (1.08) | 3x0.37 (0.41) | 1xair, 2xground | Above Crop |
| 44 | ROC_2CC_3x0.96_aerial_ground_7_CAlettuceSTD | 2CC LettuceRotation | CAlettuceSTD.scn | 2/16, 2/26, 3/8, 7/16, 7/26, 8/5 | 6x0.96 (1.08) | 6x0.37 (0.41) | 1xair, 2xground | Above Crop |

cc= crop cycle; PWC=Pesticide in Water Calculator model

[1] All application dates are calendar dates except for ornamentals, which are set relative to the emergence date in the PWC scenario

[2] Iprodione application dates. 3,5-DCA application dates were set to 28 days after the listed application date in the application dates column

[3] Application type determines the spray drift parameters for the modeling run based on **Table 8-3**

[4] App method indicates to the application method option in PWC.

[5] Aerial applications to lettuce are allowed for the first application to the crop per crop cycle. Subsequent applications are made via ground broadcast spray.

### 8.1.2 Modeling Results

**Table 8-6** summarizes the range of surface water EECs calculated for iprodione SSD and iprodione parent. The range of EECs based on average application rates only includes use patterns with available average application rate data (almonds, broccoli, lettuce, carrot (broadcast treatment), onions, potatoes, and stone fruit). The results for the scenarios relevant to risk characterization for iprodione SSD and iprodione parent are shown in **Table 8-8** and **Table 8-9**, respectively. The maximum calculated iprodione SSD ECCs were for aerial applications to turf, with 1-day, 21-day, and 60-day average iprodione SSD EECs of 962, 952, and 929 µg/L, respectively. The maximum calculated iprodione SSD EECs for ground applications were for applications to ornamentals, with 1-day, 21-day, and 60-day average EECs of 900, 893, and 887 µg/L, respectively. The maximum estimated iprodione SSD EECs for an agricultural use pattern were for the 3-crop cycle lettuce-broccoli-lettuce crop rotation, with 1-day, 21-day, and 60-day average EECs of 778, 771, and 762 µg/L, respectively. Spray drift accounted for 7% to 94% of the EEC values, depending on scenario.

The EECs based on the average use rates range from 64% to 100% of the maximum application rate EECs. The primary uncertainty in the total residues approach to modeling is the difference in the sorption properties of iprodione and RP30228. The TR modeling approach uses the mobility of the most mobile ROC. The primary degradate of iprodione, RP30228, is more persistent but less mobile than iprodione. The combination of the mobility of the parent and the persistence of the degradate to iprodione resulted in TR EECs that are 5x to 10x greater than the parent-only values. The EECs for a bounding case analysis using the iprodione SSD model input half-lives and the sorption coefficient of RP30228 were 9% to 40% of the standard iprodione SSD EECs, with EECs from the maximum application rate scenarios (*e.g.,* turf, ornamentals, multiple crop cycle lettuce) 1x to 4x greater than the parent-only EECs. Pore-water EECs for iprodione plus RP30228 were comparable to the surface water concentrations, while pore water concentrations for iprodione parent alone were 5x-10x less than the surface water concentrations. Formation-Decline modeling was simulated for maximum application rates for turf, for the lettuce-broccoli-lettuce rotation with three crop cycles per year assuming maximum application rates, and also average application rates for a single crop cycle of lettuce. These are the most refined and reliable EECs reflecting the potential exposure to iprodione total residues. See **Appendix F** for the complete modeling results.

**Table 8-6. Modeled Estimated Environmental Concentration (EEC) range for Iprodione and Iprodione Total Residues (TR).**

| Residue | Range of EECs Values (µg/L)[1] | | |
|---|---|---|---|
| | Daily Average | 21-Day Average | 60-Day Average |
| **Maximum Application Rate (Full Range of EECs)** | | | |
| Iprodione Parent | 0.707 - 166 | 0.482 - 134 | 0.274 - 94.2 |
| Iprodione SSD[1] (total residue)[2] | 1.33 - 962 | 1.27 - 952 | 1.22 - 929 |
| Iprodione SSD (formation-decline)[2] | 17.2 - 251 | 13.6 - 217 | 10.6 - 189 |

| Residue | Range of EECs Values (µg/L)[1] | | |
|---|---|---|---|
| | Daily Average | 21-Day Average | 60-Day Average |
| **Average Application Rate (Selected Use Patterns)[3]** | | | |
| Iprodione Parent | 3.16 - 90.1 | 2.12 - 58.2 | 0.943 - 38.5 |
| Iprodione SSD[1] | 14 - 718 | 13.8 - 713 | 13.6 - 706 |

[1] Iprodione SSD includes iprodione and degradate RP30228

[2] Iprodione SSD were simulated using two different modeling approaches. A range of use patterns were simulated using the total residue calculation approach, and turf; one crop cycle of lettuce and a 3-crop cycle rotation of broccoli and lettuce were simulated using the Formation-Decline methodology.

[3] Average application rate EECs were only calculated for almonds, broccoli, lettuce, carrot (broadcast treatment), onions, potatoes, and stone fruit. The maximum number of applications was assumed for the average app rate simulations.

**Table 8-7** summarizes the range of surface water EECs calculated for 3,5-DCA and 3,5-DCA plus material balances. The maximum calculated 3,5-DCA ECCs were for application to ornamentals, with 1-day, 21-day, and 60-day average EECs of 78.8, 61.3, and 40.0 µg/L, respectively. The maximum 3,5-DCA EECs for an agricultural use pattern were for applications to carrots, with 1-day, 21-day, and 60-day average EECs of 46.6, 32.4, and 18.8 µg/L, respectively. The EECs for 3,5-DCA plus material balances were 100% to 107% of the 3,5-DCA only values, indicating that the low material balances were not a significant source of uncertainty in the assessment. The former assumption that 75% of iprodione may be converted 3,5-DCA is a high-end estimate, and EFED has since determined that it may be assumed that the amount of 3,5-DCA formed is 30% (see **Appendix L** for supporting information). To understand the impact of this refinement, EECs calculated using the 75% assumption are multiplied by 0.4 (0.3/0.75). All 3,5-DCA EECs are available in **Appendix F**.

**Table 8-7. Modeled Estimated Environmental Concentration (EEC) range for 3,5-Dichloroanaline (3,5-DCA) and 3,5-DCA Plus Material Balances Based on 75% Conversion of Iprodione to 3,5-DCA.**

| Residue | Range of EECs Values (µg/L)[1,22] | | |
|---|---|---|---|
| | 1-Day Average | 21-Day Average | 60-Day Average |
| 3,5-DCA | 0.32 - 78.8 | 0.20 - 61.3 | 0.11 - 40.0 |
| 3,5-DCA Plus Material Balances[1] | 0.3 2- 79.5 | 0.30 - 75.7 | 0.12 - 40.6 |

[1] See **Section 5.2** for information on the 3,5-DCA plus material balances calculations.

The PWC simulates the impact of daily weather on a treated agricultural field over a period of thirty years. During this time, pesticide may be washed off the field into the water body by twenty to forty rainfall/runoff events per year. Because the simulated pond has no outlet it does not allow discharge of water or washout of pesticide. Compounds with sufficiently slow degradation rates can thus continue to build up in the pond over the duration of a simulation, with each new addition of pesticide (associated with spray drift or runoff) adding to residues left over from previous applications of the pesticide. The PWC simulations represent long-term accumulation within the pond. As iprodione SSD residues are relatively stable, sufficient chemical remains in the pond each year after application that EECs increase each year. The effect is illustrated in **Figure 1** of **Appendix F**, which shows peak EECs for the Pennsylvania turf (PAturf) scenario over time. This figure demonstrates that, due to iprodione SSD's persistence, the residues of concern are expected to steadily accumulate in the benthos. For this reason, in the risk characterization the number of years until a LOC exceedance would occur is determined to better characterize potential aquatic exposure in ponds. An example of the aquatic modeling output can also be found in **Appendix F.**

**Table 8-10** summarizes the results of the Formation-Decline modeling for Iprodione SSD for the turf, 3-crop cycle lettuce and single crop cycle lettuce application patterns. Iprodione plus RP30228 EECs calculated using the Total Residues method were approximately 4x to 6x higher than those calculated using the Formation-Decline method.  This indicates that the TR method will overestimate the concentrations of iprodione plus RP30228, but by less than the magnitude of the RQ exceedances for several aquatic taxa (See **Section 8.3**).

**Table 8-8. Selected Surface Water Estimated Environmental Concentrations (EECs) for Iprodione plus RP30228 Estimated Using the Pesticide in Water Calculator (PWC; version 1.52) Based on Maximum Label Application Rates.**

| Run Name[1] | Run Number[1] | Use | PWC Scenario | Annual App Rate lbs a.i./A, App type | 1-in-10 year mean EEC | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Water Column (µg/L) | | | Pore-Water (µg/L) | |
| | | | | | 1-day | 21-day | 60-day | 1-day | 21-day |
| ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 1 | Almonds | CAalmond_WirrigsSTD | 2.0, aerial | 69 | 68 | 67 | 62 | 62 |
| ROC_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 45 | 2CC Broccoli Rotation | CAColeCropRLF_V2.scn | 4.0, ground | 296 | 294 | 293 | 282 | 282 |
| ROC_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 43 | Lettuce – Broccoli – Lettuce Rotation | CAlettuceSTD | 3.0, 2.0, 3.0, aerial and ground | 778 | 771 | 762 | 721 | 721 |
| ROC_1CC_4x1.0_aerial_7_FLcarrotSTD | 5 | Carrots | FLcarrotsSTD | 4.0, aerial | 352 | 346 | 336 | 305 | 305 |
| ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 34 | Cotton | MScottonSTD | 0.27, in furrow | 8.9 | 8.8 | 8.7 | 8.0 | 8.0 |
| ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 15 | Grapes | NYGrapesSTD | 2.0, aerial | 145 | 144 | 144 | 138 | 138 |
| ROC_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 42 | Lettuce | CAlettuceSTD | 3.0, aerial and ground | 203 | 201 | 199 | 188 | 188 |
| ROC_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 44 | | | 6.0, aerial and ground | 296 | 294 | 293 | 282 | 282 |
| ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 53 | Ornamentals | NJNurserySTD_V2 | 24, ground | 900 | 893 | 887 | 841 | 841 |
| ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 13 | Turf | PAturfSTD | 24, aerial | **962** | **952** | **929** | **863** | **863** |

Maximum EECs are shown in bold.

[1] The "Run Name" and "Run Number" in this table corresponds to the run name in **Table F-1**.

[2] The benthic conversion factor is 17.4 and the fraction organic carbon ($f_{OC}$) is 0.04 in the EPA standard pond.

**Table 8-9. Selected Surface Water Estimated Environmental Concentrations (EECs) for Iprodione Parent Based on Maximum Use Rates (Estimated Using the Pesticide in Water Calculator (PWC; version 1.52)**

| Run Name[1] | Run Number[1] | Use | PWC Scenario | Annual App Rate lbs a.i./A, App type | 1-in-10 year mean EEC | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Water Column (µg/L) | | | Pore-Water (µg/L) | |
| | | | | | 1-day | 21-day | 60-day | 1-day | 21-day |
| ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 1 | Almonds | CAalmond_WirrigsSTD | 2.0, aerial | 12 | 8.4 | 5.5 | 2.4 | 2.3 |
| ROC_2CC_2x0.75_ground_7_CAColeCropRLF_V2 | 45 | | | 4.0, ground | 40 | 30 | 17 | 7.7 | 7.5 |
| ROC_3CC_rotation_3x0.96+2x0.75+3x.96_air_ground_7_CAlettuceSTD | 43 | Lettuce – Broccoli – Lettuce Rotation | CAlettuceSTD | 3.0, 2.0, 3.0, aerial and ground | 85 | 61 | 40 | 18 | 17 |
| ROC_1CC_4x0.89_aerial_7_FLcarrotSTD | 5 | Carrots | FLcarrotsSTD | 4.0, aerial | 97 | 60 | 29 | 11 | 9.8 |
| ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 34 | Cotton | MScottonSTD | 0.27, in furrow | 2.4 | 1.6 | 0.83 | 0.32 | 0.31 |
| ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 15 | Grapes | NYGrapesSTD | 2.0, aerial | 12 | 8.0 | 5.4 | 6.7 | 5.1 |
| ROC_1CC_3x0.96_1xair_2xground_7_CAlettuceSTD | 42 | Lettuce | CAlettuceSTD | 3.0, aerial and ground | 35 | 27 | 16 | 7.0 | 6.8 |
| ROC_2CC_3x0.96_aerial_ground_7_CAlettuceSTD | 44 | | | 6.0, aerial and ground | 45 | 32 | 22 | 10 | 9.8 |
| ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 53 | Ornamentals | NJNurserySTD_V2 | 24, ground | **166** | **134** | **94** | **50** | **49** |
| ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 13 | Turf | PAturfSTD | 24, aerial | 123 | 80 | 51 | 22 | 21 |

Maximum EECs are shown in bold.

[1] The "Run Name" and "Run Number" in this table corresponds to the run name in **Table F-2**.

[2] The benthic conversion factor is 17.4 and the fraction organic carbon (foc) is 0.04 in the EPA standard pond.

**Table 8-10. Selected Upper Bound Surface Water Estimated Environmental Concentrations (EECs) for Iprodione Plus RP30228 Based on Maximum or Average Use Rates Calculated Using the Formation-Decline Method (PWC; version 1.52)**

| Run | PWC Scenario | Annual App Rate lbs a.i./A, App type | 1-in-10 year mean EEC | | | | |
|---|---|---|---|---|---|---|---|
| | | | Water Column (µg/L) | | | Pore-Water (µg/L) | |
| | | | 1-day | 21-day | 60-day | 1-day | 21-day |
| Turf Formation-Decline | PAturfSTD | 24[1], aerial | 251 | 217 | 189 | 162 | 162 |
| 3-Crop Cycle Lettuce-Broccoli-Lettuce Formation-Decline | CAlettuceSTD | 3.0, 2.0, 3.0[1], aerial and ground | 155 | 137 | 124 | 105 | 105 |
| 1 Crop Cycle Lettuce Early Application Formation-Decline | CALettuceSTD | 0.96[2], aerial | 41.8 | 32.8 | 22.0 | 14.3 | 14.2 |
| 1 Crop Cycle Lettuce Late Application Formation-Decline | CALettuceSTD | 0.96[2], ground | 17.2 | 13.6 | 10.6 | 7.27 | 7.24 |

[1] Maximum application rate and number.
[2] Average application rate and number.

## 8.2 Monitoring

### 8.2.1 Nontargeted Monitoring

The following databases and sources were searched for monitoring information on iprodione and degradates 3,5-DCA and RP30228 in January 2020:

- Water Quality Portal (USEPA *et al.*)[16]
- California Environmental Data Exchange Network (CEDEN) (State Water Resources Control Board, 2015)[17]
- California Department of Pesticide Regulation Surface Water Database (CADPR)[18] (CADPR, 2004)

Monitoring data comprise a useful line of evidence to explore whether exposure in the environment is occurring at the levels of the modeled EECs and whether monitoring shows that exposure is occurring at levels that are higher than toxicity endpoints. For non-targeted monitoring data, if LOC exceedances are not occurring, this is not evidence that exceedances will not occur with usage; however, if there are acute or chronic risk LOC exceedances, it confirms that exposure occurred in the environment at levels where adverse effects are expected to occur.

[16] https://www.waterqualitydata.us/
[17] http://www.ceden.org/
[18] http://www.cdpr.ca.gov/docs/emon/surfwtr/surfdata.htm

The monitoring studies were not specifically targeted at iprodione use areas and the frequency of sample collection in all studies was not adequate to ensure the capture of peak concentrations. Monitoring data are useful in that they provide some information on the occurrence of iprodione in the environment under existing usage conditions. However, the measured concentrations should not be interpreted as reflecting the upper end of potential exposures unless they were collected in areas with frequent sampling, where and when usage was occurring. Absence of detections from non-targeted monitoring cannot be used to indicate exposure is not likely to occur because monitoring data are often collected in areas where the pesticide is not used. Additionally, modeling results are not expected to be similar to monitoring results as monitoring does not reflect the conceptual model simulated nor do the sampling frequency and duration reflect what is simulated in modeling.

#### 8.2.1.1 Surface Water Monitoring

In the Water Quality Portal dataset, there were 462 reported detections (1.8%) of iprodione out of 26,303 surface water samples and 1 reported detection (0.7%) of iprodione out of 136 finished water (treated water ready for distribution) samples analyzed, with a maximum measured concentration of 141 µg/L. The LOQ ranged from 0.004 to 1.42 µg/L. There were 154 reported detections (1.5%) of 3,5-DCA out of 10,350 surface water samples and 1 reported detection (1.2%) of 3,5-DCA out of 81 samples with a maximum measured concentration of 0.521 µg/L. The limit of quantitation (LOQ) ranged from 0.003 to 0.012 µg/L. While concentrations in finished water are not directly relevant to ecological exposure, the values are a line of evidence that iprodione can reach nontarget waterbodies and persist in the environment for long enough to be detected in water samples.

In the CADPR dataset, there were 44 reported detections (2.9%) of iprodione out of 1,532 surface water samples with a maximum measured concentration of 141 µg/L, representing the same monitoring event found in the Water Quality Portal database. The LOQ ranged from 0.004 to 1.42 µg/L. The CADPR data is included in the national water monitoring dataset and represents the maximum measured surface water concentration on a national scale.

In the CEDEN dataset, there were 17 reported detections of iprodione (8.3%) out of 204 surface water samples, with a maximum surface water concentration of 0.201 µg/L. The limits of detection (LOD) ranged from 0.008-4.4 µg/L. Also, out of 144 surface water samples, there were no reported detections of 3,5-DCA greater than or equal to the method detection limit of 7.6 ng/L.

In addition to the uncertainties associated with infrequent monitoring, it is unknown whether samples were collected in areas where iprodione is used and whether the 3,5-DCA is associated with iprodione use or with the use of other pesticides that degrade into 3,5-DCA. Additionally, there were no monitoring data available for RP30228 in any of the databases. Since iprodione converts to RP30228 in aquatic environments in days, the measured water concentrations of iprodione are likely not representative of RP30228 exposure.

The maximum measured surface water concentrations were lower than the most sensitive acute toxicity endpoint of 240 µg a.i./L (48-hour Daphnid $LC_{50}$), but higher than the most sensitive chronic endpoint of 7.5 µg a.i./L (28-day Mysid NOAEC). While these data indicate that there is potential exposure in surface water, due to the irregular sampling frequency EFED cannot conclude that the maximum measured surface water concentration represents the peak surface water concentration and cannot calculate a reliable average surface water concentration from the available sampling data, so the magnitude of the risk is uncertain.

**Table 8-11. Non-Targeted Surface Water Monitoring Results for Iprodione and its Degradate 3,5-Dichloroaniline (3,5-DCA).**

| Sites (Dataset Source, Date Accessed) | Compound | Year | Study Type[1] | Sampling Frequency | Maximum Conc. (µg/L) | Detection frequency (Detects/samples) |
|---|---|---|---|---|---|---|
| National Database | | | | | | |
| Water Quality Portal (USEPA and USGS, 2020) | Iprodione | 1995-2019 | General | Irregular | 141[2] | 463/26439 |
| | 3,5-DCA | 1999-2019 | General | Irregular | 0.521 | 154/10350 |
| California Databases | | | | | | |
| California (CADPR, 2020) | Iprodione | 1991-2018 | General | Irregular | 141[2] | 44/1532 |
| California (CEDEN, 2020) | Iprodione | 2012-2017 | General | Irregular | 0.201 | 17/204 |
| | 3,5-DCA | 2015-2017 | General | Irregular | - | 0/144 |

[1] General refers to studies in which, when samples were collected, no consideration was given to pesticide use patterns specific to the chemical of interest.
[2] Maximum measured concentration represents same monitoring event listed in both databases

**Table 8-12 Non-Targeted Finished Water Monitoring Results for Iprodione and its Degradate 3,5-Dichloroaniline (3,5-DCA).**

| Sites (Dataset Source, Date Accessed) | Compound | Year | Study Type[1] | Sampling Frequency | Maximum Conc. (µg/L) | Detection frequency (Detects/samples) |
|---|---|---|---|---|---|---|
| National Database | | | | | | |
| Water Quality Portal (USEPA and USGS, 2020) | Iprodione | 2004-2012 | General | Irregular | 0.013 | 1/136 |
| | 3,5-DCA | 1999-2019 | General | Irregular | 0.008 | 1/81 |

[1] General refers to studies in which, when samples were collected, no consideration was given to pesticide use patterns specific to the chemical of interest.

#### 8.2.1.2 Groundwater Monitoring

Groundwater and surface water are connected; where groundwater may feed surface water or surface water may move into groundwater. Both groundwater and surface water monitoring are important in understanding the potential for exposure in the aquatic environment. In most cases, residues observed in groundwater are expected to be diluted when moving into and interacting with surface water; however, there are cases where groundwater may be the dominant source of a surface water body during dry periods.

In the Water Quality Portal dataset, there was 1 reported detection (0.01%) of iprodione out of 10,624 surface water samples, with a maximum measured concentration below the limit of quantification of 0.538 µg/L. There were 52 reported detections (1.5%) of 3,5-DCA out of 6,560 surface water samples, with a maximum measured concentration of 0.098 µg/L. The LOQ ranged from 0.003 to 0.072 µg/L.

**Table 8-13 Non-Targeted Groundwater Monitoring Results for Iprodione and its Degradate 3,5-Dichloroaniline (3,5-DCA).**

| Sites (Dataset Source, Date Accessed) | Compound | Year | Study Type[1] | Sampling Frequency | Maximum Conc. (µg/L) | Detection frequency (Detects/samples) |
|---|---|---|---|---|---|---|
| National Database | | | | | | |
| Water Quality Portal (USEPA and USGS, 2020) | Iprodione | 2001-2019 | General | Irregular | 0.016 | 1/10,624 |
| | 3,5-DCA | 2001-2019 | General | Irregular | 0.098 | 52/6,560 |

[1] General refers to studies in which, when samples were collected, no consideration was given to pesticide use patterns specific to the chemical of interest.

#### 8.2.1.3 Targeted Water Monitoring

Following the 1998 iprodione Reregistration Eligibility Document (RED), surface water monitoring was required for iprodione and 3,5-DCA. The required surface water monitoring started in 2006 in watersheds that contained high numbers of golf courses. The preliminary report did not provide adequate ancillary information to enable thorough evaluation of the data (no MRID available). Surface water detections of iprodione included three detections greater than 1 µg/L including 8.8 µg/L at a golf course pond, 1.1 µg/L at a golf course pond, and 2.6 µg/L at unknown type of surface water (identified as a greenhouse). Surface water detections of 3,5-DCA include 4 µg/L and 1.5 µg/L in golf course ponds, along with three other golf course pond samples less than 1 µg/L (USEPA, 2009b).

Targeted surface water sampling near water treatment facilities (MRIDs 47579101 and 47881501) associated with golf course applications of iprodione was conducted by Bayer CropScience from 2006 to 2009. Iprodione ROC were detected in 34 raw water samples in Rahway, NJ, with maximum concentrations of iprodione, RP30228, and 3,5-DCA of 0.56, 0.31 and 0.1 µg/L, respectively. Iprodione and RP30228 were both detected in paired raw and finished water samples, with iprodione concentrations less than or equal to 0.15 µg/L, and RP30228 concentrations less than limit of quantification of 0.05 µg/L. No finished water samples contained 3,5-DCA above the limit of detection. Treatment methods were not reported in the study.

## 8.3 Aquatic Organism Risk Characterization

### 8.3.1 Aquatic Vertebrates

Iprodione is moderately toxic to freshwater ($LC_{50}$=6,160 µg a.i./L) and estuarine/marine fish ($LC_{50}$>8,140 µg a.i./L) on an acute exposure basis while chronic toxicity studies with iprodione and estuarine/marine fish did not detect any statistically significant adverse effects up to the highest concentration tested (NOAEC=57 µg a.i./L). Freshwater fish exposed on a chronic basis had a NOAEC/LOAEC of 260/550 µg a.i./L based on a reduction in larval survival.

There are no acute LOC exceedances (LOC = 0.5) for aquatic vertebrate species. The acute RQs for uses with aerial applications of iprodione are ≤0.16 and are ≤0.15 for ground applications. Additionally, RQs for uses with air blast applications, in-furrow applications and seed treatments are all ≤0.02.

On the basis of iprodione SSD, aquatic vertebrate RQs exceed the chronic risk LOCs (LOC=1.0) for all uses (except cotton) based on maximum use rates. For aerial applications and based on maximum application rates, freshwater vertebrate chronic RQs ranged from 0.26-3.6, and saltwater chronic RQs ranged from 1.2-16 (**Table 8-14**). For ground applications and based on maximum rates, freshwater vertebrate chronic RQs ranged from 0.12-3.4, and saltwater chronic RQs ranged from 0.56-15. Chronic RQs for uses with airblast applications ranged from 0.10-1.6; in-furrow applications ranged from 0.03-0.15 and seed treatments ranged from 0.43-2.0. As noted earlier though, no adverse effects were detected in the chronic toxicity study with estuarine/marine fish and the study resulted in a non-definitive LOAEC value (LOAEC>57 µg ai/L); therefore, it is not possible to gauge the concentration at which chronic exposure to iprodione results in adverse effects.

In the available chronic early life stage (ELS) toxicity study with Fathead Minnow (MRID 40550801), larval survival was reduced by 10% at the LOAEC of 550 µg a.i./L (NOAEC=260 µg a.i./L), and 42% at the next highest treatment level (1,100 µg a.i./L). There is also a full lifecycle study in which Fathead Minnow (MRID 49767901) were exposed (under flow-through conditions) to mean-measured concentrations of 6.17 - 84.9 µg a.i./L. There were no significant adverse effects on survival, growth or reproduction observed up to the highest concentration tested, consequently the NOAEC was 84.9 µg a.i./L. While the Fathead Minnow full life cycle study, having the most sensitive NOAEC value, would provide a more conservative endpoint to represent the chronic toxicity to freshwater vertebrates, the ELS test with the same species was used instead since adverse effects were observed during exposure. Chronic RQs estimated for freshwater vertebrates using the NOAEC (260 µg a.i./L) from the Fathead Minnow ELS study demonstrated LOC exceedances for ground application to broccoli (2CC), lettuce-broccoli rotation, carrots, crucifers for seed, lettuce, ornamentals, potato and turf (RQs range from 1.1-3.4) and aerial application to carrots, crucifers for seed, potato, and turf (RQs range from 1.3-3.6). When the LOAEC (550 µg a.i./L) from the ELS is used, there are still chronic LOC exceedances for the lettuce-broccoli-lettuce rotation, ornamental, and aerial applications to turf for one and two crop cycles (RQs range from 1.3-1.6). However, when considering Formation-Decline modeling, the highest 60-day EEC of 189 µg/L does not exceed the NOAEC of 260 µg a.i./L for freshwater fish (RQ = 0.73).

In the acute toxicity test with estuarine/marine vertebrates there was 30% mortality of Sheepshead Minnows (MRID 49526510) at 8,140 µg a.i./L, the highest tested concentration; therefore, the 96-h $LC_{50}$ was estimated to be >8,140 µg a.i./L. In the available chronic toxicity (flow-through) study with Sheepshead Minnow (MRID 49664102), there were no significant adverse effects on survival, reproduction or growth up to 57.4 µg iprodione/L, resulting in a NOAEC of 57.4 µg a.i./L. There is some uncertainty in the risk prediction for chronic exposure to estuarine/marine fish since the risk is calculated using an unbounded endpoint. We do not have chronic empirical data available where the estuarine/marine fish were exposed to high enough concentrations to elicit adverse effects. Using Formation-Decline modeling the highest potential 60-day EEC for the turf use pattern of 189 µg/L is 3.2x higher than the highest level tested where no effects were observed. When using Formation-Decline modeling, the 60-day EEC for the 1-crop cycle use on lettuce at average application rates was 22 µg/L (RQ: 0.38), which does not exceed the chronic risk LOC.

Alternatively, chronic RQs for freshwater and estuarine/marine vertebrates were estimated based on iprodione SSD, using average usage rates (provided by BEAD) for aerial, ground and air blast applications to broccoli, lettuce-broccoli-lettuce rotation, carrots, lettuce, onion, potato and stone fruit (see **Appendix G**). There are LOC exceedances for chronic freshwater and estuarine/marine exposures, for all uses except for stone fruit (freshwater: aerial, ground and air blast applications; estuarine/marine: ground and air blast applications). For ground applications, chronic RQs range from 0.55-5.4 and for aerial applications, chronic RQs range from 0.98-5.7. When risk quotients are calculated on the basis of parent iprodione alone and maximum use rates (see **Appendix G**), there are no acute or chronic LOC exceedances for freshwater or estuarine/marine vertebrates for any use except for ground applications to ornamentals (chronic freshwater RQ: 1.1; chronic estuarine/marine RQ: 1.6). When risk quotients are based on parent iprodione alone and average use rates (see **Appendix G**), there are no acute or chronic risk LOC exceedances for either freshwater or estuarine/marine vertebrates for any uses.

Analysis of year-to-year peaks in iprodione concentrations provide evidence of iprodione SSD accumulating in the modeled pond farm. According to that modeling, acute and chronic exceedances would occur for freshwater fish after three years for application to turf at the maximum application rate and estuarine/marine fish after one year of iprodione application at the maximum rate to turf and after 20 years of iprodione application to cotton at the maximum application rate. Accumulation in the pond was also observed in the Formation-Decline modeling, with exceedances of the chronic fish endpoint occurring after 6 years of applications to turf.

**Table 8-14. Summary of Acute and Chronic Risk Quotients (RQs) for Non-listed Vertebrate Species Exposed to Iprodione SSD Based on Maximum Label Application Rates.**

| Use Sites | Run Name[1] | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|---|
| | | | | Freshwater | | Estuarine/Marine | |
| | | Daily Mean | 60-day Mean | Acute[2] | Chronic[3] | Acute[4] | Chronic[3] |
| | | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Almonds - AER | ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 69 | 67 | 0.01 | 0.26 | N/A[4] | **1.2** |
| Broccoli - GRD (2 CC) | ROC_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 296 | 293 | 0.05 | **1.1** | | **5.1** |
| Lettuce-Broccoli-Lettuce Rotation | ROC_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 778 | 762 | 0.13 | **2.9** | | **13** |
| Carrots - AER | ROC_1CC_4x1.0_aerial_7_FLcarrotSTD | 352 | 336 | 0.06 | **1.3** | | **5.9** |
| Cotton - In_furrow | ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 8.9 | 8.68 | <0.01 | 0.03 | | 0.15 |
| Grapes - AER | ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 145 | 144 | 0.02 | **0.55** | | **2.5** |
| Lettuce - AERx1, GRDx2 | ROC_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 203 | 199 | 0.03 | **0.77** | | **3.5** |
| Lettuce - AER1x, GRDx2 (2 CC) | ROC_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 296 | 293 | 0.05 | **1.1** | | **5.1** |
| Ornamentals - GRD | ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 900 | 887 | 0.15 | **3.4** | | **15** |
| Turf - AER (1 CC) | ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 962 | 929 | 0.16 | **3.6** | | **16** |

**Bolded** values exceed the acute risk to non-listed species level of concern (LOC) of 0.5 or the chronic risk LOC of 1.0. The toxicity endpoints listed in the table are those used to calculate the RQ.
CC = Crop Cycle
[1] Run Name corresponds to the model input information in **Table 8-8**
[2]The EECs used to calculate these RQs are based on the 1-in-10-year 1-day average value from **Table 8-8.**
[3] The EECs used to calculate these RQs are based on the 1-in-10-year 60-day average value from **Table 8-8**.
[4] In the acute toxicity study with the Sheepshead Minnow (MRID 49526510), there was only 30% mortality at 8,140 µg a.i./L, the highest tested concentration; therefore the96-h $LC_{50}$ was estimated to be >8,140 µg a.i./L; non-definitive endpoints cannot be used to calculate risk quotients.

**Table 8-15** summarizes the aquatic vertebrate RQs calculated with different refinement assumptions. There are no acute risk LOC exceedances for freshwater fish. For chronic LOC exceedances, RQs were calculated considering maximum application rates and average application rates (**Appendix G**) for selected use patterns for both residues of iprodione SSD (parent plus RP30228) and parent alone. Chronic LOC exceedances occur for both maximum application rates and when considering iprodione alone. As noted earlier though, no adverse effects were detected in the estuarine/marine fish ELS study used in the RQ calculations an (LOAEC>57 µg ai/L). The RQs were also characterized using the freshwater fish ELS endpoint and still resulted in exceedances of the chronic risk LOC. Analysis of year-to-year peaks in iprodione concentrations provide evidence of iprodione accumulating in the modeled pond farm. According to that modeling, chronic exceedances would occur for freshwater and estuarine/marine fish after three and one year of iprodione application, respectively. These results are discussed in more detail below. Surface water monitoring from grab samples exceeded the NOAEC and the fish early life stage LOAEC for aquatic vertebrates.

**Table 8-15. Aquatic Vertebrate Risk Characterization Summary**

| Refinement Assumptions | Residues (modeling method)[1] | FW Acute RQ Range | FW Chronic RQ Range | E/M Acute RQ Range | E/M Chronic RQ Range[2] |
|---|---|---|---|---|---|
| Max app rates | Iprodione+RP30228 (total residue) | <0.01-0.16 | 0.03-**3.6** | N/A | 0.15-**16** |
| Max app rates | Iprodione+RP30228 (formation-decline) | 0.03-0.04 | 0.48-0.73 | N/A | **2.2 – 3.3** |
| Average app rates[3] | Iprodione+RP30228 (total residue) | 0.01-0.11 | 0.10-**2.6** | N/A | 0.44-**12** |
| Average app rate[4] | Iprodione+RP30228 (formation-decline) | <0.01-0.01 | 0.04-0.08 | N/A | 0.18-0.38 |
| Max app rates (Using ELS LOAEC) | Iprodione+RP30228 (total residue) | N/A | 0.02-**1.7** | N/A | N/A |
| Max app rates | Iprodione alone | <0.01-0.03 | <0.01-0.36 | N/A | 0.01-**1.6** |
| Average app rates [2] | Iprodione alone | <0.01-0.01 | 0.01-0.15 | N/A | 0.04-0.66 |

[1] Iprodione SSD were simulated using two different modeling approaches. A range of use patterns were simulated using the total residue calculation approach. In addition, turf, one crop cycle of lettuce and a 3-crop cycle rotation of broccoli and lettuce were simulated using the Formation-Decline methodology. N/A=not applicable; FW = freshwater; E/M = estuarine/marine; ELS = early life stage. [Since the freshwater species fish full life cycle was non-definitive (no observed adverse effects up to the highest concentration tested), the definitive endpoints observed in the early life stage test were modeled for comparison.]

[2]Using the NOAEC from a test without a LOAEC. No effects were observed at the highest level tested.

[3]Average application rates for use on broccoli, lettuce-broccoli-lettuce rotation, carrots, lettuce, onion, potato and stone fruit only.

[4]Average application rate for use on lettuce only.

**Bolded** values exceed the acute risk to non-listed species LOC of 0.5 or the chronic risk LOC of 1.0.

Therefore, based on the available data, there may be chronic risks of concern for estuarine/marine fish when exposure is based on iprodione SSD (*i.e.*, iprodione+RP30228), from both aerial and ground applications using maximum application rates for all uses and considering Formation-Decline modeling results. There is some uncertainty with this conclusion as there were no effects observed in toxicity testing up to the highest level tested. A fish full life cycle study is not available and there may be reproductive effects not captured in an early life stage study. So, the RQ based on the early life stage endpoint for freshwater fish may underestimate the potential risk to freshwater fish. Additionally, there are no data available to evaluate risk to fish due to exposure to 3,5-DCA. Since freshwater fish serve as surrogates for aquatic-phase amphibians, risk estimates for fish extend to this other taxon as well.

### 8.3.2 Aquatic Invertebrates

While iprodione is highly toxic to freshwater invertebrates ($EC_{50}$ =240 µg a.i./L), it is moderately toxic to estuarine/marine invertebrates ($LC_{50}$=2,240 µg a.i./L) on an acute exposure basis.

Chronic exposure of freshwater invertebrates resulted in a NOAEC of 288 µg a.i./L (LOAEC of 557 µg a.i./L) while exposure of estuarine/marine invertebrates resulted in a NOAEC of 7.5 µg a.i./L (LOAEC of 14 µg a.i./L). Based on iprodione SSD, freshwater invertebrate RQs exceed the acute risk LOC for some uses based on maximum application rates. Specifically, for aerial applications, RQs exceed the acute risk LOC (0.5) for uses on carrots, crucifers for seed, grapes, lettuce, onions, potato and turf (RQs range from 0.60-4.0). For ground applications, RQs exceed the acute risk LOC for all uses except for almonds, grapes and stone fruit (RQs range from 0.14-3.8). However, the acute risk LOC is only equal to the RQ for turf using the Formation-Decline modeling results. There are no acute LOC exceedances for estuarine/marine invertebrates for any of the uses evaluated (RQs were ≤0.43).

On the basis of iprodione SSD and maximum application rates, freshwater invertebrate RQs exceed the chronic risk LOC for some uses (*i.e.*, broccoli, carrots, crucifers for seed, lettuce, ornamentals, potato and turf); whereas, for estuarine/marine invertebrates, RQs exceed the chronic risk LOC for all uses. For aerial applications and based on maximum application rates, freshwater and estuarine/marine invertebrate chronic RQs are 0.24-3.3 and 9.1-127, respectively (**Table 8-17.**). For ground applications at maximum application rates, freshwater and estuarine/marine invertebrate chronic RQ ranges are 0.11-3.1 and 4.3-119, respectively. **Table 8-16** summarizes the aquatic invertebrate RQs calculated with different refinement assumptions. Acute and chronic RQs for freshwater and estuarine/marine invertebrates were estimated based on iprodione SSD, using average usage rates (provided by BEAD) for aerial, ground and air blast applications to broccoli, lettuce-broccoli-lettuce rotation, carrots, lettuce, onion, potato and stone fruit (see **Appendix G**). For aerial applications and based on average application rates, freshwater and estuarine/marine invertebrate acute RQ ranges are 0.35-1.4 and 0.04-0.15, respectively and chronic RQ ranges are 0.29-1.2 and 11-44, respectively (see **Appendix G**). For ground applications at average rates, freshwater and saltwater invertebrate acute RQ ranges are 0.20-1.3 and 0.02-0.14, respectively and chronic RQ ranges are 0.16-1.1 and 6.3-42, respectively. Chronic risk to invertebrates was also estimated using the lowest observed adverse effect concentration (LOAEC = 14 µg a.i./L) instead of the NOAEC based on iprodione SSD and maximum application rates. Freshwater invertebrate RQs based on the LOAEC exceed the chronic risk LOC for lettuce-broccoli-lettuce rotations (RQ = 1.4), ground application to ornamentals (RQ = 1.6) and aerial applications to turf for one and two crop cycles (RQs = 1.7 and 1.5, respectively). Estuarine/Marine invertebrate RQs exceed the chronic risk LOC for all uses except for in-furrow applications to cotton (RQs range from 1.9-68).

When risk quotients are calculated on the basis of parent iprodione alone and maximum use rates (see **Appendix G**), there are acute risk LOC exceedances for freshwater invertebrates for ground applications to turf (RQ= 0.69) and aerial application to turf during one crop cycle (RQ = 0.51). There are no other acute risk LOC exceedances for freshwater or estuarine/marine invertebrates for any of the other uses evaluated. Based on parent iprodione alone and maximum use rates, there are also no chronic risk LOC exceedances for freshwater invertebrates for any of the uses evaluated. There are chronic risk LOC exceedances for estuarine/marine invertebrates for all uses (RQs range from 1.1 – 18) except ground and air blast applications to almonds, grapes and stone fruit and in-furrow applications to cotton.

When risk quotients are based on parent iprodione alone and average use rates (see **Appendix G**), there are no acute risk LOC exceedances for freshwater or estuarine/marine invertebrates. Similarly, when based on parent alone and average use rates, there are no chronic risk LOC exceedances for freshwater invertebrates, for any uses. Based on average application rates and parent iprodione alone, there are chronic risk LOC exceedances for estuarine/marine invertebrates for ground applications to broccoli over one and two crop cycles (RQs = 2.1 and 3.0, respectively); uses on lettuce-broccoli-lettuce rotations (RQ = 7.8); aerial and ground applications to carrots (RQ = 7.1 and 7.2, respectively); aerial and ground applications to lettuce over one and two crop cycles (RQs = 3.4 and 4.1, respectively); aerial and ground applications to onion (RQs = 2.0 and 1.8, respectively); aerial and ground applications to potatoes (RQ = 2.3 and 1.6, respectively); and aerial applications to stone fruit (RQ = 1.1).

When considering the results from the Formation-Decline modeling, which provides the most refined estimate of exposure to iprodione residues, the RQ for turf (maximum application rate) is equal to the acute risk LOC for freshwater invertebrates (RQ=1.0) and there are no chronic risk LOC exceedances. There are no acute risk LOC exceedances for estuarine/marine invertebrates. There are chronic risk LOC exceedances for estuarine/marine invertebrates with RQs of 18 for the broccoli and lettuce rotation and 29 for the turf use pattern (at maximum application rates). The estuarine/marine chronic risk RQ for a single crop cycle of lettuce at average application rates is 4.4 for an early application and 1.8 for a late application.

Based on 3,5-DCA exposure to freshwater invertebrates and maximum application rates with a 75% conversion factor, freshwater invertebrate RQs exceed the chronic risk LOC for some uses. Specifically, RQs exceed the chronic risk LOC for uses on lettuce-broccoli-lettuce rotations, aerial and ground application to carrots, ground applications to ornamentals, and aerial applications to a single crop cycle of turf (RQs range from 1.0-2.8). The assumption that 75% of iprodione may be converted 3,5-DCA is a high-end estimate, with further evaluation it was determined that it may be assumed that the amount of 3,5-DCA formed is 30% (see **Appendix L** for supporting information). To understand the impact of this refinement, RQs calculated using the 75% assumption are multiplied by 0.4 and drop to 0.01 to 1.1. With the 30% 3,5-DCA formation assumption, the only LOC exceeded was for use on ornamentals assuming six applications at 4 lbs a.i./A with an RQ of 1.1.

**Table 8-16. Aquatic Invertebrate Risk Characterization Summary**

| Refinement Assumptions | Residues (modeling method)[1,2] | FW Acute RQ range | FW Chronic RQ range | E/M Acute RQ Range | E/M Chronic RQ Range |
|---|---|---|---|---|---|
| Max app rates (Using NOAEC) | Iprodione+RP30228 (total residue) | 0.04-**4.0** | 0.03-**3.3** | <0.01-0.43 | **1.2-127** |
| Max app rate | Iprodione+RP30228 (formation-decline) | 0.65-**1.1** | 0.48-0.75 | 0.07-0.11 | **18-29** |
| Average app rates[3] | Iprodione+RP30228 (total residue) | 0.17-**3.0** | 0.14-**2.5** | 0.02-0.32 | **5.3-95** |
| Average app rates[4] | Iprodione+RP30228 (formation-decline) | 0.07-0.17 | 0.05-0.11 | 0.01-0.02 | **1.8-4.4** |

| Refinement Assumptions | Residues (modeling method)[1,2] | FW Acute RQ range | FW Chronic RQ range | E/M Acute RQ Range | E/M Chronic RQ Range |
|---|---|---|---|---|---|
| Max app rates (Using LOAEC) | Iprodione+RP30228 (total residue) | N/A | 0.02-**1.7** | N/A | 0.63-**68** |
| Max app rates | Iprodione alone | 0.01-**0.69** | 0.01-0.47 | <0.01-0.07 | 0.21-**18** |
| Average app rates[3] | Iprodione alone | 0.02-0.38 | 0.01-0.20 | <0.01-0.04 | 0.57-**7.8** |
| Max app rates | 3,5-DCA (75% conversion) | N/A | 0.03-**2.8** | N/A | N/A |
| Max app rates | 3,5-DCA (30% conversion) | N/A | 0.01 – **1.1** | N/A | N/A |

N/A=not applicable.

[1] Iprodione SSD were simulated using two different modeling approaches. A range of use patterns were simulated using the total residue calculation approach and turf and a 3-crop cycle rotation of broccoli and lettuce were simulated using the Formation-Decline methodology.

[2] 3,5-DCA EECs were calculated using the assumption that 75% of iprodione was converted to 3,5-DCA and the assumption was subsequently refined to 30%.

[3]Average application rates for use on broccoli, lettuce-broccoli-lettuce rotation, carrots, lettuce, onion, potato and stone fruit only.

[4] Average application rates for use on lettuce only.

**Bolded** values exceed the acute risk to non-listed species LOC of 0.5 or the chronic risk LOC of 1.0.

**Table 8-17. Summary of Acute and Chronic Risk Quotients (RQs) for Non-listed Invertebrate (In the water column) Based on Iprodione Total Residue (TR) From Maximum Label Application Rates.**

| Use Sites | Run Name[1] | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|---|
| | | | | Freshwater | | Estuarine/Marine | |
| | | Daily Mean | 21-day Mean | Acute[2] | Chronic[3] | Acute[2] | Chronic[3] |
| | | | | $LC_{50}$ = 240 µg a.i./L | NOAEC = 288 µg a.i./L | $LC_{50}$ = 2240 µg a.i./L | NOAEC = 7.5 µg a.i./L |
| Almonds - AER | ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 69 | 68 | 0.29 | 0.24 | 0.03 | **9.1** |
| Broccoli - GRD (2 CC) | ROC_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 296 | 294 | **1.2** | **1.0** | 0.13 | **39** |
| Lettuce-Broccoli-Lettuce Rotation | ROC_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 778 | 771 | **3.2** | **2.7** | 0.35 | **103** |
| Carrots - AER | ROC_1CC_4x1.0_aerial_7_FLcarrotSTD | 352 | 346 | **1.5** | **1.2** | 0.16 | **46** |
| Cotton - In_furrow | ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 8.9 | 8.8 | 0.04 | 0.03 | <0.01 | **1.2** |
| Grapes - AER | ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 145 | 144 | **0.60** | 0.50 | 0.06 | **19** |
| Lettuce - AERx1, GRDx2 | ROC_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 203 | 201 | **0.85** | 0.70 | 0.09 | **27** |
| Lettuce - AER1x, GRDx2 (2 CC) | ROC_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 296 | 294 | **1.2** | **1.0** | 0.13 | **39** |
| Ornamentals - GRD | ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 900 | 893 | **3.8** | **3.1** | 0.40 | **119** |
| Turf - AER (1 CC) | ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 962 | 952 | **4.0** | **3.3** | 0.43 | **127** |

**Bolded** values exceed the acute risk to non-listed species LOC of 0.5 or the chronic risk LOC of 1.0. The toxicity endpoints listed in the table are those used to calculate the RQ.
CC = Crop Cycle; TR=iprodione + RP30228
[1] Run Name corresponds to the model input information in **Appendix E.**
[2]The estimated environmental concentrations (EECs) used to calculate these RQs are based on the 1-in-10-year 1-day average value from **Table 8-8.**
[3]The EECs used to calculate these RQs are based on the 1-in-10-year 21-day average value from **Table 8-8**.

In previous assessments, the $EC_{50}$ from the shell deposition study conducted with the Eastern oyster (*Crassostrea virginica*) was used (MRID 40489202, $EC_{50}$ = 2,300 µg a.i./L) to calculate RQ values; however, the new study with the mysid shrimp (MRID 49526507) provides a more sensitive toxicity endpoint with which to estimate risk to estuarine/marine invertebrates. Therefore, acute RQ values for estuarine/marine invertebrates are higher than previously estimated.

In the available chronic toxicity study with daphnids (MRID 49653701) exposed to parent iprodione, the number of offspring per adult female was reduced by 11% and the dry weight was reduced by 17% at the LOAEC of 557 µg a.i./L, resulting in a NOAEC of 288 µg a.i./L. In the chronic toxicity study with daphnids exposed to the degradate 3,5-DCA (MRID 49526511), reproduction was reduced by 15% and dry weight was reduced by 25% at the LOAEC of 45.9 µg a.i./L, resulting in a NOAEC of 21.8 µg a.i./L. These data serve as another line of evidence that 3,5-DCA is roughly an order of magnitude more toxic to freshwater invertebrates than the parent compound.

As discussed earlier, environmental fate data indicate that 3,5-DCA was only present at up to ~30% in soil/water. Since 3,5-DCA differs structurally from iprodione, the mode of action in ecological receptors is assumed to be different. Therefore, 3,5-DCA is not included in the total residue approach for assessing risk and was evaluated separately using a separate set of exposure and toxicity values. Since empirical data indicate that the degradate is an order of magnitude more toxic than the parent, separate risk estimations for 3,5-DCA for freshwater invertebrates were calculated in addition to the RQs for iprodione SSD and parent iprodione. When based on the parent iprodione, there are no chronic risk LOC exceedances for freshwater invertebrates; however, when based on the degradate, 3,5-DCA and the assumption that 30% of iprodione may be converted to 3,5-DCA, there is a chronic risk LOC exceedances for ground applications to ornamentals (RQ = 1.1) only. There is only the one toxicity study that provides empirical data for the degradate 3,5-DCA; therefore, determining the potential impacts the degradate has on other taxa is not possible. However, ECOSAR predictions for anilines suggest that 3,5-DCA will be more toxic to both fish and invertebrates and RQs indicate that the likelihood of adverse effects in freshwater invertebrates from chronic exposure to 3,5-DCA is higher than that from parent iprodione alone.

In the chronic toxicity study on the toxicity of iprodione to the mysid shrimp (MRID 40832201) there was a 29% reduction in the number of young per female per reproductive day at the LOAEC of 14 µg a.i./L, resulting in a NOAEC of 7.5 µg a.i./L.

There are no toxicity data for benthic invertebrates exposed to iprodione or 3,5-DCA. In order to characterize the risk for benthic invertebrates, the EECs for 21-day sediment pore water concentrations were compared to chronic aquatic invertebrate toxicity data. The RQs range from 0.03 to 3.3 for freshwater invertebrates, based on the daphnid chronic NOAEC of 288 µg a.i./L; whereas, chronic RQs range from 1.1 to 127 for estuarine/marine invertebrates, based on the mysid chronic NOAEC of 7.5 µg a.i./L. Both ranges were estimated using the EECs calculated using maximum application rates for iprodione. Analysis of year-to-year iprodione surface water concentrations provide evidence of iprodione accumulating in the modeled farm pond. According to the surface water modeling, chronic risk LOC exceedances would occur due to accumulation in the pond for estuarine/marine invertebrates after 1 year of iprodione application.

Therefore, based on the available data, there are risks of concern for aquatic and benthic invertebrates from the use of iprodione when EECs account for the presence of parent iprodione SSD or for 3,5-DCA (freshwater invertebrates on a chronic basis only) for most uses based on the maximum application rates. There are also risks of concern for chronic exposure to estuarine/marine invertebrates when considering exposure to iprodione SSD using both total residue modeling and Formation-Decline modeling estimates of exposure.

### 8.3.3 Aquatic Plants:

In the available study with vascular aquatic plant species, there are no adverse effects on growth up to the highest tested concentrations. Specifically, in a 7-d toxicity test with duckweed (*Lemna gibba*; MRID 45741301), there were no adverse effects on frond number, growth rate or biomass up to a concentration of 12,640 µg a.i./L. There were statistically significant ($p<0.05$) adverse effects detected in the available studies with non-vascular plant species. In a 96-h test (MRID 49526506) with the cyanobacterium *A. flos-aquae*, there was a 26% reduction in yield at the LOAEC of 2,250 µg a.i./L ($p < 0.05$). The resulting $IC_{50}$ and NOAEC were 5,548 and 641 µg a.i./L, respectively. Similarly, in the study with the freshwater diatom, *N. pelliculosa* (MRID 49526505), there was a 27% reduction in the area under the growth curve (biomass) at the LOAEC of 81 µg a.i./L, resulting in an $IC_{50}$ and NOAEC of 2,864 and 23 µg a.i./L, respectively. In the study with the green algae, *R. subcapitata* (MRID 49526504), there was an 11% reduction in cell density at the LOAEC of 1,330 µg a.i./L, resulting in an $IC_{50}$ and NOAEC of 5,170 and 568 µg a.i./L, respectively. In a study with the marine diatom *S. costatum*, there was a 15% reduction in cell growth at the LOAEC. The resulting $IC_{50}$ and NOAEC were 330 and 30 µg a.i./L, respectively. These data indicate that both freshwater and marine diatoms are the most sensitive of the aquatic non-vascular plants tested; whereas, green algae and cyanobacteria are roughly 19 – 21x less sensitive than the diatoms.

On the basis of iprodione SSD (parent + RP30228), RQs for non-vascular plants exceed the LOC of 1.0 for risk to plants from some iprodione uses based on maximum application rates. Aerial applications to carrots (RQ = 1.1), crucifers for seed (RQ = 1.5), potato (RQ = 1.1) and turf (RQs range from 2.6-2.9) exceed the LOC. For ground applications, RQs exceed the LOC for risk to non-vascular plants from uses on lettuce-broccoli-lettuce rotations (RQ = 2.4), carrots (RQ = 1.1), crucifers for seed (RQ = 1.2), ornamentals (RQ = 2.7) and turf (RQs range from 1.2-1.5) [see **Table 8-19**]. No RQ values are reported for vascular aquatic plants since the available toxicity study with duckweed (MRID 45741301) did not indicate any adverse effects on the plants up to the highest concentration tested (NOAEC=12,640 µg ai/L); therefore, the $IC_{50}$ value is non-definitive ($IC_{50}$>12,640 µg ai/L).

**Table 8-18** summarizes the aquatic plant RQs calculated with different refinement assumptions. The RQs for non-vascular plants were estimated based on parent + RP30228, using average usage rates (provided by BEAD) for aerial, ground and air blast applications to broccoli, lettuce-broccoli-lettuce rotation, carrots, lettuce, onion, potato and stone fruit (see **Appendix G**). For aerial applications and based on parent + RP30228 and average application rates, non-vascular plant RQs range from 0.26-1.0 (see **Appendix G**). For ground applications at average rates, non-vascular plant RQs range from 0.14-0.97 and are below LOC for risks to aquatic plants. There were plant risk LOC exceedances for iprodione use in a lettuce-broccoli-lettuce rotation (RQ = 2.2) and for aerial and ground applications to lettuce for two crop cycles (RQ = 1.3) based on parent + RP30228 and average application rates. When based on parent iprodione alone and maximum application rates, there were no exceedances of the LOC for risks to aquatic plants (RQs range from 0.01-0.37) for non-vascular plants, nor were there LOC exceedances when modeled based on parent iprodione at average application rates (RQs range from 0.02-0.27). Additionally, when considering Formation-Decline modeling, the highest daily EEC of 251 µg/L does not exceed the $IC_{50}$ of 330 µg a.i./L for non-vascular plants (RQ = 0.76).

**Table 8-18. Aquatic Plant Risk Characterization Summary.**

| Refinement Assumptions | Residues | Vascular Plant RQ Range | Non-Vascular Plant RQ Range |
|---|---|---|---|
| Max app rates | Iprodione+RP30228 (total residue) | <0.01-0.08 | 0.03-**2.9** |
| Max app rates[1] | Iprodione+RP30228 (formation-decline) | 0.01-0.02 | 0.47-0.76 |
| Average app rates[2] | Iprodione+RP30228 (total residue) | <0.01-0.06 | 0.12-**2.2** |
| Average app rates[3] | Iprodione+RP30228 (formation-decline) | <0.01 | 0.05-0.13 |
| Max app rates | Iprodione alone | <0.01-0.01 | 0.01-0.37 |
| Average app rates [2] | Iprodione alone | <0.01-0.01 | 0.02-0.27 |

[1] Iprodione SSD were simulated using two different modeling approaches. A range of use patterns were simulated using the total residue calculation approach and turf and a 3-crop cycle rotation of broccoli and lettuce were simulated using the Formation-Decline methodology.
[2]Average application rates for use on broccoli, lettuce-broccoli-lettuce rotation, carrots, lettuce, onion, potato and stone fruit only.
[3] Average application rates for use on lettuce only.

**Table 8-19 Summary of Risk Quotients (RQs) for Non-listed Aquatic Plant Species Exposed to Iprodione Residues of Concern (ROC =parent plus RP30228) Based on Label Application Rates**

| Use Sites | Run Name[1] | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|---|
| | | | Vascular | Non-vascular |
| | | | $IC_{50}$ >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Almonds - AER | ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 69 | N/A | 0.21 |
| Broccoli - GRD (2 CC) | ROC_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 296 | | 0.90 |
| Lettuce-Broccoli-Lettuce Rotation | ROC_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 778 | | **2.4** |
| Carrots - AER | ROC_1CC_4x1.0_aerial_7_FLcarrotSTD | 352 | | **1.1** |
| Cotton - In_furrow | ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 8.9 | | 0.03 |
| Grapes - AER | ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 145 | | 0.44 |
| Lettuce - AERx1, GRDx2 | ROC_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 203 | | 0.62 |
| Lettuce - AER1x, GRDx2 (2 CC) | ROC_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 296 | | 0.90 |
| Ornamentals - GRD | ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 900 | | **2.7** |
| Turf - AER (1 CC) | ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 962 | | **2.9** |

The LOC for non-listed plants is 1. The endpoints listed in the table are the endpoint used to calculate the RQ.
[1] Run Name corresponds to the model input information in **Appendix F.**

As mentioned previously, RP30228 is relatively persistent in water and can accumulate over time. Monitoring data indicate residues higher than modeled iprodione concentrations and estimated residues in the standard pond increased over time. Therefore, based on available environmental fate and ecological effect data, there are risks to non-vascular plants when exposure is based on parent + RP30228 and maximum application rates for iprodione uses on lettuce-broccoli-lettuce rotations, carrots, crucifers for seed, ornamentals, potato (aerial application) and turf. There are no LOC exceedances for non-vascular aquatic plants when based on parent iprodione alone for either maximum or average application rates or when using Formation-Decline estimates of exposure for iprodione SSD at maximum application rates.

Risk quotients for vascular plants could not be calculated based on the non-definitive endpoint for vascular aquatic plants (MRID 45741301); however, the highest EEC calculated for aquatic vascular plants is 962 µg/L and there were no observed adverse effects on vascular aquatic plants in the laboratory study up to a concentration of 12,640 µg a.i./L. There is some uncertainty in the EECs using the total residue approach (parent + RP30228), especially given the differences in the sorption coefficients for parent and RP30228. We are likely overestimating exposure using the most mobile sorption coefficient. Therefore, it can be assumed that the likelihood of adverse effects on aquatic vascular plants is low but possible.

# 9 Terrestrial Vertebrates Risk Assessment

## 9.1 Terrestrial Vertebrate Exposure Assessment

Terrestrial wildlife exposure estimates are typically calculated for birds and mammals by emphasizing the dietary exposure pathway. Iprodione is applied through aerial and ground application methods, as well as through seed treatments. Therefore, potential dietary exposure for terrestrial wildlife in this assessment is based on consumption of iprodione residues on food items following spray (foliar or soil) applications, and from possible dietary ingestion of iprodione residues on treated seeds. The EECs for birds[19] and mammals from consumption of dietary items on the treated field were calculated using T-REX v.1.5.2. Since iprodione has a $K_{OW}$ of 3.1, terrestrial wildlife may also be exposed to iprodione through ingestion of residues in aquatic organisms; therefore, exposure through this pathway was evaluated using the $K_{ow}$-based Aquatic Bioaccumulation Model (KABAM; ver. 1.0) model with exposure estimates in Appendix I.

### 9.1.1 Residues in Aquatic Organisms Serving as Food Sources for Birds and Mammals

The $K_{OW}$ (based) Aquatic BioAccumulation Model (KABAM; version 1.0) was used to evaluate the potential exposure and risk of direct effects to birds and mammals via bioaccumulation and biomagnification in aquatic food webs. The model is used to estimate potential bioaccumulation of hydrophobic organic pesticides in freshwater aquatic ecosystems and risks to mammals and birds consuming aquatic organisms which have bioaccumulated these pesticides. The bioaccumulation portion of KABAM is based upon work by Arnot and Gobas (2004) who parameterized a bioaccumulation model based on PCBs and some pesticides (*e.g.*, lindane, DDT) in freshwater aquatic ecosystems (Arnot and Gobas, 2004). The KABAM relies on a chemical's octanol-water partition coefficient ($K_{OW}$) to estimate uptake and elimination constants through respiration and diet of organisms in different trophic levels. Pesticide tissue residues are calculated for organisms at different levels of an aquatic food web. The model then uses pesticide tissue concentrations in aquatic animals to estimate dose- and dietary-based exposures and associated risks to mammals and birds (surrogate for amphibians and reptiles) consuming aquatic organisms. Seven different trophic levels including phytoplankton, zooplankton, benthic invertebrates, filter feeders, small-sized (juvenile) forage fish, medium-sized forage fish, and larger piscivorous fish, are used to represent an aquatic food web. Importantly, chemical metabolism by biota is assumed to be zero in KABAM unless evidence indicates such metabolism is likely to affect the model predictions substantially. **Table 9-1** summarizes the model inputs for KABAM.

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[19] Birds are also used as a proxy for reptiles and terrestrial-phase amphibians.

**Table 9-1. $K_{OW}$ (based) Aquatic BioAccumulation Model (KABAM)** Input Values for Iprodione Total Residues.

| Parameter | Input Value | Source |
|---|---|---|
| Pesticide Name | Iprodione | N/A |
| Log $K_{OW}$ | 3.24 | Estimated using EPIWEB version 4.1; $K_{OW}$ for RP30228 |
| $K_{OC}$ (mL/g) | 426 | MRID 43349202; Value for iprodione |
| Pore water EEC (µg/L) | 251 | Maximum 1-in-10 year daily average EEC from surface water Formation-Decline modeling. The water-column value was used as the pore water concentration was not readily available. The estimated time to reach steady state was 3 days. |
| Water column EEC (µg/L) | 251 | Maximum 1-in-10 year daily average value surface water modeling for iprodione total residues using Formation-Decline modeling. The estimated time to reach steady state was 3 days. |

Based on KABAM results, estimated concentrations of iprodione residues in the tissue of organisms in the different trophic levels following application to turf range from 16 to 21 mg/kg-tissue (**Table 9-2**). The measured bioconcentration factor (BCF) in whole fish of iprodione in Bluegill Sunfish (*L. macrochirus*) was 46.8 L/kg-wet-weight (Cleveland and Hamilton, 1983), and is slightly lower than BCF values of 84 L/kg-wet weight fish estimated in KABAM modeling, suggesting that the KABAM estimates are consistent with the measured values.

**Table 9-2. $K_{OW}$ (based) Aquatic BioAccumulation Model (KABAM) Predicted Concentrations of Iprodione in Aquatic Organism Tissues at Different Trophic Levels (µg/kg-wet weight)**

| Use Scenario | Phytoplank-ton | Zooplank-ton | Benthic Inverts. | Filter Feeders[1] | Small Fish | Medium Fish | Large Fish |
|---|---|---|---|---|---|---|---|
| PAturfSTD (5.51 lbs a.i./A, 4 appl./CC + 1.96 lbs a.i./A, 1 appl./CC; 1CC/yr) | 20,603 | 15,139 | 16,503 | 10,935 | 21,224 | 21,298 | 21,425 |

[1] Filter feeders include clams, krill, sponges, whales, and many fish and may be vertebrates or invertebrates.

Because the empirical BCF value and the BCF value generated by KABAM are very similar and the measured BCF value is based on total residues, the KABAM-generated BCF value for fish was used to estimate iprodione concentrations in aquatic organisms. The empirical BCF for iprodione is 46.8 L/kg for whole fish. The highest estimated BCF value calculated by KABAM is 84 L/kg. The maximum 1-in-10-year daily average EECs from the Formation-Decline modeling of 251 µg/L (iprodione plus RP30288 at maximum label rates) was assumed for the KABAM analysis because the estimated time to equilibrium was 3-days.

It should be noted that tissue concentrations in some aquatic vertebrates will likely be limited by the toxicity of iprodione to these organisms.

### 9.1.2 Dietary Items on the Treated Field (for Foliar Applications)

T-REX EECs are calculated on the basis of the maximum single application rates, total number of applications, minimum re-application intervals presented in **Table 3-1** and the foliar dissipation rate for a given chemical. Most use sites had a single crop cycle, with multiple applications during the crop cycle. Only three uses allow for more than one crop cycle within a year (lettuce, broccoli and turf). In order to appropriately bracket (*i.e.*, present high and low estimates of likely environmental exposure and resulting ecological risk) RQs for terrestrial vertebrates, the following use scenarios were used for T-REX modeling: almonds (4x 0.50 lbs a.i./A); crucifers for seed (3x 2.00 lbs a.i./A); grapes, which also covered carrots (4x 1.00 lbs a.i./A); A rotational crop of lettuce (3x 1.00 lb a.i./A), broccoli (2x 1.00 lb a.i./A) and lettuce (3x 1.00 lb a.i./A); onion (4x 1.00 lbs a.i/A); cotton, in furrow (1x 0.272 lbs a.i./A); and carrots, seed treatment (1x 0.616 lbs a.i./A). Use on turf and ornamentals are limited to a maximum annual application rate of 24 lbs a.i./A. Turf was modeled at a rate of 5.51 lbs a.i./A applied 4 times followed by a single application at 1.96 lbs a.i./A to equal a total of 24 lbs a.i./A/year. Ornamentals were modeled at a rate of 4.00 lbs a.i./A applied 6 times to equal a total of 24 lbs a.i./A/year (as was recommended by BEAD).

For foliar uses of iprodione, EECs are based on application rates, number of applications, and intervals presented in **Table 3-1.** T-REX modeling assumed multiple applications at 0.50 (maximum single application rate on almonds) or 1.00 (maximum single application rate on lettuce, carrots, onion, broccoli, stone fruit and grapes) lbs a.i./A, with re-treatment intervals of 5-7 days (beans); 7,10 or 14 days (ginseng, carrots and onions); 10-14 days (mustard); 10, 14, 21 days (potatoes); 14 days (small fruit); or 14-21 days (peanuts). The labels did not specify a retreatment interval for almonds, crucifers for seed, or grapes; therefore, a 5-day retreatment interval was assumed based on that being the lowest retreatment interval listed on any label. Up to 2 applications per year at 1.00 lbs a.i./A are permitted on labels for broccoli. Up to 3 applications per year are permitted on labels at 1.00 lbs a.i./A for lettuce and 2.00 lbs a.i./A for crucifers for seed. Up to 4 applications per year at 0.50 lbs a.i./A are permitted on labels for almonds and at 1.00 lb a.i./A for carrots, onions and grapes. California has labels that allow application of 0.75 lbs a.i./A, up to 4 times per year for onion and 1.00 lb a.i./A up to 5 times per year for crucifers for seed; however, these use scenarios were not modeled in T-REX as other use scenarios are protective of these uses. The default foliar dissipation half-life (*i.e.*, 35-days), as well as the default Mineau scaling factor (*i.e.*, 1.15), were also used in T-REX.

Upper-bound Kenaga nomogram values are used to derive EECs for iprodione exposures to terrestrial mammals and birds on the field of application based on a 1-year time period for applications of flowables. Consideration is given to different types of feeding strategies for mammal and birds, including herbivores, insectivores and granivores. Dose-based exposures are estimated for three weight classes of birds (*i.e.*, 20 g, 100 g, and 1,000 g) and three weight classes of mammals (*i.e.*, 15 g, 35 g, and 1,000 g). The EECs on terrestrial food items range from 4.1 to 3,660 mg/a.i. kg-diet based on upper-bound Kenaga values. Dose-based EECs, adjusted for body weight, range from 0.26 to 4,168 mg/a.i. kg-bw for birds and 0.14 to 3,489 mg/a.i. kg-bw for mammals. A Summary of EECs are found in **Appendix I.** A summary of the EECs for the high and low application rates is found in **Table 9-3**. An example of the T-REX output is presented in **Appendix H**.

**Table 9-3 Summary of Dietary- (mg a.i./kg-diet) and Dose-based Estimated Environmental Concentrations (EECs; mg a.i./kg-bw) as Food Residues for Birds, Reptiles, Terrestrial-Phase Amphibians and Mammals from Labeled Uses of Iprodione (T-REX v. 1.5.2, Upper-Bound Kenaga).**

| Food Type | Dietary-Based EEC (mg/kg-diet) | Dose-Based EEC (mg/kg-body weight) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Birds | | | Mammals | | |
| | | Small (20 g) | Medium (100 g) | Large (1000 g) | Small (15 g) | Medium (35 g) | Large (1000 g) |
| **Turf (5.51 lbs a.i./A, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr, modeled as 4 appl. at 5.51 + 1 appl. at 1.96 lbs a.i./A** | | | | | | | |
| Short grass | 3660 | 4168 | 2377 | 1064 | 3489 | 2412 | 559 |
| Tall grass | 1677 | 1910 | 1089 | 488 | 1599 | 1105 | 256 |
| Broadleaf plants/small insects | 2059 | 2345 | 1337 | 599 | 1963 | 1357 | 315 |
| Fruits/pods/seeds (dietary only) | 229 | 261 | 149 | 67 | 218 | 151 | 35 |
| Arthropods | 1433 | 1632 | 931 | 417 | 1367 | 945 | 219 |
| Seeds (granivore)[1] | NA | 58 | 33 | 15 | 48 | 33 | 7.8 |
| **Cotton, in furrow (0.272 lbs a.i./A, 1x, 40 in. row spacing, 1 in. bandwidth)** | | | | | | | |
| Short grass | 65 | 74 | 42 | 19 | 62 | 43 | 10 |
| Tall grass | 30 | 34 | 19 | 8.7 | 29 | 20 | 4.6 |
| Broadleaf plants/small insects | 37 | 42 | 24 | 11 | 35 | 24 | 5.6 |
| Fruits/pods/seeds (dietary only) | 4.1 | 4.7 | 2.7 | 1.2 | 3.9 | 2.7 | 0.62 |
| Arthropods | 26 | 29 | 17 | 7.4 | 24 | 17 | 3.9 |
| Seeds (granivore)[1] | NA | 1.0 | 0.59 | 0.26 | 0.86 | 0.60 | 0.14 |

[1] Seeds presented separately for dose – based EECs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

### 9.1.3 Dietary Items based on Seed Treatment

Application rates (in terms of lbs a.i/A, mg a.i./seed and fl oz a.i./cwt) were presented in **Table 3-1** (use table)**,** and resulting EECs from iprodione-treated seeds are provided in **Table 9-4** (below)**.** Results include Nagy dose-based values (*i.e.*, mg/kg-bw) and available mass of active ingredient per unit area (*i.e.*, mg a.i/$ft^2$). Seed treatment exposure estimates are based not only on lb a.i./A, but on how many seeds are planted on a given acre. Fewer seeds sown per acre may increase dietary exposure due to more active ingredient per unit of dietary item (the seed) available up to a maximum allowable poundage per acre. Seeding rates for cotton and soybean are based on the values used in T-REX v 1.5.2 and represent national maximum values.

**Table 9-4. Avian and Mammalian Dose-Based Estimated Environmental Concentrations (EECs) and mg a.i./$ft^2$ EECs for Iprodione Seed Treatments.**

| Crop | Animal Size | Maximum Application Rate | Maximum Seed Application Rate | Avian Nagy Dose | Mammalian Nagy Dose | Available AI |
|---|---|---|---|---|---|---|
| | | (lbs ai/A) | (mg ai/kg seed) | (mg ai/kg-bw/day) | (mg ai/kg-bw/day) | (mg ai/$ft^2$) |
| Carrot[1] | Small | 0.06 | 4816 | 1219 | 1020 | 0.60 |
| | Medium | | | 695 | 705 | |
| | Large | | | 311 | 164 | |

[1] Based on a seeding rate of 11.9 lbs/A

### 9.1.4 Dietary Items based on In-furrow Application

An in-furrow application for cotton was modeled based on a single application at a rate of 0.272 lbs a.i./A. The label information indicated that row spacing could be 30 or 40 in. Additionally, BEAD provided the bandwidth of 1 inch for modeling.

## 9.2 Terrestrial Vertebrate Risk Characterization

### 9.2.1 Residues on Treated Fields

Iprodione is classified as slightly toxic to birds on an acute oral ($LD_{50}$=930 mg ai/kg bw) and subacute dietary exposure basis ($LC_{50}$=1,800 mg a.i./kg diet). Following chronic exposure, the NOAEC was 400 mg a.i./kg diet.  With respect to mammals, iprodione is slightly toxic on an acute oral exposure basis ($LD_{50}$=1,160 mg a.i./kg bw) while chronic exposure resulted in a NOAEC of 300 mg a.i./kg diet (equivalent to a NOAEL=15 mg/kg bw).

The RQ values are generated based on the upper-bound EECs discussed above and toxicity values contained in **Table 6-2**. Dietary-based EECs range from 4.1 to 3,660 mg/kg-diet. For acute dose-based exposures for birds, RQs are <0.01-6.2, <0.01-2.8, and <0.01-0.88, respectively for small, medium, and large-sized birds based on upper-bound Kenega exposure values.  For acute dietary-based exposure, avian RQ values range from 0.01 to 2.0; following chronic dietary-based exposure, avian RQ values range from 0.05-12. There are exceedances of both the acute and chronic risk LOCs for non-listed birds. Since birds serve as surrogates for reptiles and terrestrial-phase amphibians, risk estimates for birds extend to these other taxa as well.

Chronic dietary-based RQs for the turf and ornamental uses (maximum use of 24 lbs a.i./A/yr) range from 0.67 to 12; (**Table 9-5**); there are some chronic risk LOC exceedances for all uses. Therefore, there is a likelihood of adverse effects on birds (and by extension to terrestrial-phase amphibians and reptiles) from exposure resulting from registered uses of iprodione.

**Table 9-5. Acute and Chronic Risk Quotient (RQ) values for Birds, Reptiles, and Terrestrial-Phase Amphibians from Labeled Uses of Iprodione (T-REX v. 1.5.2, Upper-Bound Kenaga).**

| Food Type | Acute Dose-Based RQ $LD_{50}$ = 930 mg a.i./kg-bw | | | Acute Dietary-Based RQ $LC_{50}$ = 1,800 mg a.i./kg-diet | Chronic Dietary RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|---|
| | Small (20 g) | Medium (100 g) | Large (1,000 g) | | |
| **Almonds (0.50 lb a.i./acre, 4x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **0.71** | 0.32 | 0.10 | 0.23 | **1.4** |
| Tall grass | 0.32 | 0.15 | 0.05 | 0.11 | 0.64 |
| Broadleaf plants | 0.40 | 0.18 | 0.06 | 0.13 | 0.78 |
| Fruits/pods/seeds | 0.04 | 0.02 | 0.01 | 0.01 | 0.09 |
| Arthropods | 0.28 | 0.12 | 0.04 | 0.09 | 0.54 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | <0.01 | <0.01 | N/A | N/A |
| **Lettuce – Broccoli - Lettuce (1.00 lbs ai/A, 3x, 10-day interval – 2x, 5-day interval – 3x, 10-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **1.1** | 0.48 | 0.15 | 0.35 | **2.1** |
| Tall grass | 0.49 | 0.22 | 0.07 | 0.16 | 0.96 |
| Broadleaf plants | **0.60** | 0.27 | 0.09 | 0.20 | **1.2** |
| Fruits/pods/seeds | 0.07 | 0.03 | 0.01 | 0.02 | 0.13 |
| Arthropods | 0.42 | 0.19 | 0.06 | 0.14 | 0.82 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | 0.01 | <0.01 | N/A | N/A |
| **Lettuce (1.00 lbs ai/A, 3x, 10-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **0.95** | 0.43 | 0.14 | 0.31 | **1.9** |
| Tall grass | 0.44 | 0.20 | 0.06 | 0.14 | 0.86 |
| Broadleaf plants | **0.54** | 0.24 | 0.08 | 0.17 | **1.1** |
| Fruits/pods/seeds | 0.06 | 0.03 | 0.01 | 0.02 | 0.12 |
| Arthropods | 0.37 | 0.17 | 0.05 | 0.12 | 0.73 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | 0.01 | <0.01 | N/A | N/A |
| **Broccoli (1.00 lb ai/A, 2x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **0.78** | 0.35 | 0.11 | 0.25 | **1.5** |
| Tall grass | 0.36 | 0.16 | 0.05 | 0.12 | 0.70 |
| Broadleaf plants | 0.44 | 0.20 | 0.06 | 0.14 | 0.86 |
| Fruits/pods/seeds | 0.05 | 0.02 | 0.01 | 0.02 | 0.10 |
| Arthropods | 0.30 | 0.14 | 0.04 | 0.10 | 0.60 |

| Food Type | Acute Dose-Based RQ LD50 = 930 mg a.i./kg-bw | | | Acute Dietary-Based RQ LC50 = 1,800 mg a.i./kg-diet | Chronic Dietary RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|---|
| | Small (20 g) | Medium (100 g) | Large (1,000 g) | | |
| Granivores | | | | | |
| Seeds[1] | 0.01 | <0.01 | <0.01 | N/A | N/A |
| **Crucifer for Seed (2.00 lbs a.i./A, 3x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **2.2** | **1.0** | 0.32 | **0.73** | **0.73** |
| Tall grass | **1.0** | 0.46 | 0.14 | 0.33 | 0.33 |
| Broadleaf plants | **1.3** | **0.56** | 0.18 | 0.41 | 0.41 |
| Fruits/pods/seeds | 0.14 | 0.06 | 0.02 | 0.05 | 0.05 |
| Arthropods | **0.87** | 0.39 | 0.12 | 0.28 | 0.28 |
| Granivores | | | | | |
| Seeds[1] | 0.03 | 0.01 | <0.01 | N/A | N/A |
| **Grapes (1.00 lb a.i./A, 4x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **1.4** | **0.63** | 0.20 | 0.46 | **2.8** |
| Tall grass | **0.65** | 0.29 | 0.09 | 0.21 | **1.3** |
| Broadleaf plants | **0.80** | 0.36 | 0.11 | 0.26 | **1.6** |
| Fruits/pods/seeds | 0.09 | 0.04 | 0.01 | 0.03 | 0.17 |
| Arthropods | **0.55** | 0.25 | 0.08 | 0.18 | **1.1** |
| Granivores | | | | | |
| Seeds[1] | 0.02 | 0.01 | <0.01 | N/A | N/A |
| **Onion (1.00 lb a.i./A, 4x, 7-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **1.3** | **0.60** | 0.19 | 0.44 | **2.6** |
| Tall grass | **0.61** | 0.28 | 0.09 | 0.20 | **1.2** |
| Broadleaf plants | **0.75** | 0.34 | 0.11 | 0.25 | **1.5** |
| Fruits/pods/seeds | 0.08 | 0.04 | 0.01 | 0.03 | 0.16 |
| Arthropods | **0.53** | 0.24 | 0.07 | 0.17 | **1.0** |
| Granivores | | | | | |
| Seeds[1] | 0.02 | 0.01 | <0.01 | N/A | N/A |
| **Potato (2.00 lbs ai/A, 4x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **2.8** | **1.3** | 0.40 | **0.93** | **5.6** |
| Tall grass | **1.3** | **0.58** | 0.18 | 0.42 | **2.5** |
| Broadleaf plants | **1.6** | **0.71** | 0.23 | **0.52** | **3.1** |
| Fruits/pods/seeds | 0.18 | 0.08 | 0.03 | 0.06 | 0.35 |
| Arthropods | **1.1** | **0.50** | 0.16 | 0.36 | **2.2** |
| Granivores | | | | | |
| Seeds[1] | 0.04 | 0.02 | 0.01 | N/A | N/A |
| **Turf (5.51 lbs a.i./A, 6x, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **6.2** | **2.8** | **0.88** | **2.0** | **12** |
| Tall grass | **2.9** | **1.3** | 0.40 | **0.93** | **5.6** |
| Broadleaf plants | **3.5** | **1.6** | **0.50** | **1.1** | **6.9** |
| Fruits/pods/seeds | 0.39 | 0.17 | 0.06 | 0.13 | 0.76 |
| Arthropods | **2.4** | **1.1** | 0.35 | **0.80** | **4.8** |
| Granivores | | | | | |
| Seeds[1] | 0.09 | 0.04 | 0.01 | N/A | N/A |

| Food Type | Acute Dose-Based RQ LD$_{50}$ = 930 mg a.i./kg-bw | | | Acute Dietary-Based RQ LC$_{50}$ = 1,800 mg a.i./kg-diet | Chronic Dietary RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|---|
| | Small (20 g) | Medium (100 g) | Large (1,000 g) | | |
| **Ornamentals, Drench (4.00 lbs a.i./A, 6x, 15-day interval) – Max application rate = 24 lbs a.i./A/yr** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **5.5** | **2.5** | **0.78** | **1.8** | **11** |
| Tall grass | **2.5** | **1.1** | 0.36 | **0.82** | **4.9** |
| Broadleaf plants | **3.1** | **1.4** | 0.44 | **1.0** | **6.0** |
| Fruits/pods/seeds | 0.34 | 0.15 | 0.05 | 0.11 | 0.67 |
| Arthropods | **2.1** | **0.96** | 0.30 | **0.70** | **4.2** |
| Granivores | | | | | |
| Seeds[1] | 0.08 | 0.03 | 0.01 | N/A | N/A |

**Bolded** values exceed the acute risk to non-listed species level of concern (LOC) of 0.5 or the chronic risk LOC of 1.0. The toxicity endpoints listed in the table are those used to calculate the RQ.
[1] Seeds presented separately for dose – based RQs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

The RQs for acute dietary-based exposure to mammals are not quantifiable as the available acute mammalian toxicity data (MRID 42306301) do not report endpoints relative to dietary concentrations. For acute dose-based exposures for mammals, RQs for all uses and all size classes range from <0.01 to 1.4 based on upper-bound Kenaga values (**Table 9-6**). There are no exceedances of the acute risk LOC (0.5) for modeled label uses on almonds, lettuce and broccoli, crucifer for seed, grapes, onion and cotton (RQs ranged from <0.01-0.49); however, there are LOC exceedances for potato, turf and ornamental use (RQs range from 0.01-1.4).

Chronic dietary-based RQs for all uses range between 0.13 and 12; therefore, there are exceedances of the chronic risk LOC (1.0) on a dietary exposure basis (**Table 9-7**). Chronic dose-based RQs for all uses range from 0.17-106, 0.14-90, and 0.08-48, respectively, for small, medium, and large mammals based on upper-bound Kenaga values. There are exceedances of the chronic risk LOC (1.0) for all uses and all sizes of mammals foraging on short grass, tall grass, broadleaf plants and arthropods. Additionally, for uses on the rotational crops of lettuce and broccoli, there are chronic risk LOC exceedances for small mammals feeding on fruits, pods and seeds; for use on crucifers for seed, turf and ornamentals, there are exceedances for all sizes of mammals foraging on fruits, pods and seeds; and for the uses on grapes and onions, there are exceedances for small and medium-sized mammals foraging on fruits, pods and seeds.

Additional characterization of potential risk to birds and mammals was conducted using mean Kenaga values. Mean Kenaga values are ≤73% and ≤68% lower than upper-bound Kenaga values for all uses for birds and mammals, respectively. For birds, this reduces the LOC exceedances to iprodione uses on crucifers for seed, grapes, potato, turf and ornamentals; however, for mammals, there are still acute risk LOC exceedances for almost all of the same uses (see **Appendix I**). A comparison was also made for the chronic endpoints using the LOAEC values instead of the NOAEC values. This comparison showed a reduction in the upper-bound Kenaga values (69-71% for birds and 68-71% for mammals); however, there are still LOC exceedances in all use sites identified using the NOAEC values for mammals and for crucifers, ornamentals and turf for birds.

In a 2-generation rat reproduction and fertility effects study (MRID 41871601), there were 10-19% reductions in parental growth at the 1,000 mg a.i./kg-diet treatment level, the LOAEC value is 1,000 mg a.i./kg diet. When the LOAEC is compared to dose-based EECs, there are still exceedances of the chronic risk LOC for uses with applications rates equal to 0.50 lbs a.i./A. Even further refinements were explored using the high concentration from the study (2000/3000 mg a.i./kg-diet) since this was the treatment with the greatest observed effects. When this concentration is compared to the dose-based EECs, there are still exceedances of the chronic risk LOC for uses with application rates equal to 0.50 lbs a.i./A.

**Table 9-6. Acute Risk Quotient (RQ) Values for Mammals from Labeled Uses of Iprodione (T-REX v. 1.5.2, Upper-Bound Kenaga)**

| **Food Type** | **Acute Dose-Based RQ<br>$LD_{50}$ = 1,160 mg/kg-bw** | | |
|---|---|---|---|
| | **Small (15 g)** | **Medium (35 g)** | **Large (1000 g)** |
| **Almonds (0.50 lb a.i./acre, 4x, 5-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.16 | 0.13 | 0.07 |
| Tall grass | 0.07 | 0.06 | 0.03 |
| Broadleaf plants | 0.09 | 0.07 | 0.04 |
| Fruits/pods/seeds | 0.01 | 0.01 | <0.01 |
| Arthropods | 0.06 | 0.05 | 0.03 |
| Granivores | | | |

| Food Type | Acute Dose-Based RQ<br>$LD_{50}$ = 1,160 mg/kg-bw | | |
|---|---|---|---|
| | Small (15 g) | Medium (35 g) | Large (1000 g) |
| Seeds[1] | <0.01 | <0.01 | <0.01 |
| **Lettuce – Broccoli - Lettuce (1.00 lbs ai/A, 3x, 10-day interval – 2x, 5-day interval – 3x, 10-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.24 | 0.20 | 0.11 |
| Tall grass | 0.11 | 0.09 | 0.05 |
| Broadleaf plants | 0.13 | 0.11 | 0.06 |
| Fruits/pods/seeds | 0.01 | 0.01 | 0.01 |
| Arthropods | 0.09 | 0.08 | 0.04 |
| Granivores | | | |
| Seeds[1] | <0.01 | <0.01 | <0.01 |
| **Lettuce (1.00 lb ai/A, 3x, 10-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.21 | 0.18 | 0.10 |
| Tall grass | 0.10 | 0.08 | 0.04 |
| Broadleaf plants | 0.12 | 0.10 | 0.05 |
| Fruits/pods/seeds | 0.01 | 0.01 | 0.01 |
| Arthropods | 0.08 | 0.07 | 0.04 |
| Granivores | | | |
| Seeds[1] | <0.01 | <0.01 | <0.01 |
| **Broccoli (1.00 lb ai/A, 2x, 5-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.17 | 0.15 | 0.08 |
| Tall grass | 0.08 | 0.07 | 0.04 |
| Broadleaf plants | 0.10 | 0.08 | 0.04 |
| Fruits/pods/seeds | 0.01 | 0.01 | <0.01 |
| Arthropods | 0.07 | 0.06 | 0.03 |
| Granivores | | | |
| Seeds[1] | <0.01 | <0.01 | <0.01 |
| **Crucifer for Seed (2.00 lbs a.i./A, 3x, 5-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.49 | 0.42 | 0.22 |
| Tall grass | 0.22 | 0.19 | 0.10 |
| Broadleaf plants | 0.28 | 0.24 | 0.13 |
| Fruits/pods/seeds | 0.03 | 0.03 | 0.01 |
| Arthropods | 0.19 | 0.16 | 0.09 |
| Granivores | | | |
| Seeds[1] | 0.01 | 0.01 | <0.01 |
| **Grapes (1.00 lb a.i./A, 4x, 5-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.31 | 0.27 | 0.14 |
| Tall grass | 0.14 | 0.12 | 0.07 |
| Broadleaf plants | 0.18 | 0.15 | 0.08 |
| Fruits/pods/seeds | 0.02 | 0.02 | 0.01 |
| Arthropods | 0.12 | 0.10 | 0.06 |
| Granivores | | | |
| Seeds[1] | <0.01 | <0.01 | <0.01 |

| Food Type | Acute Dose-Based RQ LD$_{50}$ = 1,160 mg/kg-bw | | |
|---|---|---|---|
| | Small (15 g) | Medium (35 g) | Large (1000 g) |
| **Onion (1.00 lb a.i./A, 4x, 7-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.30 | 0.25 | 0.14 |
| Tall grass | 0.14 | 0.12 | 0.06 |
| Broadleaf plants | 0.17 | 0.14 | 0.08 |
| Fruits/pods/seeds | 0.02 | 0.02 | 0.01 |
| Arthropods | 0.12 | 0.10 | 0.05 |
| Granivores | | | |
| Seeds[1] | <0.01 | <0.01 | <0.01 |
| **Potato (2.00 lbs ai/A, 4x, 5-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | **0.62** | **0.53** | 0.29 |
| Tall grass | 0.29 | 0.24 | 0.13 |
| Broadleaf plants | 0.35 | 0.30 | 0.16 |
| Fruits/pods/seeds | 0.04 | 0.03 | 0.02 |
| Arthropods | 0.24 | 0.21 | 0.11 |
| Granivores | | | |
| Seeds[1] | 0.01 | 0.01 | <0.01 |
| **Turf (5.51 lbs a.i./A, 6x, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr** | | | |
| Herbivores/Insectivores | | | |
| Short grass | **1.4** | **1.2** | **0.63** |
| Tall grass | **0.63** | **0.54** | 0.29 |
| Broadleaf plants | **0.77** | **0.66** | 0.35 |
| Fruits/pods/seeds | 0.09 | 0.07 | 0.04 |
| Arthropods | **0.54** | 0.46 | 0.25 |
| Granivores | | | |
| Seeds[1] | 0.02 | 0.02 | 0.01 |
| **Ornamentals, Drench (4.00 lbs a.i./A, 6x, 15-day interval) – Max application rate = 24 lbs a.i./A/yr** | | | |
| Herbivores/Insectivores | | | |
| Short grass | **1.2** | **1.0** | **0.55** |
| Tall grass | **0.55** | 0.47 | 0.25 |
| Broadleaf plants | **0.68** | **0.58** | 0.31 |
| Fruits/pods/seeds | 0.08 | 0.06 | 0.03 |
| Arthropods | 0.47 | 0.40 | 0.22 |
| Granivores | | | |
| Seeds[1] | 0.02 | 0.01 | 0.01 |

**Bolded** values exceed the acute risk to non-listed species level of concern (LOC) of 0.5. The toxicity endpoint listed in the table is that used to calculate the RQ.

[1] Seeds presented separately for dose – based EECs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

**Table 9-7. Chronic Risk Quotient (RQ) values for Mammals from Labeled Uses of Iprodione (T-REX v. 1.5.2, Upper-Bound Kenaga)**

| Food Type | Chronic Dose-Based RQ NOAEL = 15 mg/kg-bw[1] | | | Chronic Dietary-Based RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|
| | Small (15 g) | Medium (35 g) | Large (1,000 g) | |
| **Almonds (0.50 lb a.i./acre, 4x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **12** | **10** | **5.5** | **1.4** |
| Tall grass | **5.5** | **4.7** | **2.5** | 0.64 |
| Broadleaf plants | **6.8** | **5.8** | **3.1** | 0.78 |
| Fruits/pods/seeds | 0.75 | 0.64 | 0.34 | 0.09 |
| Arthropods | **4.7** | **4.0** | **2.2** | 0.54 |
| Granivores | | | | |
| Seeds[2] | 0.17 | 0.14 | 0.08 | N/A |
| **Lettuce – Broccoli - Lettuce (1.00 lbs ai/A, 3x, 10-day interval – 2x, 5-day interval – 3x, 10-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **18** | **16** | **8.4** | **2.1** |
| Tall grass | **8.4** | **7.2** | **3.8** | 0.96 |
| Broadleaf plants | **10** | **8.8** | **4.7** | **1.2** |
| Fruits/pods/seeds | **1.1** | 0.98 | 0.52 | 0.13 |
| Arthropods | **7.2** | **6.1** | **3.3** | 0.82 |
| Granivores | | | | |
| Seeds[2] | 0.25 | 0.22 | 0.12 | N/A |
| **Lettuce (1.00 lb ai/A, 3x, 10-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **16** | **14** | **7.4** | **1.9** |
| Tall grass | **7.4** | **6.3** | **3.4** | 0.86 |
| Broadleaf plants | **9.1** | **7.8** | **4.2** | **1.1** |
| Fruits/pods/seeds | **1.0** | 0.86 | 0.46 | 0.12 |
| Arthropods | **6.3** | **5.4** | **2.9** | 0.73 |
| Granivores | | | | |
| Seeds[2] | 0.22 | 0.19 | 0.10 | N/A |
| **Broccoli (1.00 lb ai/A, 2x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **13** | **11** | **6.1** | **1.5** |
| Tall grass | **6.1** | **5.2** | **2.8** | 0.70 |
| Broadleaf plants | **7.4** | **6.4** | **3.4** | 0.86 |
| Fruits/pods/seeds | 0.83 | 0.71 | 0.38 | 0.10 |
| Arthropods | **5.2** | **4.4** | **2.4** | 0.60 |
| Granivores | | | | |
| Seeds[2] | 0.18 | 0.16 | 0.08 | N/A |
| **Crucifer for Seed (2.00 lbs a.i./A, 3x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **38** | **32** | **17** | **4.4** |
| Tall grass | **17** | **15** | **7.9** | **2.0** |
| Broadleaf plants | **21** | **18** | **9.8** | **2.5** |
| Fruits/pods/seeds | **2.4** | **2.0** | **1.1** | 0.27 |
| Arthropods | **15** | **13** | **6.8** | **1.7** |
| Granivores | | | | |

| Food Type | Chronic Dose-Based RQ NOAEL = 15 mg/kg-bw[1] | | | Chronic Dietary-Based RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|
| | Small (15 g) | Medium (35 g) | Large (1,000 g) | |
| Seeds[2] | 0.53 | 0.45 | 0.24 | N/A |
| **Grapes (1.00 lb a.i./A, 4x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **24** | **21** | **11** | **2.8** |
| Tall grass | **11** | **9.4** | **5.1** | **1.3** |
| Broadleaf plants | **14** | **12** | **6.2** | **1.6** |
| Fruits/pods/seeds | **1.5** | **1.3** | 0.69 | 0.17 |
| Arthropods | **9.4** | **8.1** | **4.3** | **1.1** |
| Granivores | | | | |
| Seeds[2] | 0.33 | 0.29 | 0.15 | N/A |
| **Onion (1.00 lb a.i./A, 4x, 7-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **23** | **19** | **10** | **2.6** |
| Tall grass | **10** | **8.9** | **4.8** | **1.2** |
| Broadleaf plants | **13** | **11** | **5.9** | **1.5** |
| Fruits/pods/seeds | **1.4** | **1.2** | 0.65 | 0.16 |
| Arthropods | **8.9** | **7.6** | **4.1** | **1.0** |
| Granivores | | | | |
| Seeds[2] | 0.32 | 0.27 | 0.15 | N/A |
| **Potato (2.00 lbs ai/A, 4x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **48** | **41** | **22** | **5.6** |
| Tall grass | **22** | **19** | **10** | **2.5** |
| Broadleaf plants | **27** | **23** | **12** | **3.1** |
| Fruits/pods/seeds | **3.0** | **2.6** | **1.4** | 0.35 |
| Arthropods | **19** | **16** | **8.6** | **2.2** |
| Granivores | | | | |
| Seeds[2] | 0.67 | 0.57 | 0.31 | N/A |
| **Turf (5.51 lbs a.i./A, 6x, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **106** | **90** | **48** | **12** |
| Tall grass | **49** | **41** | **22** | **5.6** |
| Broadleaf plants | **59** | **51** | **27** | **6.9** |
| Fruits/pods/seeds | **6.6** | **5.7** | **3.0** | 0.76 |
| Arthropods | **41** | **35** | **19** | **4.8** |
| Granivores | | | | |
| Seeds[2] | **1.5** | **1.3** | 0.67 | N/A |
| **Ornamentals, Drench (4.00 lbs a.i./A, 6x, 15-day interval) – Max application rate = 24 lbs a.i./A/yr** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **93** | **79** | **43** | **11** |
| Tall grass | **43** | **36** | **20** | **4.9** |
| Broadleaf plants | **52** | **45** | **24** | **6.0** |
| Fruits/pods/seeds | **5.8** | **5.0** | **2.7** | 0.67 |
| Arthropods | **36** | **31** | **17** | **4.2** |
| Granivores | | | | |
| Seeds[2] | **1.3** | **1.1** | 0.59 | N/A |

**Bolded** values exceed the chronic risk to non-listed species level of concern (LOC) of 1.0. The toxicity endpoints listed in the table are those used to calculate the RQ.
[1]Based on estimated chronic daily dose equivalent to the reported chronic dietary endpoint.
[2] Seeds presented separately for dose due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

**Table 9-8** shows RQs for birds and mammals exposed to iprodione on treated seed. For small and medium-sized birds, dose-based RQs exceed the acute risk LOC (0.5) from use on carrot (RQs range from 0.81 to 1.82). On an $LD_{50}/ft^2$ basis, RQs do not exceed the acute risk LOC for any size bird consuming treated carrot seeds (RQs range from 0.0 to 0.04); RQs do not exceed the acute risk LOC for large-sized birds consuming treated carrot seed. On a chronic exposure basis, RQs exceed the chronic risk LOC (1.0) for birds consuming treated carrot seed (RQ = 16).

For mammals, dose-based RQs do not exceed the acute risk LOC for any size class (RQs range from 0.00 to 0.40). On a chronic exposure basis, RQs exceed the chronic risk LOC for all size classes consuming treated carrot seed (RQs range from 14 to 31).

**Table 9-8. Acute Dose-Based, $LD_{50}/ft^2$ based and Chronic dose-based Risk Quotients (RQs) for Birds and Mammals Exposed to Iprodione-Treated Seed.**

| Crop | Risk Quotients | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Avian ($LD_{50}$ = 930 mg a.i./kg-bw, NOAEC = 300 mg a.i./kg-diet) | | | | Mammalian ($LD_{50}$ = 1,160 mg a.i./kg-bw, NOAEC = 300 mg a.i./kg-diet) | | | |
| | Animal Size | Acute Dose-Based | Acute $LD_{50}/ft^2$ | Chronic | Animal Size | Acute Dose-Based | Acute $LD_{50}/ft^2$ | Chronic |
| Carrot | 20 g | **1.82** | 0.04 | **16** | 15 g | 0.40 | 0.02 | **31** |
| | 100 g | **0.81** | 0.01 | | 35 g | 0.34 | 0.01 | **26** |
| | 1000 g | 0.26 | 0.00 | | 1000 g | 0.18 | 0.00 | **14** |

**Bold** values exceed acute LOC (0.5) and chronic LOC (1.0).
Chronic RQs are the same for all size classes since body weight toxicity endpoints are not scaled for avian species.
$LD_{50}/ft^2$ is the amount of pesticide estimated to kill 50% of exposed animals in each square foot of applied area.

### Off-field Risk

It is useful to know how far from the edge of the field iprodione spray drift exposure could result in risk to birds and mammals (*i.e.*, "distance of effect"). AgDrift™ (version 2.1.1) was used to determine potential risk to birds and mammals from spray drift exposure to iprodione off the site of application. The terrestrial spray drift distance was determined using Tier I ground and terrestrial point deposition estimates. Assuming a high boom height, the American Society of Agricultural Engineers (ASAE) Very Fine to Fine droplet size distribution and a $90^{th}$ data percentile, distance from edge of field where spray drift could result in RQs greater than LOCs for birds is 33 ft and for mammals is 249 ft. The terrestrial spray drift distance was determined using Tier I aerial estimates. Assuming ASAE Fine to Medium droplet size, distance from the edge of the field where spray drift could result in RQs greater than LOCs for birds is 115 ft and for mammals is >997 ft (the maximum spray drift distance using Tier I analysis).

**Table 9-9. Summary of distances from the edge of treated field to which risk quotient (RQ) values excent the acute risk level of concern (LOC) for birds and mammals from ground and aerial applications of iprodione.**

| Application | Taxa | Off-field Distance (ft) | Model Parameters |
|---|---|---|---|
| Aerial | Birds | 115 | Tier I, fine to medium |
| Ground | Birds | 33 | Tier I, high boom height, very fine to fine droplet size |
| Aerial | Mammals | >997 | Tier I, fine to medium |
| Ground | Mammals | 249 | Tier I, high boom height, very fine to fine droplet size |

Therefore, based on the available data, there is a likelihood of direct adverse effects to both birds and mammals from acute exposure to iprodione as a result off-site drift from registered iprodione uses.

### 9.2.2 Residues in Aquatic Organisms

Since iprodione has a $K_{OW}$ of 3.1, terrestrial wildlife may also be exposed to iprodione through ingestion of residues in aquatic organisms; therefore, exposure through this pathway was evaluated using KABAM. The model was used to evaluate the potential exposure and subsequent risk to birds and mammals via consumption of residues that have bioconcentrated and biomagnified in aquatic prey items. The model uses a default metabolism rate constant of 0 (assuming that no metabolism is taking place). In cases where pesticide metabolism does occur, this could overestimate pesticide accumulation of residues in tissues. In the available BCF study, degradate residues were measured in the fish tissue, indicating that some metabolism in fish occurred during the study; however, insufficient data are provided on parameters required for calculation of the organism-water partition coefficient (KBW), so an empirically-based metabolism rate constant (KM) could not be estimated to re-parameterize KABAM. Otherwise, default parameters in KABAM closely approximated conditions during the empirical BCF study and so no model parameters were altered.

Based on available empirical data, the mean-measured bioconcentration potential in whole fish of iprodione in Bluegill Sunfish (*Lepomis macrochirus*) is 46.8 L/kg-wet weight (MRID 43091001) and is 25% lower than the bioconcentration factor (BCF) value for fish estimated using KABAM (*i.e.*, the maximum BCF from KABAM was 84 L/kg in whole fish). The difference between the empirical and KABAM-estimated BCF values indicates that the estimated values are reasonable, and therefore KABAM-generated RQs are included in this assessment. No acute or chronic LOCs were exceeded for birds or mammals (**Table 9-10**) consuming aquatic prey items containing residues of iprodione as a result of bioaccumulation.

**Table 9-10. Risk Quotient (RQ) Values for Birds and Mammals Consuming Fish Contaminated with Iprodione Residues.**

| Use Scenario | Water-Column 1-day EEC (µg/L) | Iprodione conc in Food (mg/kg-tissue) | Chronic RQ | |
|---|---|---|---|---|
| | | | Mammals NOAEC= 300 mg/kg-diet | Birds NOAEC= 300 mg/kg-diet |
| PAturfSTD (5.51 lbs a.i./A, 4 appl./CC + 1.96 lbs a.i./A, 1 appl./CC; 1CC/yr) | 251 | 16 - 21 | Dose: ≤0.057<br>Diet: ≤0.07 | Dose: NA<br>Diet: ≤0.07 |

Conc=concentration

# 10 Terrestrial Invertebrate Risk Assessment

## 10.1 Bee Exposure Assessment

The list of crops to which iprodione is applied (excluding turf and ornamentals) is listed in **Table 10-1.**, along with the United States Department of Agriculture (USDA) pollinator attractive data (USDA, 2018) to identify which crops may represent direct exposure to pollinators on the field. Bees (either *Apis* spp. or non-*Apis* spp. such as bumble bees [*Bombus* spp]) may be exposed on the field to every crop labeled for iprodione use. For some crops on which iprodione is used (*e.g.*, almonds, stone fruit; and for carrots, onions and crucifers grown for seed) managed pollination services are required. Therefore, the labeled use sites of iprodione shown in **Table 10-1** pose a likelihood of direct on-field exposure for honey bees, bumble bees, and/or other non-*Apis* bee species. Additionally, off-field assessments are conducted for any chemical applied via foliar spray regardless of whether labeled crops are attractive or not; off-field exposure is particularly likely with iprodione, which can be applied aerially.

**Table 10-1. Summary of Information on the Attractiveness of Registered Use Patterns for Iprodione to Bees Based on U.S. Department of Agriculture Crop Attractiveness Report (USDA 2018).**

| Crop Name | Honey Bee Attractive?[1,2,3] | Bumble Bee Attractive?[1,2,3] | Solitary Bee Attractive?[1,2,3] | Acreage in the U.S. | Notes |
|---|---|---|---|---|---|
| Almonds (*Prunus amygdalus; P. communis; Amygdalus communis*) | + (nectar), ++ (pollen) | + | + (*Osmia*) | 780,000 | Requires bee pollination; uses managed pollinators; not harvested prior to bloom |
| Stone Fruit (Peaches/nectarines*: Prunus persica; Amygdalus persica; Persica laevis* ) | + (nectar & pollen) | + | + (*Osmia*) | 112,880, peaches; 26,400 nectarines | Requires bee pollination; uses managed pollinators |
| Lettuce (*Lactuca sativa*) | + (nectar & pollen) | + | + | 259,100 | Does not require bee pollination or use managed pollinators; |

| Crop Name | Honey Bee Attractive?[1,2,3] | Bumble Bee Attractive?[1,2,3] | Solitary Bee Attractive?[1,2,3] | Acreage in the U.S. | Notes |
|---|---|---|---|---|---|
| | | | | | harvested prior to bloom; self-pollinating |
| Carrots (*Daucus carota*) | + (nectar & pollen) | + | + (*Megachile rotunda*) | 71,400 fresh market; 13,310 processing | Requires bee pollination for seed production only; uses managed pollinators for seed production only; is harvested before bloom; only a small percentage of acreage is grown for seed |
| Onion (*Allium cepa*) | + (nectar & pollen) | - | + (*Halictus, Nomia*) | 143,340 | Requires bee pollination for seed production only; uses managed pollinators for seed production only; only a small percentage of acreage is grown for seed |
| Cauliflower and broccoli (*Brassica oleracea var. botrytis, subvarieties cauliflora and cymosa, includes headed broccoli*) | ++ (nectar & pollen) | + | + (*Andrenidae, Nomadidae, Megachilidae*) | 163,730 fresh market and processing | Requires bee pollination for seed production only, uses managed pollinators for seed production only, is harvested prior to bloom, only a small percentage of acreage is grown for seed |
| Potato (*Solanum tuberosum* – Irish potato) | - | + | + (*Andrena*) | 1,052,000 | Requires bee pollination for breeding only, does not use managed pollinators, only a small percentage of acreage is grown for breeding |
| Grapes (*Vitis vinifera*) | - (nectar), + (pollen) | - | - | 962,100 | Does not require bee pollination, does not use managed pollinators, is not harvested prior to bloom, is wind pollinated |
| Cotton (Upland cotton: *Gossypium hirsutum*; Pima cotton: *Gossypium barbardense*) | + (nectar), - (pollen) | + | + (*Halictus, Anthophora, Xylocopa, Megachile, Nomia, Ptilothrix*) | 7,664,400 | Does not require bee pollination, does not use managed pollinators, historical use for hybrid seed production; however, hybrid seed production is no longer considered economically viable; used by some beekeepers for honey production |

[1] attractiveness rating is a single "+", denoting a use pattern is opportunistically attractive to bees.
[2] attractiveness rating is a double "++" denoting a use pattern is attractive to bees in all cases.

[3] attractiveness rating is a "-", denoting a use pattern is not attractive to bees.

## 10.2 Bee Tier I Exposure Estimates

Contact and dietary exposure are estimated separately using different approaches specific for different application methods. The BeeREX model (Version 1.0) calculates default (*i.e.*, high end, yet at concentrations that may occur) EECs for contact and dietary routes of exposure for foliar, soil, and seed treatment applications. Additional information on bee-related exposure estimates, and the calculation of risk estimates in BeeREX can be found in the *Guidance for Assessing Risk to Bees* (USEPA *et al.*, 2014).

In cases where the Tier I RQs (*i.e.*, RQ values based on Bee-REX generated exposure estimates) exceed the acute and chronic risk LOCs of 0.4 and 1.0, respectively, estimates of exposure may be refined using measured pesticide concentrations in pollen and nectar of treated crops (provided measured residue data are available), and further calculated for other castes of bees using their food consumption rates as summarized in the White Paper to support the Scientific Advisory Panel (SAP) on the pollinator risk assessment process (USEPA, 2012c).

## 10.3 Bee Risk Characterization (Tier I)

For analysis of risk to bees from labeled iprodione uses, uses were separated into six general groups based on their maximum single application rate: 0.272 lb a.i./A – cotton (in-furrow soil application); 0.50 lb a.i./A – almonds (foliar); 0.616 lb a.i./A – carrots (seed treatment); 1.00 lb a.i./A – lettuce, carrots, onion, broccoli, stone fruit and grapes (foliar); 2.00 lbs a.i./A - crucifers (foliar) and, 5.51 lbs a.i./A – turf and ornamentals (foliar). Contact and oral exposure estimates for larval worker and adult forager bees from BeeREX are summarized in **Table 10-2**.

**Table 10-2. Default Tier 1 Adult Honey Bees (*Apis mellifera*) Exposure Estimates for Adult Contact, Adult Oral and Larval Oral for Foraging on Iprodione based on BeeRex (ver. 1.0)**

| Use Pattern | Bee Attractiveness | Max. Single Application Rate (lb ai/A) | Estimated Contact Dose (µg a.i./bee) | Estimated Total Oral Dose Adult Forager (µg a.i./bee) | Estimated Total Oral Dose Worker Larva (µg a.i./bee) |
|---|---|---|---|---|---|
| Cotton (in-furrow) | Y (nectar) | 0.27 | NA | 0.004 | 0.002 |
| Almonds | Y (nectar and pollen) | 0.50 | 1.35 | 16.1 | 6.80 |
| Carrots (seed) | Y (nectar and pollen) | 0.62 | NA | 0.29 | 0.12 |
| Onion[1] | Y (nectar and pollen) | 1.00 | 2.7 | 32.1 | 13.6 |
| Crucifers | Y (nectar and pollen) | 2.00 | 0.74 | 64.2 | 27.2 |

| Use Pattern | Bee Attractiveness | Max. Single Application Rate (lb ai/A) | Estimated Contact Dose (µg a.i./bee) | Estimated Total Oral Dose Adult Forager (µg a.i./bee) | Estimated Total Oral Dose Worker Larva (µg a.i./bee) |
|---|---|---|---|---|---|
| Turf/Ornamentals[2] | Y | 5.51 [l] | 14.9 | 177 | 74.9 |

[1]The onion was used in this risk assessment as a surrogate for all uses with a maximum single application rate of 1.00 lbs a.i./A, *i.e.*, for lettuce, carrots, broccoli, stone fruit and grapes.
[2]Turf and ornamental plant species are not explicitly addressed in the USDA's crop attractiveness data, but for the purposes of this assessment are assumed to be bee attractive.

### 10.3.1 Tier I Risk Estimation (Contact Exposure)

**On-Field Risk**
Since an exposure potential of bees is identified for all labeled use patterns for iprodione both on and off the treated field, the next step in the risk assessment process is to conduct a Tier 1 risk assessment. By design, the Tier 1 assessment begins with (high-end) model-generated (foliar and soil treatments) or default (seed treatments) estimates of exposure via contact and oral routes. For contact exposure, only the adult (female forager bees and male [drones] bees) life stage is considered since this is the relevant life stage for honey bees (*i.e.*, since other bees are in-hive, the presumption is that they would not be subject to contact exposure). Furthermore, toxicity testing protocols have only been developed for acute contact exposures. Effects are defined by laboratory exposures to groups of individual bees (which serve as surrogates for solitary non-*Apis* bees and individual social non-*Apis* bees).

Risk to adult honey bees from acute contact exposure to iprodione is not assessed since the available contact toxicity data (MRID 50586102) indicate ≤8% mortality and no notable sub-lethal effects up to 100 µg a.i./bee, resulting in an acute contact $LD_{50}$ of >100 µg a.i./bee (**Table 6-2**). **Table 10-3** provides estimated contact doses for bees at the maximum application rate for uses on selected crops. Based on a comparison of the maximum dose tested in the available acute contact toxicity study with adult honey bees (*i.e.*, 100 µg a.i./bee) with the maximum estimated dose from BeeREX (14.9 *µ*g a.i./bee) from the use on turf (maximum single application rate of 5.51 lb a.i./A), the resulting non-definitive RQ value (RQ>0.15) would not exceed the acute risk LOC of 0.4 based on adult bee contact exposure.

### 10.3.2 Tier I Risk Estimation (Oral Exposure)

**On-Field Risk**

For oral (dietary) exposure, the Tier 1 assessment considers just the caste of bees with the greatest oral exposure (*i.e.,* nectar foraging adults). If risks are identified, then other factors are considered for refining the Tier 1 risk estimates. These factors include other castes of bees and available information on residues in pollen and nectar which is deemed applicable to the crops of interest. These exposure data may have been collected on surrogate crops (*e.g*., phacelia, buckwheat, alfalfa) which are known to be attractive sources of both pollen and nectar for bees).

On the basis of a new acute oral toxicity study of technical grade iprodione with adult worker bees, RQs were not estimated since the study resulted in a non-definitive endpoint ($LD_{50}$ of >100 µg a.i./bee; MRID 50586102) where there was 6% mortality at the highest dose tested. Had the non-definitive endpoint been used, then at the maximum application rate for use on turf and ornamentals, the RQ would be less than 1.77. However, given that there was a maximum of 6% mortality at a contact dose of 100 µg a.i./bee, it is uncertain whether adult bees would be adversely affected following exposure to iprodione at the highest application rate for turf/ornamentals. Exposure to bees from use on turf would be influenced by the extent to which there were blooming weeds present.

Acute (single dose) toxicity data are not available for honey bee larvae; however, the larval honey bee chronic (repeat dose) study is sometimes used to provide an estimate of the $LD_{50}$ at study Day 8 (*i.e*., completion of the larval phase of development). The chronic larval toxicity study (MRID 49526514) resulted in 6% mortality at the maximum dose tested (150 µg a.i./larva); therefore, the $LD_{50}$ value for larvae is non-definitive (*i.e*., $LD_{50}$>150 µg a.i./larva). Similar to the situation with non-definitive value for adult bees, RQ values are not typically calculated for non-definitive values. However, if the non-definitive value is used and compared to exposure estimates based on the maximum application rate, it results in an RQ value of <0.5. While this value is higher than the acute risk LOC of 0.4, the likelihood of acute adverse effects is considered low given that there was only 6% mortality at this treatment level, which was not statistically different from study controls.

No chronic toxicity data are available to estimate risk for adult bees; however, as noted in the preceding paragraph, chronic toxicity data are available for larval bees. Risk to larval bees is calculated based on exposure to iprodione during a 21-day test with a resulting cumulative NOAEL of 30 µg a.i./bee and a LOAEL of 43 µg a.i./bee (representing daily doses of 7.5 µg a.i./bee/d and 10.8 µg a.i./bee/d, respectively; MRID 49526514). Based on these analyses, chronic RQs generated for uses on onions, crucifers and turf/ornamental exceed the chronic risk LOC of 1 for larval worker honey bees (RQ range 1.8 – 10; **Table 10-3**).

**Table 10-3. Tier 1 (Default) Oral Risk Quotients (RQs) for Adult Nectar Forager and Larval Worker Honey Bees (*Apis mellifera*) from BeeRex (ver. 1.0).**

| Use Pattern | Max. Single Appl. Rate | Bee Caste/Task | Oral Dose (µg a.i./bee) | Acute Oral RQ[1,2] | Chronic Oral RQ[3] |
|---|---|---|---|---|---|
| Cotton (in-furrow) | 0.27 lb a.i./A | Adult nectar forager | 0.54 | N/A | N/A |
| | | Larval worker | 0.023 | | <0.01 |
| Almonds | 0.50 lb a.i./A | Adult nectar forager | 16 | | N/A |
| | | Larval worker | 6.8 | | 0.91 |
| Carrots (seed) | 0.62 lb a.i./A | Adult nectar forager | 0.29 | | N/A |
| | | Larval worker | 0.12 | | 0.02 |
| Onions | 1.00 lb a.i./A | Adult nectar forager | 32 | | N/A |
| | | Larval worker | 14 | | **1.8** |
| Crucifers | 2.00 lb a.i./A | Adult nectar forager | 64 | | N/A |
| | | Larval worker | 27 | | **3.6** |
| Turf/Ornamentals | 5.51 lb a.i./A | Adult nectar forager | 177 | | N/A |
| | | Larval worker | 75 | | **10** |

[1] The available acute oral toxicity test with adult honey bees exposed to technical grade iprodione (MRID 50586102) is not reliable enough to be used quantitatively for risk estimation since it showed no effect up to the highest concentration tested ($LD_{50}$ >100 µg a.i./bee).
[2] **Bolded** RQ value exceeds (or potentially exceeds) the chronic risk Level of Concern (LOC) of 1.0.
[3] Based on a honey bee larval 21-d chronic NOAEL of 7.5 µg a.i./bee/d (MRID 49526514).

Average use rate data are available for iprodione for a number of agricultural crops (USEPA, 2019a). Based on the average use rate data for crucifers (specifically cauliflower at an average application rate of 0.989 lbs a.i./A), the chronic RQ for larval honey bees decreases from 3.6 to 1.8. For use on cabbage (0.808 lbs a.i./A), the chronic RQ for larval honey bees is 1.5. Therefore, all uses involving foliar application at average use rates instead of maximum application rates continue to exceed the chronic risk LOC for larval honey bees based on exposure to parent iprodione. It was estimated that risk quotients would exceed levels of concern for any foliar use ≥0.55 lbs a.i./A. Even if RQ values for larval bees were based on the LOAEL of 10.8 µg a.i./bee/day at which there was an 67% reduction in adult emergence, RQ value for onions, crucifers and turf/ornamental would be 1.3, 2.5, and 6.9, respectively and would still exceed the chronic risk LOC of 1.0.

### Off-Field Risk

In addition to adult bees foraging on the treated portions of crop fields, adult bees may also be foraging in habitats adjacent to the treated fields. The analysis of possible off-field risk to bees is typically conducted using AgDrift™. However, acute on-field risk to both adult and larval bees are considered low; therefore, the same assumption would apply to bees foraging off-field as well. With respect to potential chronic risks to adult bees, there are no data with which to assess chronic toxicity for adult bees; however, based on a NOAEL of 7.5 µg a.i./bee/day, potential chronic risks for larval bees could extend 98 ft from the edge of the treated field.

### 10.4 Bee Risk Characterization – Additional Lines of Evidence

There were three reported incidents involving honey bees (I020302, I023830 and I029770). In the first reported incident, brood losses followed applications of Rovral™ (41.6% iprodione) to blooming almond orchards; however, the magnitude of the effect to the brood near the blooming orchards was not reported. In the second incident, 16 colonies out of 80 were reported "lost" (presumed killed) after adult bees were reportedly "bearding" on the outside of the colonies and bees were indirectly sprayed during an application of Rovral™ (41.6% iprodione) to a cherry orchard. The third incident was a follow up to a report of dying hives in California. The report indicated that "thousands of bees" were incapacitated or dead. Samples were taken in affected hives <0.5 to 3 miles from spray areas (a nectarine orchard). Within the samples, a total of 23 pesticides were detected including 10 fungicides, 4 insecticides, 4 herbicides, 2 acaracides, 2 insect growth regulators and 1 synergist. Chemicals detected in the highest frequency included the amitraz degradate DMPF (amitraz is used in colonies to control Varroa mites [*Varroa destructor*]), chlorpyrifos, iprodione, oxyflurofen, pendimethalin, tebuconazole, and propiconazole. Iprodione was measured in the bee bread (pollen plus honey) samples from symptomatic colonies (<0.5 miles from the treated orchard) at concentrations of 54.2 mg/kg and was detected in the second highest quantity compared to the other chemicals (tebuconazole was detected at the highest concentration of 85.58 mg/kg).

While bee-related incidents provide some evidence that bee colony mortality has been associated with the application of iprodione in close proximity (≤0.5 miles) to bee hives, one of incidents appears to have involved the loss of adult bees. However, iprodione is practically non-toxic to adult bees on both an acute contact and acute oral exposure basis. No data are available, on the chronic toxicity of iprodione to adult bees. With respect to the brood, the measured residues in food (54.2 mg/kg) from affected colonies are below exposure levels where there were reductions in adult bee emergence (*i.e*., 130 mg ai./kg diet).

There are limited data available through open literature. The effects of iprodione on survival, behavior and brood development of honey bees after one foliar application to mustard at bloom were reported in the open literature for a semi-field study conducted following the OECD Guideline 75 tunnel test design. Three groups were tested (*i.e*., a control, a single iprodione treatment group [734.4g/ha], and a reference toxicant group). No effects were observed on overall mortality, flight intensity, behavior or brood development compared to the control. The study concluded that iprodione does not adversely affect the health of honey bees when applied in agriculture at commercially relevant rates (Berg, C *et al.*, 2018).

At this time, there are uncertainties related to the likelihood of adverse effect to honey bee larvae from chronic exposure to iprodione as a result of registered uses on onions, crucifers, turf and ornamentals. While incident data provide some evidence of adverse effects on colonies associated with the use of iprodione, an open literature study indicates that there were no colony-level effects from iprodione applied at bloom and where bees were compelled to forage on the treated crop. Also, at this time, there are no measured residue studies with which to refine RQ values and other than the open literature study, there are no additional colony-level studies that can be used to gauge the likelihood of adverse effects to bee colonies.

# 11 Terrestrial Plant Risk Assessment

## 11.1 Terrestrial Plant Exposure Assessment

The EECs for terrestrial plants are calculated using TERRPLANT v.1.2.2. Exposure is estimated for a single application evaluating exposure via spray drift and runoff. In the RQ table, the runoff RQs for dryland and semi-aquatic areas are relying upon the summation of the exposure from drift and runoff. Additionally, the spray drift RQs rely on estimated exposure from spray drift alone. It is important to note that for spray drift, the TERRPLANT exposure estimate corresponds to an equivalent AgDrift™-estimated deposition for fine-medium droplets at approximately 200 feet from the edge of the treated field. For runoff, there are a few assumptions regarding the ratio of treated area to receiving non-target area that have an impact on the exposure estimation. In a dry area adjacent to the treatment area, exposure is estimated as sheet runoff. Sheet runoff is the amount of pesticide in water that runs off of the soil surface of a target area of land that is equal in size to the non-target area (1:1 ratio of areas). This differs for semi-aquatic areas, where runoff exposure is estimated as channel runoff. Channel runoff is the amount of pesticide that runs off of a target area 10 times the size of the non-target area (10:1 ratio of areas).

Exposures from runoff and spray drift are compared to measures of survival and growth (*e.g.*, effects to seedling emergence and vegetative vigor) to develop RQ values. Resulting upper-bound exposure estimates to terrestrial and semi-aquatic (wetland) plants adjacent to the treated field are in **Table 11-1**. The EECs are based on the maximum single application rate for terrestrial uses, solubility, and spray drift fraction. The EECs represent residues from off-site exposure via spray drift and/or run-off to non-target plants found near application sites.

**Table 11-1. TerrPlant Calculated Estimated Environmental Concentrations (EECs) for Terrestrial Plants inhabiting Dry and Semi-Aquatic Areas near Iprodione Terrestrial Use Areas**

| Use Site | Application Method/Form | Single Max. Application Rate (lb a.i./A) | EECs (lb a.i./A)[1] | | |
|---|---|---|---|---|---|
| | | | Dry Areas (Total) | Semi-Aquatic Areas (Total) | Spray Drift |
| Almonds | Aerial[2] | 0.50 | 0.035 | 0.13 | 0.025 |
| | Ground[3] | 0.50 | 0.015 | 0.11 | 0.005 |
| Cotton | Ground[3] (In-furrow) | 0.27 | 0.0082 | 0.057 | 0.0027 |

| Use Site | Application Method/Form | Single Max. Application Rate (lb a.i./A) | EECs (lb a.i./A)[1] | | |
|---|---|---|---|---|---|
| | | | Dry Areas (Total) | Semi-Aquatic Areas (Total) | Spray Drift |
| Crucifers and Potato | Aerial[2] | 2.00 | 0.14 | 0.50 | 0.10 |
| | Ground[3] | 2.00 | 0.060 | 0.42 | 0.020 |
| Lettuce, Broccoli, Grapes, Onion and Stone Fruit | Aerial[2] | 1.00 | 0.070 | 0.25 | 0.050 |
| | Ground[3] | 1.00 | 0.030 | 0.21 | 0.010 |
| Turf | Aerial[2]-granule | 5.51 | 0.11 | 1.1 | 0.00 |
| | Aerial[2]-liquid | 5.51 | 0.39 | 1.4 | 0.28 |
| | Drench | 22.1 | 0.66 | 4.6 | 0.22 |
| | Ground[3]-granule | 5.51 | 0.11 | 1.1 | 0.00 |
| | Ground[3]-liquid | 5.51 | 0.17 | 1.2 | 0.055 |

[1] Based on a runoff fraction of 0.02
[2] Based on a drift fraction of 5% (*i.e.*, 0.05) for flowable; 0% for granular.
[3] Based on a drift fraction of 1% (*i.e.*, 0.01) for flowable; 0% for granular.

## 11.2 Terrestrial Plant Risk Characterization

In the available seedling emergence (MRID 49526502) and vegetative vigor (MRID 49526503) tests there were no adverse effects noted up to a maximum application rate of 7.62 lbs a.i./acre for any species tested. This rate is higher than the maximum single application rate allowed for foliar uses of iprodione; therefore, all of the RQs for terrestrial plants are below the LOC for risk to terrestrial plants (*i.e.*, the RQs are all <1).

There are 16 plant incidents associated with iprodione in the IDS database. The reported incidents occurred between 2002 and 2010 and impacted anywhere from a portion of one acre to a total of 80 acres of plants (*i.e.,* tulips, blueberries, non-specified plants). In one incident (I013636-027, 2002), 6 acres of tulips were damaged (twisting of leaves); however, the incident reported that in addition to Chipco™ 26019® (50% iprodione), Gallery™ 75DF (75% isoxaben) was used along with Roundup™ (2% glyphosate), Elevate™ (50% fenhexamid), Awaken™ (20% nitrogen), and Hoelon™ (34.7% diclofop-methyl). There were 14 incidents in 2003 (I014027-001 through I014027-014) involving blueberries, specifically Rabbiteye blueberry plants, a hybrid variety of blueberry. The plants were damaged (with a primary symptom of leaf burn) after being treated with Rovral™ 4F (41.6% iprodione), which is approved for highbush and lowbush varieties of blueberries. Since these incidents were reported, the technical registrant (Bayer CropScience) was to have issued a label amendment to restrict the use of Rovral™ 4F on Rabbiteye blueberries. At the present time, this product (EPA Reg. #264-482) is not registered for use on any variety of blueberry. Additionally, one incident in 2010 (I021913) involved phytotoxicity (*i.e.*, bleaching, veining, necrosis and death) to various horticultural nursery plants following field and greenhouse application of Chipco™ 26019 (50% iprodione). Application rates were not reported for any of the incidents; however, it is assumed that the label prescribed maximum application rates were used. Based on the available information, it is not possible to preclude that some or all of the plant incidents were the result of iprodione exposure. Although there are no LOC exceedances for terrestrial plants based on the available terrestrial plant studies, and risk to plants from iprodione use is expected to be low, there is some uncertainty with this conclusion based on the available incident data.

Based on these endpoints and the EECs calculated using TerrPlant (**Table 11-1**), RQs for dicots are ≤0.1 in dry areas and in areas exposed to spray drift and are ≤0.61 in semi-aquatic areas. RQs for monocots are ≤0.1 in dry areas and in areas exposed to spray drift and are ≤0.18 in semi-aquatic areas on the basis of either ground or aerial applications in any exposure scenario; therefore, there are no exceedances of the LOC (1.0) for dicots or monocots. Typical application rate data are available for iprodione for a number of agricultural crops; however, since there were no LOC exceedances, no further refinement is needed to characterize potential risk.

Based on the available terrestrial plant toxicity data, the risk to terrestrial plants from the use of iprodione is expected to be low; however, incident data raise concerns regarding the potential for adverse effects to plants not tested (*e.g.*, blueberries, ornamentals) as part of the suite of laboratory-based studies.

# 12 Conclusions

**Table 12-1** summarizes environmental fate characteristics of concern for iprodione. The compound is characterized as non-persistent to moderately persistent and it is moderately mobile. In soil, iprodione degrades to RP30228 and to 3,5-DCA which can in turn move into surface water. For this assessment residues of concern include the parent compound and its degradate RP30228 while 3,5-DCA was assessed separately. Iprodione and 3,5-DCA have been detected in surface and groundwater monitoring studies at concentrations up to 141 and 0.521 µg/L, respectively. Iprodione concentrations in surface water grab samples exceeded the most sensitive chronic toxicity endpoint in 20 out of 26,439 samples and are within the range of EECs used to calculate RQs. However, monitoring studies were not targeted to iprodione use and cannot be considered representative of maximum or chronic exposure values. They are likely to underestimate the potential range of exposure in the aquatic environment.

Given the uses of iprodione and the chemical's environmental fate properties, there is a likelihood of exposure of iprodione ROC to non-target terrestrial and/or aquatic organisms. When used in accordance with the label and based on the available environmental fate and ecological effects data, there is a potential for direct adverse effects to estuarine/marine fish and aquatic invertebrates, mammals, birds and terrestrial invertebrates, from exposure to iprodione as a result of registered uses and maximum application rates. Although risk estimates for terrestrial plants are below levels of concern, incident data suggest that exposure to iprodione can result in adverse effects on susceptible terrestrial plants. A more in-depth summary of the risk conclusions is available in the Executive Summary **Section 1**.

**Table 12-1. Potential Environmental Fate Concerns Identified for Iprodione and 3,5-DCA.**

| Bioconcentration/ Bioaccumulation[1] | Groundwater Contamination | Sediment | Persistence[2] | Residues of Concern | Volatilization |
|---|---|---|---|---|---|
| **Iprodione** | | | | | |
| No, log $K_{OW}$>3 but BCF study and KABAM analysis indicate low bioconcentration potential | Yes, for parent | Yes, for RP30228 | Non-Persistent to Persistent | Iprodione, RP30228 | No |
| **3,5-DCA** | | | | | |
| No, log $K_{OW}$<3 | Yes | No | Non-persistent to Moderately Persistent | 3,5-DCA | Yes |

[1] Based on $K_{ow}$ Based Aquatic Bioaccumulation Model (KABAM) for chemicals with a log $K_{ow}$ >3.
[2] Persistence classification consistent with Goring *et al* (1975) applied to aerobic soil metabolism studies.

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**162-4 Aerobic aquatic metabolism**

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| 42503801 | Spare, W. (1992) Aerobic Aquatic Metabolism of Iprodione: Supplemental Report MRID #41927601\|: Lab Project Number: 1514. Unpublished study prepared by Agrisearch Inc. 117 p. |
| 44605001 | Purser, D. (1992) (Carbon 14)-Iprodione: Degradation and Retention in Water/Sediment Systems: Amended Final Report: Lab Project Number: 68/113: 7397: P6876D. Unpublished study prepared by Hazleton UK. 160 p. |

**163-1 Leaching/adsorption/desorption**

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**830.7370 Dissociation constants in water**

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**830.7550 Partition coefficient (n-octanol/water), shake flask method**

| MRID | Citation Reference |
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**830.7560 Partition coefficient (n-octanol/water), generator column method**

| MRID | Citation Reference |
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**830.7570 Partition coefficient (n-octanol/water), estimation by liquid chromatography**

| MRID | Citation Reference |
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**830.7840 Water solubility: Column elution method, shake flask method**

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**830.7860 Water solubility, generator column method**

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**830.7950 Vapor pressure**

| MRID | Citation Reference |
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**835.1230 Sediment and soil absorption/desorption for parent and degradates**


| MRID | Citation Reference |
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**835.2120 Hydrolysis of parent and degradates as a function of pH at 25 C**

| MRID | Citation Reference |
|---|---|
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**835.2240 Direct photolysis rate of parent and degradates in water**

| MRID | Citation Reference |
|---|---|
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**835.2410 Photodegradation of parent and degradates in soil**

| MRID | Citation Reference |
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**835.4100 Aerobic soil metabolism**

| MRID | Citation Reference |
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**835.4300 Aerobic aquatic metabolism**

| MRID | Citation Reference |
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| 49726504 | Clark, B. (2015) (Carbon 14)-3,5-DCA: Aerobic Aquatic Metabolism in Two Sediment Systems. Project Number: 80654. Unpublished study prepared by ABC Laboratories, Inc. 123p. |

**835.4400 Anaerobic aquatic metabolism**

| MRID | Citation Reference |
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| 49726505 | Clark, B. (2015) (Carbon 14)-Iprodione: Anerobic Aquatic Metabolism in Two Sediment Systems. Project Number: 80655. Unpublished study prepared by ABC Laboratories, Inc. 126p. |
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**Non-Guideline Study**

| MRID | Citation Reference |
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| 49526501 | Allan, J. (2014) RP35606: Estimation of the Adsorption Coefficient (Koc) on Soil and/or on Sewage Sludge using High Performance Liquid Chromatography (HPLC). Project Number: 80994, 2014EFT/IPD1235. Unpublished study prepared by ABC Laboratories, Inc. 64p. |

## Appendix A. Endocrine Disruptor Screening Program (EDSP)

As required by FIFRA and the Federal Food, Drug, and Cosmetic Act (FFDCA), EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, subchronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, EPA evaluates acute tests and chronic studies that assess growth, developmental and reproductive effects in different taxonomic groups. As part of the Draft Ecological Risk Assessment for Registration Review, EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA section 408(p), Iprodione is subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

EPA has developed the EDSP to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA section 408(p), the Agency must screen all pesticide chemicals. Between October 2009 and February 2010, EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. A second list of chemicals identified for EDSP screening was published on June 14, 2013[1] and includes some pesticides scheduled for registration review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors. Iprodione is on List 1. The Agency has reviewed all of the assay data received for the appropriate List 1 chemicals and the conclusions of those reviews are available in the chemical-specific public dockets. For further

[1] See http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2009-0477-0074 for the final second list of chemicals.

information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and Tier 1 screening battery, please visit our website.[2]

[2] Available: http://www.epa.gov/endo/

## Appendix B. Summary of ECOSAR Analyses for Iprodione

**Table B-1. Quantitative Structure-Activity Relationships (QSAR) Toxicity Predictions for Iprodione and Relevant Major (>10%) Degradates Using ECOSAR**

| Compound Class Used by ECOSAR | Toxicity Endpoint (µg a.i/L) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 96-hr FW Fish $LC_{50}$ | 96-hr E/M Fish $LC_{50}$ | 48-hr Daphnid $LC_{50}$ | 96-hr Mysid $LC_{50}$ | 96-hr Green Algae $EC_{50}$ | Chronic FW Fish[1] | Chronic E/M Fish[1] | Chronic Daphnid [1] | Chronic Mysid[1] |
| **Parent (iprodione)** | | | | | | | | | |
| **Measured** | 6,160 | >8,140 | 240 | 2,240 | 19,490 | 378 | >57 | 401 | 43 |
| *Neutral organic* | *48,590* | -- | *31,070* | -- | *18,980* | *4,530* | -- | *3,340* | -- |
| Amides | 9,050 | -- | 6,840 | -- | 420 | 50 | -- | 90 | -- |
| Imides | 20,860 | -- | 24,670 | -- | 2,450 | 2,030 | -- | 2,250 | -- |
| Substituted Ureas | 22,780 | -- | 34,550 | -- | 190 | 380 | -- | 3,560 | -- |
| Anilines | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Amides-acid | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| **3,5-Dichloroaniline (DCA)** | | | | | | | | | |
| **Measured** | | | | | | | | 32 | |
| *Neutral organic* | *61,290* | -- | *36,960* | -- | *18,510* | *5,770* | -- | *3,640* | -- |
| Amides | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Imides | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Substituted Ureas | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Anilines | 15,120 | -- | 1,300 | -- | 7,040 | 40 | -- | 20 | -- |
| Amides-acid | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| **RP30228** | | | | | | | | | |
| *Neutral organic* | 22,710 | -- | 15,220 | -- | 10,920 | 2,100 | -- | 1,750 | -- |
| Amides | 4,450 | -- | 3,840 | -- | 330 | 30 | -- | 50 | -- |
| Imides | 10,310 | -- | 12,620 | -- | 1,220 | 1,000 | -- | 1,220 | -- |

| Compound Class Used by ECOSAR | Toxicity Endpoint (µg a.i/L) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 96-hr FW Fish $LC_{50}$ | 96-hr E/M Fish $LC_{50}$ | 48-hr Daphnid $LC_{50}$ | 96-hr Mysid $LC_{50}$ | 96-hr Green Algae $EC_{50}$ | Chronic FW Fish[1] | Chronic E/M Fish[1] | Chronic Daphnid [1] | Chronic Mysid[1] |
| Substituted Ureas | 11,840 | -- | 16,630 | -- | 180 | 210 | -- | 1,860 | -- |
| Anilines | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Amides-acid | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| **RP32490** | | | | | | | | | |
| *Neutral organic* | 617,280 | -- | 334,290 | -- | 116,190 | 59,280 | | 28,140 | |
| Amides | 96,510 | -- | 45,340 | -- | 890 | 570 | | 600 | |
| Imides | 217,610 | -- | 228,050 | -- | 6,830 | 21,450 | | 17,120 | |
| Substituted Ureas | 199,220 | -- | 395,89 | -- | 190 | 2,920 | | 30,650 | |
| Anilines | N/D | -- | N/D | -- | N/D | N/D | | N/D | |
| Amides-acid | N/D | -- | N/D | -- | N/D | N/D | | N/D | |
| **RP35606** | | | | | | | | | |
| *Neutral organic* | *17,150* | -- | *11,740* | -- | *9,030* | *1,580* | -- | *1,390* | -- |
| Amides | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Imides | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Substituted Ureas | 93,660 | -- | 127,170 | -- | 1,850 | 1,670 | -- | 14,750 | -- |
| Anilines | N/D | -- | N/D | -- | N/D | N/D | -- | N/D | -- |
| Amides-acid | 34,300 | -- | 31,460 | -- | 3,090 | 200 | -- | 420 | -- |
| Imide-acids | N/D | -- | N/D | -- | 10,620 | N/D | -- | N/D | -- |

RED: Highlighted values have a toxicity ratio >0.1.

Toxicity Ratio: (parent or degradate endpoint/parent or degradate endpoint)* Max % AR [whichever of the two endpoints is lower should be used as the numerator.

N/D: No data available.

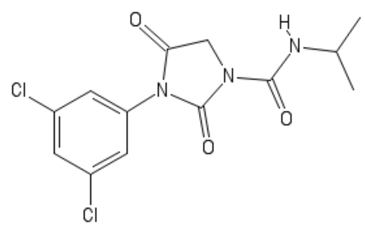
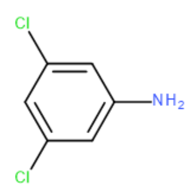
[1] Chronic toxicity values used in ECOSAR represent the geometric mean of the NOAEC and LOAEC (*i.e.*, the MATC value).

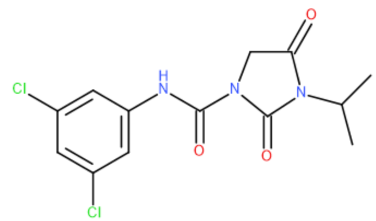
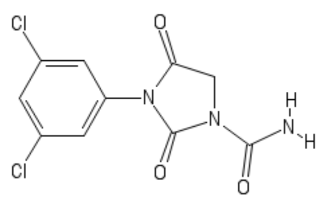
**Table B-2. Summary of QSAR Toxicity Predictions for Iprodione and Relevant Major (>10%) Degradates Using ECOSAR**

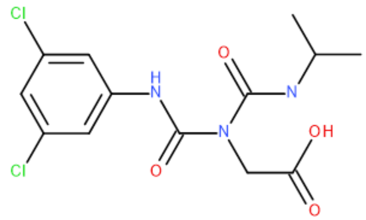
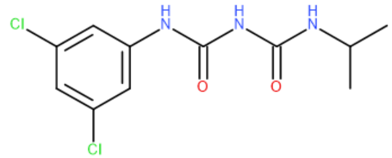
| Matching Classes | | | |
|---|---|---|---|
| Species | Degradate | Quality of Match | Matching Measured Compound Class |
| Freshwater fish acute | 3,5-DCA (0.24) | Fair | Neutral organic |
| Green algae acute | 3,5-DCA (0.29) | Good | Neutral organic |
| Freshwater fish chronic | 3,5-DCA (2.65) | N/A | N/A |
| Daphnia chronic | 3,5-DCA (0.27) | Fair | Neutral organic |
| Freshwater fish acute | RP30228 (0.43-0.48) | Fair-Good | Neutral organic, amides, imides, substituted ureas |
| Green algae acute | RP30228 (0.46-0.88) | Poor-Good | Neutral organic, amides, imides, substituted ureas |
| Freshwater fish chronic | RP30228 (0.43-0.53) | Poor-Good | Neutral organic, amides, imides, substituted ureas |
| Daphnid chronic | RP30228 (0.49-0.52) | Fair-Good | Neutral organic, amides, imides, substituted ureas |
| Green algae acute | RP32490 (0.15) | Poor | Substituted ureas |
| Non-Matching Classes | | | |
| Freshwater fish acute | 3,5-DCA (0.12) | N/A | Anilines |
| Green algae acute | 3,5-DCA (0.83) | N/A | Anilines |
| Freshwater fish chronic | 3,5-DCA (2.89) | N/A | Anilines |
| Daphnid chronic | 3,5-DCA (5.97) | N/A | Anilines |
| Daphnid chronic | RP35606 (0.11) | N/A | Amides-acid |

## Appendix C. ROCKS table

**Table C-1. Chemical Names and Structures of Iprodione and its Transformation Products**

| Code Name/ Synonym | Chemical Name | Chemical Structure | Study Type | MRID | Maximum %AR (day) | Final %AR (day) |
|---|---|---|---|---|---|---|
| **PARENT COMPOUND** | | | | | | |
| Iprodione | 3-(3,5-dichlorophenyl)-N-(1-methylethyl)-2,4-dioxo-1-imidazolidinecarboxamide<br><br>SMILES: c1c(Cl)cc(Cl)cc1N2C(=O)CN(C(=O)NC(C)C)C2(=O)<br><br>CAS No. 36734-19-7 |   | Hydrolysis | 41885401 | | 82% (pH 5, Day 30) |
| | | | | | | 41% (pH 7, 125 hrs) |
| | | | | | | 5.6% (pH 9, 2 hrs) |
| | | | Aqueous photolysis | 41861901 | | 68% (Day 33) |
| | | | Aerobic soil | 43091002 | | 0.75% (Day 276) |
| | | | | 44590501 | | 6.85% (Day 100) |
| | | | | 49726502 | | 9.9% (Day 122) |
| | | | Aerobic aquatic | 42503801 | | 7.8% (Day 30) |
| | | | | 49726503 | | 8.7% (Day 102) |
| | | | Anaerobic aquatic | 41755801 | | 3.4% (Day 365) |
| | | | | 49726505 | | 6.4% (Day 101) |
| | | | Terrestrial field | 41877401 | | <0.01 ppm (Day 538) |
| | | | Aquatic field ($H_2O$)<br>Aquatic field (soil) | 43718301 | | 0.008 ppm (Day 44)<br>0.007 ppm (Day 44) |
| **MAJOR (>10%) TRANSFORMATION PRODUCTS** | | | | | | |
| RP32596, 3,5-DCA | 3,5-dichloroaniline (3,5-DCA)<br><br>SMILES: Nc(cc(cc1CL)CL)c1<br><br>CAS No. 626-43-7 |   | Aerobic soil | 43091002 | 9% (Day 30) | ND (Day 276) |
| | | | | 44590501 | 3.9% (Day 50) | ND (Day 100) |
| | | | | 49726502 | **29.8% (Day 28)** | **12.9% (Day 122)** |
| | | | Aerobic aquatic | 42503801 | **11.7% (Day 30)** | **11.7% (Day 30)** |
| | | | | 49726503 | 1.1 (Day 102) | 1.1 (Day 102) |
| | | | Anaerobic aquatic | 41755801 | 3.6% (Day 275) | 2.4% (Day 365) |
| | | | | 49726505 | 5.2% (Day 101) | Day 5.2% (101) |
| | | | Aquatic field ($H_2O$) | 43718301 | <0.005 ppm (Day 44) | <0.005 ppm (Day 44)<br><0.005 ppm (Day 44) |

| Code Name/ Synonym | Chemical Name | Chemical Structure | Study Type | MRID | Maximum %AR (day) | Final %AR (day) |
|---|---|---|---|---|---|---|
| | | | Aquatic field (soil) | | <0.005 ppm (Day 44) | |
| RP30228 | 3-(1-methylethyl)-N-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide<br><br>SMILES: c1c(CL)cc(CL)cc1NC(=O)N2CC(=O)N(C(C)(C))C2(=O)<br><br>CAS No. NA |  | Hydrolysis | 41885401 | **46% (pH 7, 125 hrs)** | **46% (pH 7, 125 hrs)** |
| | | | | | **93% (pH 9, 2 hr)** | **93% (pH 9, 2 hr)** |
| | | | Aqueous photolysis | 41861901 | 2.7% (Day 17) | 2% (Day 33) |
| | | | Aerobic soil | 43091002 | 6.9% (Day 14) | 2% (Day 276) |
| | | | | 44590501 | **29% (Day 30)** | **15% (Day 100)** |
| | | | | 49726502 | **30.8% (Day 28)** | **20.4% (Day 122)** |
| | | | Aerobic aquatic | 42503801 | **65% (Day 14)** | **56% (Day 30)** |
| | | | | 49726503 | **89.4 (Day 102)** | **89.4 (Day 102)** |
| | | | Anaerobic aquatic | 41755801 | **70% (Day 14)** | **21% (Day 365)** |
| | | | | 49726505 | **84.6% (Day 60)** | **81.9% (Day 102)** |
| | | | Terrestrial field | 41877401 | 0.47 ppm (Day 28) | 0.15 ppm (Day 538) |
| | | | Aquatic field ($H_2O$)<br>Aquatic field (soil) | 43718301 | 0.057 ppm (Day 2)<br>0.13 ppm (1 mon) | 0.016 ppm (Day 44)<br>0.012 ppm (Day 44) |
| RP32490 | 3-(3,5-dichlorophenyl)-2,4-dioxo-1-imidazolidine-carboxamide<br><br>SMILES: c1c(CL)cc(CL)cc1N2C(=O)CN(C(=O)N)C2(=O)<br><br>CAS No. NA |  | Aerobic soil | 43091002 | 0.28% (Day 1) | ND7 (Day 276) |
| | | | Aerobic aquatic | 42503801 | 15% (Day 1) | 4% (Day 30) |
| | | | Anaerobic aquatic | 41755801 | 8.4% (Day 30) | 0.8% (Day 365) |
| | | | Terrestrial field | 41877401 | 0.09 ppm (Day 7) | <0.01 ppm (Day 538) |
| | | | Aquatic field (H2O)<br>Aquatic field (soil) | 43718301 | 0.006 ppm (Day 2)<br><0.005 ppm (Day 44) | <0.005 ppm (Day 44)<br><0.005 ppm (Day 44) |
| RP35606 | [(dichloro-3,5-phenyl)-1-isopropylcarbamoyl-3]-2-acetic acid | | Hydrolysis | 41885401 | 12% (pH 5, Day 30) | 12% (pH 5, Day 30) |
| | | | | | 10% (pH 7, 40 hrs) | 5.5% (pH 7, 125 hrs) |
| | | | | | 2% (pH 9, 107 hrs) | 2% (pH 9, 107 hrs) |
| | | | Aerobic soil | 43091002 | 1.2% (Day 7) | ND7 (Day 276) |
| | | | Aerobic soil | 44590501 | 1.7% (Day 7) | ND (Day 100) |

| Code Name/ Synonym | Chemical Name | Chemical Structure | Study Type | MRID | Maximum %AR (day) | Final %AR (day) |
|---|---|---|---|---|---|---|
| | SMILES: c1c(CL)cc(CL)cc1NC(=O)N(CC(=O)(O))C(=O)NC(C)(C)<br><br>CAS No. NA |  | Aerobic aquatic | 41927601 | 8.9% (Day 30) | 8.9% (Day 30) |
| RP36221 | 1-(3,5-dichlorophenyl)-5-isopropyl biuret<br><br>SMILES: CC(C)NC(=O)NC(=O)Nc1cc(Cl)cc(Cl)c1<br><br>CAS No. NA |  | Aerobic Soil | 41885401 | **13% (Day 100)** | **13% (Day 100)** |

ND= means “not detected”. AR means “applied radioactivity”. MW means “molecular weight”. LOQ means “limit of quantitation”. Bolded values are laboratory study values >10%AR.

## Appendix D. Summary of Available Ecological Effects Data for Iprodione

While the most sensitive ecological toxicity studies and all new ecological studies for iprodione are summarized in Section 6, this appendix serves to summarize all available ecological toxicity data for iprodione which is provided in Table F-1 (for aquatic taxa) and Table F-2 (for terrestrial taxa). Additionally, more detailed descriptions are provided below for all studies that are newly submitted since the Problem Formulation.

Two new chronic studies with the freshwater invertebrate (*Daphnia magna*) were submitted, one demonstrating the effects of exposure to the parent iprodione (MRID 49653701) and the second one demonstrating the effects of exposure to 3,5-DCA (MRID 49526511). The 21-day-chronic toxicity of Iprodione to *Daphnia magna* was studied under static-renewal conditions. Result of the test are reported based on the mean-measured concentrations. No treatment-related effects were observed on survival or successful birth rate. Days to first brood release, total length, and reproduction (number of live young/surviving adult) were significantly different from controls at 1.12 mg ai/L, the highest concentration tested. Dry weight was significantly decreased from controls at the 0.557 and 1.12 mg ai/L treatment levels. Based on treatment-related effects in dry weight, the NOAEC and LOAEC values were 0.288 and 0.557 mg ai/L, respectively. The 21-day-chronic toxicity of 3,5-Dichloroaniline (metabolite of Iprodione) to *Daphnia magna* was studied under flow-through conditions. Results of the study are based on mean-measured concentrations. Days to first brood release was significantly delayed in the 0.197 mg ai/L group, the highest concentration tested. Mean length was significantly decreased at ≥0.101 mg ai/L. The number of offspring per adult reproductive day and dry weight were significantly decreased at ≥0.0459 mg ai/L. Based on the statistically significant effects on reproduction (offspring/reproductive day) and dry weight at ≥0.0459 mg ai/L, the NOAEC and LOAEC were 0.0218 and 0.0459 mg ai/L, respectively. No treatment-related effects were observed on survival at any exposure level.

In a 96-hour acute toxicity study, fathead minnow (*Pimephales promelas*) were exposed to iprodione under static-renewal conditions (MRID 49526509). Results of the study are based on time-weighted average concentrations. Mortality (60%) was observed in the 6.93 mg ai/L treatment group, the highest concentration tested. No mortalities were observed in the negative or saturator controls. Sublethal effects observed included fish on the bottom of the test chamber, loss of equilibrium, and/or surfacing. The $LC_{50}$ was 6160 µg a.i./L based on the TWA concentrations.

Over a 213-day exposure period, the effects of technical grade iprodione (96.3% active ingredient; ai) on fathead minnows (*Pimephales promelas*) were assessed on embryos (<24 hrs post-fertilization) to adults ($F_0$) along with their offspring ($F_1$) under flow-through conditions (MRID 49767901). Results of the study were based on time-weighted average concentrations. Initially, 50 embryos per replicate with 4 replicates per treatment (*i.e.*, 200 embryos/treatment) were exposed; adults ($F_0$) were then spawned to generate $F_1$ offspring in which there were 30 embryos/replicate with 4 replicates per treatment (*i.e.*, 120 embryos/treatment). Average hatching success of $F_0$ and $F_1$ embryos in controls was 97 and 100%, respectively; average survival of control $F_0$ fry and adults was ≥93%; the average survival of $F_1$ controls fry was ≥92%; average fertility of $F_0$ controls was 95%. Although there was a statistically significant ($p<0.05$) difference (6.22% reduction) in hatching success in fish treated with 6.11 µg a.i./L, relative to controls, the effect was not concentration responsive and was not considered to be treatment-related. No treatment-related effects on hatching, growth, or reproductive parameters were determined for any endpoint with replicate data provided for this life cycle toxicity test with fathead minnow. The overall NOAEC and LOAEC were 84.9 and >84.9 µg ai/L, respectively, based on the time-weighted average concentrations.

In a 96-hour acute toxicity study, Sheepshead minnow (*Cyprinodon variegatus*) were exposed to iprodione under static-renewal conditions (MRID 49526510). The results of the study are based on the time-weighted average concentrations. After 96 hours, mortality was 30% in the TWA 8.14 mg ai/L group; no mortalities were observed in the controls or the ≤4.03 mg ai/L groups. Sublethal effects included fish on the bottom of the test chamber, discoloration, loss of equilibrium, erratic swimming pattern, and/or irregular respiration. The $LC_{50}$ was >8140 µg a.i./L based on the TWA concentrations.

The 36-day chronic toxicity of technical grade iprodione (96.3% active ingredient; ai) to the early life-stage of the estuarine/marine Sheepshead Minnow (*Cyprinodon variegatus*) was studied under flow-through conditions (MRID 49664102). Fertilized embryos (80/level, <24 hours old) were exposed until reaching 28 days post-hatch (36 days total). Results of the study are based on the time-weighted average concentrations. Based on a lack of treatment-related effects in any parameter (*i.e.*, embryo survival; time to hatch; hatching success; larval survival; standard length; blotted wet weight; and, behavior) the overall NOAEC and LOAEC were 57.4 and >57.4 µg ai/L, respectively, using TWA concentrations.

In a 96-hour acute toxicity study, Rainbow trout (*Oncorhynchus mykiss*) were exposed to iprodione under static-renewal conditions (MRID 49526508). Results of the study are based on the time-weighted average concentrations. No mortalities were observed in the negative or saturator controls. Sublethal effects included fish on the bottom of the test chamber, discoloration, loss of equilibrium, and/or erratic swimming pattern. Mortality (40%) was observed in the highest concentration tested. The $LC_{50}$ was >9,460 µg a.i./L based on the TWA concentrations.

The acute toxicity of technical grade iprodione (96.3% active ingredient; a.i.) to the estuarine/marine invertebrate mysid shrimp *Americamysis bahia* was evaluated at measured time-weighted average concentrations of <0.0050 (<minimum quantifiable limit [MQL]; controls), 0.347, 0.700, 1.33, 2.72, and 5.68 mg ai/L under static renewal conditions. After 96-hrs, the $LC_{50}$ (with 95% C.I.) was 2.20 (1.89-2.56) mg ai/L on the basis of time-weighted average concentrations and 70 and 100% mortality observed in the 2.72 and 5.68 mg a.i./L treatment groups, respectively. Based on the study results, technical grade (96.3% ai) iprodione is categorized as moderately toxic to mysid shrimp on an acute exposure basis (MRID 49526507).

A 28-day chronic toxicity of iprodione to mysids (*Americamysis bahia*) was studied under flow-through conditions (MRID 49726507). Results of the study are based on mean-measured concentrations. The most sensitive endpoint was number of offspring/female, resulting in 28-day NOAEC and LOAEC values of 30 and 62 µg ai/L, respectively (based on the mean-measured concentrations). The sublethal effects included $F_0$ survival (post-pairing) and number of offspring/female. Production of offspring in the treated groups indicated that iprodione had an effect on reproduction at concentrations ≥62 µg ai/L. This study was scientifically sound and acceptable but was not the most sensitive chronic endpoint submitted to date and was therefore not used to assess risk. The chronic mysid study used for assessment of risk (MRID 40832201) where juvenile mysids were exposed to TG iprodione for 28 days had a NOAEC/LOAEC of 7.5 and 14 µg a.i./L, respectively based on a 37% reduction in reproduction in the 14 µg a.i./L treatment group when compared to the negative control group.

Three toxicity studies with non-vascular aquatic plants were submitted. Including the blue-green algae *Anabaena flos-aquae* [MRID 49526506], the freshwater diatom *Navicula pelliculosa* [MRID 49526505], and the green algae *Pseudokirchneriella subcapitata* [MRID 49526504]. The freshwater diatom was the most sensitive of the three new aquatic non-vascular plants tested with $IC_{50}$ and NOAEC values of 2,864 µg a.i./L and 23 mg a.i./L, respectively. The saltwater diatom, *Skeletonema costatum* (MRID 41604109) is still the most sensitive of the vascular and non-vascular plants tested to date with an $IC_{50}$ and NOAEC of 330 and 30 µg a.i./L, respectively.

In a 96-hour toxicity study, cultures of freshwater blue-green alga *Anabaena flos-aquae* (strain not reported) were exposed to technical grade iprodione (96.3% active ingredient; a.i.) at nominal concentrations of 0 (negative control), 0.050, 0.15, 0.44, 1.3, 4.0, and 12 mg/L under static conditions. Measured concentrations of iprodione decreased over the course of the study with 96-hour measured concentrations ranging from 3 to 9% of 0 hour measured concentrations; therefore, the reviewer-based exposure values on initial measured concentrations which were <0.005 (<MQL, negative control), 0.0277, 0.0805, 0.240, 0.641, 2.25, and 5.89 mg ai/L. After 96 hours, NOAEC values for all endpoints (yield, growth rate, and area under the curve (AUC)) were 0.641 mg ai/L, based on initial measured concentrations. The $IC_{50}$ value for yield was 5.55 mg ai/L, based on initial measured concentrations; whereas, the $IC_{50}$ values for growth rate and AUC were >5.89 mg ai/L, based on initial measured concentrations. The percent growth inhibition of cell density in the treated algal culture as compared to the control ranged from -3 to 49%.

In a 96-hour toxicity study, cultures of freshwater diatom, *Navicula pelliculosa* (strain not reported), were exposed to technical grade iprodione (96.3% active ingredient; a.i.) at nominal concentrations of 0 (negative control), 0.050, 0.15, 0.44, 1.3, 4.0, and 12 mg/L under static conditions. Measured concentrations of iprodione declined over the course of the study, with 96-hour measured concentrations ranging from 3 to 11% of 0 hour measured concentrations. Therefore, the reviewer-based toxicity values on initial measured concentrations which were <0.005 (<minimum quantifiable limit [MQL], negative control), 0.0230, 0.0805, 0.239, 0.747, 1.46, and 4.63 mg ai/L. The $IC_{50}$ and NOAEC values for yield were 3.46 and 0.023 mg ai/L, respectively. The $IC_{50}$ and NOAEC values for growth rate were >4.63 and 0.747 mg ai/L, respectively. The $IC_{50}$ and NOAEC values for area under the growth (AUC; biomass) curve were 2.86 and 0.023 mg ai/L, respectively. The percent growth inhibition of cell density in the treated algal culture as compared to the control ranged from -2 to 61% (MRID 49526506).

In a 96-hour toxicity study, cultures of freshwater green alga, *Raphidocelis subcapitata* formerly *Pseudokirchneriella subcapitata* (strain not reported), were exposed to technical grade iprodione (96.3% active ingredient; ai) at nominal concentrations of 0 (negative control), 0.016, 0.049, 0.15, 0.44, 1.3, 4.0, and 12 mg ai/L under static conditions. Iprodione concentrations decreased over the course of the study, with 96-hour measured concentrations ranging from 1 to 35% of 0 hour measured concentrations, so the reviewer-based toxicity values on initial measured concentrations which were less than the minimum quantifiable limit (<MQL) of 0.005 mg ai/L, negative control), 0.00716, 0.0203, 0.0650, 0.195, 0.568, 1.33, and 5.17 mg ai/L. After 96 hours, $IC_{50}$ and NOAEC values for all endpoints (yield, growth rate, and area under the growth curve (AUC)) were >5.17 and 0.568 mg ai/L, respectively, based on initial measured concentrations. The percent growth inhibition of cell density in the treated algal culture as compared to the control ranged from -5 to 24% (MRID 49526504).

**Table D-1 Summary of Available Aquatic Toxicity Endpoints for Iprodione (Bolded Values Represent Toxicity Endpoints Used to Assess Risk)**

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value in µg a.i./L (unless otherwise specified) | MRID or ECOTOX No./ Classification | Comments |
|---|---|---|---|---|---|
| **Freshwater Fish (Surrogates for Vertebrates)** | | | | | |
| Acute | TGAI | **Fathead Minnow *(Pimephales promelas)*** | **$LC_{50}$ = 6,160** | **49526509[N] Acceptable** | **96-h duration; moderately toxic** |
| Acute | TGAI | Rainbow Trout *(Oncorhynchus mykiss)* | $LC_{50}$ = >9,460 | 49526508[N] Supplemental | 96-h duration; moderately toxic |
| Chronic | TGAI | Fathead Minnow *(Pimephales promelas)* | **NOAEC = 260 LOAEC = 550** | **40550801 Supplemental** | **34-d duration; reduced larval survival** |
| Chronic | TGAI | Fathead Minnow *(Pimephales promelas)* | NOAEC = 84.9 LOAEC >84.9 | 49767901[N] Acceptable | 30-w duration; no effect study |
| **Estuarine/Marine Fish (Surrogates for Vertebrates)** | | | | | |
| Acute | TGAI | Sheepshead Minnow *(Cyprinodon variegatus)* | **$LC_{50}$ >8,140** | **49526510[N] Supplemental** | **96-h duration; moderately toxic** |
| Chronic | TGAI | Sheepshead Minnow *(Cyprinodon variegatus)* | **NOAEC = 57.4 LOAEC >57.4** | **49664102 Acceptable** | **36-d duration; no treatment-related adverse effects on any parameter.** |
| **Freshwater Invertebrates (Water-Column Exposure)** | | | | | |
| Acute | TGAI | Water Flea | **$EC_{50}$ = 240** | **41642001 Supplemental** | **48-h duration; highly toxic** |

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value in µg a.i./L (unless otherwise specified) | MRID or ECOTOX No./ Classification | Comments |
|---|---|---|---|---|---|
| Chronic | 3,5-DCA | (*Daphnia magna*) | **NOAEC = 21.8<br>LOAEC = 45.9** | **49526511[N]<br>Acceptable** | **21-day duration; sig. diff. in time to 1st brood, growth and repro.(growth and repro, most sensitive)** |
| | TGAI | | **NOAEC = 288<br>LOAEC = 557** | **49653701[N]<br>Acceptable** | **21-day duration; sig. diff. in days to 1st brood release, reproduction and dry weight** |
| **Estuarine/Marine Invertebrates (Water-Column Exposure)** | | | | | |
| Acute | TGAI | Mysid Shrimp (Americamysis bahia) | **$LC_{50}$ = 2,240** | **49526507[N]<br>Acceptable** | **96-h duration; moderately toxic** |
| Chronic | | | **NOAEC = 7.5<br>LOAEC = 14** | **40832201<br>Supplemental** | **28-d duration; adverse effect on reproduction** |
| | | | NOAEC <15[†]<br>LOAEC = 15 | 40550802<br>Supplemental | 28-d duration; #young/female was sig. affected in all treatment groups |
| | | | NOAEC = 30<br>LOAEC = 62 | 49726507[N]<br>Acceptable | 28-d duration; sig. diff. for #young/female; sublethal effects in survival and #young/female |
| **Freshwater Invertebrate (Sediment Exposure)** | | | | | |
| No data available. | | | | | |
| **Estuarine/ Marine Invertebrates (Sediment Exposure)** | | | | | |
| No data available. | | | | | |
| **Mollusks (Water Column Exposure)** | | | | | |
| Acute Shell Deposition | TGAI | Eastern Oyster *(Crassostrea virginica)* | **$EC_{50}$ = 2300** | **40489202<br>Supplemental** | **96-h duration; moderately toxic** |
| **Aquatic Plants and Algae** | | | | | |
| Vascular | *TGAI* | Duckweed *(Lemna gibba)* | **$IC_{50}$ >12,640[†]<br>NOAEC = 12,640<br>LOAEC >12,640** | **45741301<br>Supplemental** | **7-d duration; no effect study** |
| Non-vascular | TGAI | Blue-Green Algae *(Anabaena flos-aquae)* | $IC_{50}$ = 5,548<br>NOAEC = 641<br>LOAEC = 2250 | 49526506[N]<br>Acceptable | 96-hour duration; significant decrease in yield |
| | | Freshwater Diatom *(Navicula pelliculosa)* | $IC_{50}$ = 2,864<br>NOAEC = 23<br>LOAEC = 80.5 | 49526505[N]<br>Acceptable | 96-hour duration; Area under the growth curve most sensitive endpoint |
| | | Green Algae | $IC_{50}$ >130[†]<br>NOAEC = 130<br>LOAEC = >130 | 41604107<br>Acceptable | 120-H duration; no effect |

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value in µg a.i./L (unless otherwise specified) | MRID or ECOTOX No./ Classification | Comments |
|---|---|---|---|---|---|
| | | *(Pseudokirchneriella subcapitata)* | $IC_{50}$ = >5170<br>NOAEC = 568<br>LOAEC = 1330 | 49526504[N]<br>Acceptable | 96-hour duration; significant decrease in cell density, area under the growth curve, growth rate and yield (biomass) at 96 hours |
| | | Marine Diatom (*Skeletonema costatum*) | **$IC_{50}$ = 330**<br>**NOAEC = 30** | **41604109**<br>**Acceptable** | **120-hour duration; decreased cell growth** |

TGAI=Technical Grade Active Ingredient; a.i.=active ingredient

[N] Studies submitted since the Problem Formulation was completed are designated with an N associated with the MRID number.

>Greater than values designate non-definitive endpoints where no effects were observed at the highest level tested, or effects did not reach 50% at the highest concentration tested (USEPA, 2011).

< Less than values designate non-definitive endpoints where growth, reproductive, and/or mortality effects are observed at the lowest tested concentration.

The subacute dietary toxicity of technical grated iprodione (96.3% active ingredient; a.i.) to 4.5 to 6-month old Zebra Finch (*Taeniopygia guttata*) was assessed over 5 days of treatment, followed by a 6-day recovery period. Technical grade iprodione was administered to the birds in the diet at nominal concentrations of 0 (negative control), 500, 1000, 2000, 4000, and 8000 mg ai/kg. Mean-measured concentrations were <6.32 (<LOQ, control), 441, 960, 1923, 4090, and 7682 mg ai/kg diet. Mortality was 0% in the control group, compared to 0, 20, 50, 90, and 100% in the mean-measured 441, 960, 1923, 4090, and 7682 mg/kg diet treatment groups, respectively. Clinical signs of toxicity were observed in all iprodione- treated groups. At 441 mg ai/kg diet, sublethal effects included piloerection and lethargy. With increasing dietary concentrations, various signs of emaciation were observed, corresponding to the concurrent decrease in food consumption. At higher dietary exposure levels, the following signs were noted: labored breathing, wing droop, asthenia, hyporeactivity, sternal recumbence, ataxia, tremors, coma, uncontrolled movements, and loss of righting reflex. Following treatment, all surviving birds resumed normal food consumption and returned to normal behavior. Body weight gains during the exposure period (Days 0-5) were significantly decreased ($p<0.0001$) compared to the controls at ≥960 mg ai/kg diet. Food consumption during the exposure period (Days 1-5) was significantly decreased ($p<0.05$) compared to the controls in all treatment groups. The mean food consumption values decreased in a clear step-wise fashion with increasing concentrations of iprodione in the diet. The data requirement for passerine species is for an acute oral toxicity test; however, the registrant provided a subacute dietary toxicity test since preliminary oral toxicity testing with the finches resulted in regurgitation. This study is scientifically sound and is classified as acceptable**.** With an $LC_{50}$ values of 1,804 mg ai/kg diet, iprodione would be classified as slightly toxic to passerine species on a subacute dietary exposure basis (MRID 49526512).

The one-generation reproductive toxicity of Iprodione Technical (95.5% a.i.) to 12 groups (consisting of one male and two female) per level of 6-month old Northern bobwhite quail

(*Colinus virginianus*) was assessed over 18 weeks (Accession Number: 00099126). Technical grade iprodione was administered to the birds in the diet. Results of the study are based on the mean-measured concentrations in the diet. Reproduction was adversely affected by exposure at the 941 mg ai/kg diet level. A reduction was noted in the percentage of eggs laid of maximum laid (39% versus 51% for the control) and in the mean body weight of hatchlings (6.0 g versus 6.3 g for the control). A statistically-significant ($p<0.05$) reduction in the percentage of normal hatchlings of eggs set at the 941 mg ai/kg diet level (41% versus 56% for the controls) was also noted, and a significant reduction ($p=0.009$; 19% of control) at the same level in the proportion of number hatched to live 3-week embryos. The resulting NOAEC and LOAEC were found to be 324 and 941 mg a.i./kg-diet, respectively. A previously reviewed study with the Mallard Duck (Accession No. 00086840) was more sensitive, with a NOAEC of 300 mg a.i./kg-diet due to a reduction in survival of 14-day old birds, and was used for this assessment.

Individual synchronized honey bee (*Apis mellifera*) larvae (second instar; 24 – 48 hours old; L2 on Day 0 of the study) were exposed *in vitro* to technical grade iprodione (96.3% ai) [MRID 49526514]. Negative and solvent (acetone) controls were included in the study design, and dimethoate was used as a reference toxicant at a nominal dietary concentration of 40 mg ai/kg diet, corresponding to a nominal dietary dose of 1.3 µg ai/larva. All groups consisted of 2 replicates with 24 larvae/replicate, and each larva was contained within the plastic well of a 24-well cell culture plate. Mortality for the reference toxicant treatment group was not reported throughout the study. By Day 21, adult emergence was 81, 71, 71, 75, 62, 27 and 0% in the negative and solvent controls, and 7.7, 16, 30, 43, and 150 µg ai/larva treatment groups, respectively. Based on these results, the 21-day NOAEL and $ED_{50}$ were 30 and 27 µg ai/larva, respectively (equivalent to a NOAEC and $EC_{50}$ of 130 and 124 mg ai/kg diet, respectively). Underdeveloped wings were the only related sub-lethal effect observed throughout the duration of the study. The percent of emerging adults with underdeveloped wings was 0, 0, 7, 54, and 0% among larvae exposed to the 7.7, 16, 30, 43, and 150 µg ai/larva treatment groups, respectively. No underdeveloped wings were observed in either the negative or solvent control groups. Based on adverse effects on adult emergence, the NOAEL/LOAEL for chronic (repeated) exposure by honey bees to technical grade iprodione (96.3% ai) is 30/43 ug ai/larva or a daily dose of 7.5/10.75 ug ai/larva/day (equivalent to 130/200 mg ai/kg diet).

A combination acute oral and contact study with adult honey bees was also conducted (MRID 50586102); however, it is currently under review. An initial cursory review of the data indicated that there was no adverse effect observed on adult honey bees up to a dose level of 100 µg a.i./bee.

The effect of the iprodione formulated end-use product Rovral™ Flowable Fungicide (41.8% active ingredient; a.i.) on the seedling emergence of monocotyledonous (Corn, *Zea mays*; Oat, *Avena sativa*; Onion, *Allium cepa*; Ryegrass, *Lollium perenne*) and dicotyledonous (Cucumber, *Cucumis sativus*; Oilseed rape, *Brassica napus*; Pea, *Pisum sativum*; Radish, *Raphanus sativus*; Soybean, *Glycine max*; and Tomato, *Lycipersicon esculentum*) crops was studied at nominal concentrations of 0 (negative control), 0.0703, 0.141, 0.281, 0.563, 1.13, 2.25, 4.5, and 9 lb ai/A (MRID 49526502). Test concentrations were analytically confirmed at all treatment levels and were <0.00000041 (<LOQ, negative control), 0.0634, 0.144, 0.267, 0.549, 0.971, 1.95, 3.96 and 7.62 lb ai/A for oilseed rape and onion and were <0.00000043 (<LOQ, negative control), 0.0734, 0.129, 0.281, 0.573, 1.22, 2.41, 4.44 and 8.61 lb ai/A for all other species tested. The most sensitive monocot and dicot could not be determined due to a lack of toxicity. The NOAEC and $EC_{25}$/$IC_{25}$ values were 7.62/8.61 and >7.62/8.61 lb ai/A, respectively. There was a significant effect in onion height (inhibition 20%) at the 1.95 lb ai/A treatment level, however, this was not dose responsive and not considered a treatment related effect.

The effect of the iprodione formulated end-use product Rovral™ Flowable Fungicide (41.8% active ingredient; a.i.) on the vegetative vigor of monocotyledonous (Corn, *Zea mays*; Oat, *Avena sativa*; Onion, *Allium cepa*; Ryegrass, *Lollium perenne*) and dicotyledenous (Cucumber, *Cucumis sativus*; Oilseed rape, *Brassica napus*; Pea, *Pisum sativum*; Radish, *Raphanus sativus*; Soybean, *Glycine max*; and Tomato, *Lycipersicon esculentum*) crops was studied at nominal concentrations of 0 (negative control), 0.0703, 0.141, 0.281, 0.563, 1.13, 2.25, 4.5, and 9 lb ai/A (MRID 49526503). Test concentrations were analytically confirmed at all treatment levels and were 0.0634, 0.144, 0.267, 0.549, 0.97, 1.95, 3.96 and 7.62 lb ai/A. The most sensitive monocot and dicot could not be determined due to a lack of toxicity, NOAEC and $EC_{25}$/$IC_{25}$ values were 7.62 and >7.62 lb ai/A, respectively.

**Table D-2 Summary of Available Terrestrial Toxicity Endpoints for Iprodione (Bolded Values Represent Toxicity Endpoints Used to Assess Risk)**

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value[1] | MRID/Accession No. & Classification | Comments |
|---|---|---|---|---|---|
| **Birds (Surrogates for Terrestrial Amphibians and Reptiles)** | | | | | |
| Acute Oral | TGAI | Mallard Duck *(Anas platyrhynchos )* | $LD_{50}$ >10,437 mg a.i./kg-bw | Acc. No. 00232703 Supplemental | practically non-toxic |
| | | Northern Bobwhite Quail *(Colinus virginianus)* | **$LD_{50}$ = 930 mg a.i./kg-bw** | **Acc. No. 00232703 Supplemental** | **6-d duration; slightly toxic** |
| | | | $LD_{50}$ >2,000 mg a.i./kg-bw | 41604101 Acceptable | 14-d duration; practically non-toxic |
| Sub-acute dietary | TGAI | Mallard Duck *(Anas platyrhynchos )* | $LC_{50}$ >5,620 mg a.i./ kg-diet | 41604103 Acceptable | 8-d duration; practically non-toxic |
| | | Northern Bobwhite Quail *(Colinus virginianus)* | $LC_{50}$ >5,620 mg a.i./kg-diet | 41604102 Acceptable | 8-d duration; practically non-toxic |
| | | **Zebra Finch (*Taeniopygia guttata*)** | **$LC_{50}$ = 1,800 mg ai/kg-diet** | **49526512[N] Acceptable** | **11-d duration; slightly toxic** |
| Chronic | TGAI | **Mallard Duck *(Anas platyrhynchos )*** | **NOAEC = 300 mg a.i./kg-diet** | **Acc. No. 00086840 Acceptable** | 17% reduction in 14-day old survivors noted at the LOAEC. |

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value[1] | MRID/Accession No. & Classification | Comments |
|---|---|---|---|---|---|
| | | Northern Bobwhite Quail *(Colinus virginianus)* | NOAEC = 324<br>LOAEC = 941 mg ai/kg-diet | Acc. No. 00099126[N]<br>Acceptable | Reductions in normal hatchlings of eggs set (27%), number of eggs laid (24%) and body weights (5%) of hatchlings at the LOAEC. |
| **Mammals** | | | | | |
| Acute Oral | TGAI | Laboratory Rat (*Rattus norvegicus*) | **$LD_{50}$ = 1,160 mg ai/kg-bw** | **Acc. No. 00236497** | **slightly toxic** |
| | | | $LD_{50}$ = 3,050 mg ai/kg-bw | Acc. No. 00232701 | practically non-toxic |
| | | | $LD_{50}$ = 4,468 mg ai/kg-bw | 42306301 | 24-days duration; practically non-toxic |
| 2-year Carcino-genicity Study | TGAI | | NOAEC = 150<br>LOAEC = 300 mg ai/kg-diet | 42637801<br>Supplemental | 2-year duration; testicular hyperplasia, reduced spermatozoa in epididymis |
| 2-generation Reproductive Toxicity | TGAI | | **NOAEC = 300<br>LOAEC = 1000 mg ai/kg-diet** | **41871601<br>Core minimum** | **2 generations; decreased parental body weight, body weight gain and food consumption in both sexes** |
| **Terrestrial Invertebrates** | | | | | |
| Acute contact (adult) | TGAI | *Apis mellifera* (Honey Bee) | $LD_{50}$ = >100 | 50586102[N]<br>(Under review) | 8% mortality observed in 100 µg a.i./bee treatment |
| Acute oral (adult) | TGAI | *Apis mellifera* (Honey Bee) | $LD_{50}$ = >100 | 50586102[N]<br>(Under review) | 6% mortality observed in 100 µg a.i./bee treatment |
| Chronic oral (adult) | No data available. | | | | |
| Acute oral (larval) | No data available. | | | | |
| Chronic oral (larval) | *TGAI* | *Apis mellifera* (Honey bee) | **NOAEL = 7.5<br>LOAEL = 11 µg ai/larva/day** | **49526514[N]<br>Supplemental** | **21-day duration; reduction in adult emergence** |
| Foliage Residue | No data available. | | | | |
| Semi-field study or full field study) | No data available. | | | | |
| **Terrestrial Plants** | | | | | |

| Study Type | Test Substance (% a.i.) | Test Species | Toxicity Value[1] | MRID/Accession No. & Classification | Comments |
|---|---|---|---|---|---|
| Seedling Emergence | Rovral Flowable (41.8% iprodione) | Various | **Dicot (all): $IC_{25}$ = ≥7.62 lb a.i./A; NOAEC = 7.61 lb a.i./A (oilseed rape), 8.61 lb a.i./A (all other dicots)**<br><br>**Monocot (all): $IC_{25}$ = ≥7.62 lb a.i./A; NOAEC = 7.62 lb a.i./A (onion), 8.61 lb a.i./A (all other monocots)** | **49526502[N] Acceptable** | **21-days duration; no effect study** |
| Vegetative Vigor | Rovral Flowable (41.8% iprodione) | Various | **Monocot/Dicot: $IC_{25}$ = ≥7.62 lb a.i./A; NOAEC = 7.62 lb a.i./A** | **49526503[N] Acceptable** | **21-day duration; no effect study** |

TGAI=Technical Grade Active Ingredient; a.i.=active ingredient

[N] Studies submitted since the Problem Formulation was completed are designated with an N associated with the MRID number.

[1] NOAEC and LOAEC are reported in the same units.

>Greater than values designate non-definitive endpoints where no effects were observed at the highest level tested, or effects did not reach 50% at the highest concentration tested (USEPA, 2011).

< Less than values designate non-definitive endpoints where growth, reproductive, and/or mortality effects are observed at the lowest tested concentration.

## Appendix E. PWC Modeling Input Parameters for Iprodione, Iprodione SSD, and 3,5-DCA, Maximum and Average Application Rates

**Table E-1. PWC Input Parameters Specific to Use Patterns for Iprodione, Maximum Application Rate (Applications Tab and Crop/land Tab)**

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) Maximum | | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Iprodione | 3,5-DCA | | |
| 1 | 1CC_4x0.50_aerial_2_CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | 4x0.18 (0.21) | aerial | Above Crop |
| 2 | 1CC_2x1.0_aerial_2_CAfruit_WirrigSTD | Stone Fruit Apricot | Cafruit_Wirrigstd.scn | 1/16, 1/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | aerial | Above Crop |
| 3 | 1CC_2x1.0_aerial_2_GAPeachesSTD | Stone Fruit Peaches | GAPeachesSTD.scn | 3/16, 3/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | aerial | Above Crop |
| 4 | 1CC_2x1.0_aerial_2_MICherriesSTD | Stone Fruit Cherries | MIcherriesstd.scn | 4/16, 4/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | aerial | Above Crop |
| 5 | 1CC_4x1.0_aerial_2_FLcarrotSTD | Carrots Broadcast | FLcarrotstd.scn | 10/16, 10/23, 10/23, 11/6 | 4x1.00 (1.12) | 4x0.37 (0.41) | aerial | Above Crop |
| 6 | 1CC_4x1.0_aerial_2_CAonion_WirrigSTD | Onion CA CO | CAonion_Wirrigstd.scn | 2/16, 2/23, 3/2, 3/9 | 4x1.00 (1.12) | 4x0.37 (0.41) | aerial | Above Crop |
| 7 | 1CC_5x1.0_aerial_2_GAOnion_WirrigSTD | Onion GA | GAOnion_WirrigSTD.scn | 9/16, 9/30, 10/14, 10/28, 11/11 | 5x1.00 (1.12) | 5x0.37 (0.41) | aerial | Above Crop |
| 8 | 1CC_5x1_aerial_2_CAColeCropRLF_V2 | Crucifer For Seed | CAlettuceSTD.scn | 4/16, 4/21, 4/26, 5/1, 5/6 | 5x1.00 (1.12) | 5x0.37 (0.41) | aerial | Above Crop |
| 9 | 1CC_3x2_aerial_2_CAColeCropRLF_V2 | Crucifer For Seed | CAlettuceSTD.scn | 4/16, 4/21, 4/26 | 3x2.00 (2.24) | 2x0.37 (1.10) | aerial | Above Crop |
| 10 | 1CC_4x1.0_aerial_2_IDNpotato_WirrigSTD | Potato | IDNpotato_WirrigSTD.scn | 5/16, 5/26, 6/5, 6/15 | 4x1.00 (1.12) | 4x0.37 (0.41) | aerial | Above Crop |
| 11 | 1CC_4x1.0_aerial_2_MEpotatoSTD | Potato | MEpotatostd.scn | 5/16, 5/26, 6/5, 6/15 | 4x1.00 (1.12) | 4x0.37 (0.41) | aerial | Above Crop |

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) Maximum | | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Iprodione | 3,5-DCA | | |
| 12 | 1CC_4x5.51+1x1.96_aerial_2_FLturfSTD | Turf | FLturfstd.scn | 3/16, 3/30, 4/13, 4/27, 5/11 | 2x5.51+ 1x0.98 (6.17, 1.23) | 4x2.02, 1x0.72 (2.27, 0.81) | aerial | Above Crop |
| 13 | 1CC_4x5.51+1x1.96_aerial_2_PAturfSTD | Turf | PAturfstd.scn | 4/16, 4/30, 5/14, 5/28, 6/11 | 2x5.51+ 1x0.98 (6.17, 1.10) | 4x2.02, 1x0.72 (2.27, 0.81)) | aerial | Above Crop |
| 14 | 1CC_4x0.50_aerial_2_CAgrapes_WirrigSTD | Grapes | CAgrapes_Wirrigstd.scn | 5/1, 5/8, 5/15, 5/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | aerial | Above Crop |
| 15 | 1CC_4x0.50_aerial_2_NYGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | aerial | Above Crop |
| 16 | 1CC_4x0.50_ground_2_CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | 4x0.18 (0.21) | ground | Above Crop |
| 17 | 1CC_2x1.0_ground_2_CAfruit_WirrigSTD | Stone Fruit Apricot | Cafruit_Wirrigstd.scn | 1/16, 1/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | ground | Above Crop |
| 18 | 1CC_2x1.0_ground_2_GAPeachesSTD | Stone Fruit Peaches | GAPeachesSTD.scn | 3/16, 3/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | ground | Above Crop |
| 19 | 1CC_2x1.0_ground_2_MICherriesSTD | Stone Fruit Cherries | MIcherriesstd.scn | 4/16, 4/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | ground | Above Crop |
| 20 | 1CC_4x1.0_ground_2_FLcarrotSTD | Carrots Broadcast | FLcarrotstd.scn | 10/16, 10/23, 10/23, 11/6 | 4x1.00 (1.12) | 4x0.37 (0.41) | ground | Above Crop |
| 21 | 1CC_1x0.62_seed_treatment_2_FLcarrotSTD | Carrots Seed | FLCarrotstd.scn | 9/25 | 0.62 (0.69) | 0.23 (0.27) | seed treatment | Linear increasing with depth (0.635 cm) |
| 22 | 1CC_1_ground_2_CAonion_WirrigSTD | Onion CA CO | CAonion_Wirrigstd.scn | 2/16, 2/23, 3/2, 3/9 | 4x1.00 (1.12) | 4x0.37 (0.41) | ground | Above Crop |
| 23 | 1CC_5x1_ground_2_GAOnion_WirrigSTD | Onion GA | GAOnion_WirrigSTD.scn | 9/16, 9/30, 10/14, 10/28, 11/11 | 5x1.00 (1.12) | 5x0.37 (0.41) | ground | Above Crop |
| 24 | 1CC_5x1_ground_2_CAColeCropRLF_V2 | Crucifer For Seed | CAlettuceSTD.scn | 4/16, 4/21, 4/26, 5/1, 5/6 | 5x1.00 (1.12) | 5x0.37 (0.41) | ground | Above Crop |

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) Maximum | | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Iprodione | 3,5-DCA | | |
| 25 | 1CC_3x2_ground_2_CAColeCropRLF_V2 | Crucifer For Seed | CAlettuceSTD.scn | 4/16, 4/21, 4/26 | 3x2.00 (2.24) | 2x0.74 (0.83) | ground | Above Crop |
| 26 | 1CC_2x1.0_ground_2_CAColeCropRLF_V2 | Broccoli | CAlettuceSTD.scn | 1/16, 1/23 | 2x1.00 (1.12) | 2x0.37 (0.41) | ground | Above Crop |
| 27 | 1CC_4x1.0_ground_2_IDNpotato_WirrigSTD | Potato | IDNpotato_WirrigSTD.scn | 5/16, 5/26, 5/6, 5/16 | 4x1.00 (1.12) | 4x0.37 (0.41) | ground | Above Crop |
| 28 | 1CC_4x1.0_ground_2_MEpotatoSTD | Potato | MEpotatostd.scn | 5/16, 5/26, 5/6, 5/16 | 4x1.00 (1.12) | 4x0.37 (0.41) | ground | Above Crop |
| 29 | 1CC_4x5.51+1x1.96_ground_2_FLturfSTD | Turf | FLturfstd.scn | 3/16, 3/30, 4/13, 4/27, 5/11 | 2x5.51+ 1x0.98 (6.17, 1.23) | 4x2.02, 1x0.72 (2.27, 0.81) | ground | Above Crop |
| 30 | 1CC_4x5.51+1x1.96_ground_2_PAturfSTD | Turf | PAturfstd.scn | 4/16, 4/30, 5/14, 5/28, 6/11 | 2x5.51+ 1x0.98 (6.17, 1.10) | 4x2.02, 1x0.72 (2.27, 0.81) | ground | Above Crop |
| 31 | 1CC_4x0.50_ground_2_CAgrapes_WirrigSTD | Grapes | CAgrapes_Wirrigstd.scn | 5/1, 5/8, 5/15, 5/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | ground | Above Crop |
| 32 | 1CC_4x0.50_ground_2_NYGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | ground | Above Crop |
| 33 | 1CC_1x0.27_In_Furrow_2_CAcotton_WirrigSTD | Cotton | CAcotton_Wirrigstd.scn | 4/1 | 0.27 (0.30) | 0.13 (0.15) | in furrow | At depth (1.27 cm) |
| 34 | 1CC_1x0.27_In_Furrow_2_MScottonSTD | Cotton | MScottonstd.scn | 4/20 | 0.27 (0.30) | 0.13 (0.15) | in furrow | At depth (1.27 cm) |
| 35 | 1CC_1x0.27_In_Furrow_2_NCcottonSTD | Cotton | NCcottonstd.scn | 4/20 | 0.27 (0.30) | 0.13 (0.15) | in furrow | At depth (1.27 cm) |
| 36 | 1CC_4x0.50_airblast_2_CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | 4x0.18 (0.21) | airblast | Above Crop |
| 37 | 1CC_2x1.0_airblast_2_CAfruit_WirrigSTD | Stone Fruit Apricot | Cafruit_Wirrigstd.scn | 1/16, 1/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | airblast | Above Crop |

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) Maximum | | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Iprodione | 3,5-DCA | | |
| 38 | 1CC_2x1.0_airblast_2_GAPeachesSTD | Stone Fruit Peaches | GAPeachesSTD.scn | 3/16, 3/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | airblast | Above Crop |
| 39 | 1CC_2x1.0_airblast_2_MICherriesSTD | Stone Fruit Cherries | MIcherriesstd.scn | 4/16, 4/21 | 2x1.00 (1.12) | 2x0.37 (0.41) | airblast | Above Crop |
| 40 | 1CC_4x0.50_airblast_2_CAgrapes_WirrigSTD | Grapes | CAgrapes_Wirrigstd.scn | 5/1, 5/8, 5/15, 5/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | airblast | Above Crop |
| 41 | 1CC_4x0.50_airblast_2_NYGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | 4x0.18 (0.21) | airblast | Above Crop |
| 42 | 1CC_3x1.0_1xair_2xground_2_CAlettuceSTD | Lettuce | CAlettuceSTD.scn | 2/16, 2/26, 3/8 | 3x1.00 (1.12) | 3x0.49 (0.55) | 1xair, 2xground | Above Crop |
| 43 | 3CC_rotation_3x1.0+2x1+3x1.0_air_ground_2_CAlettuceSTD | 3CC Let Broc Let Rotation | CAlettuceSTD.scn | 1/15, 1/25, 2/4, 4/26, 5/3, 9/1, 9/11, 9/21 | 8x1.00 (1.12) | 8x0.49 (0.55) | 1xaerial+2xground, 2xground, 1xaerial+2xground | Above Crop |
| 44 | 2CC_3x1.0_aerial_ground_2_CAlettuceSTD | 2CC LettuceRotation | CAlettuceSTD.scn | 2/16, 2/26, 3/8, 7/16, 7/26, 8/5 | 6x1.00 (1.12) | 6x0.49 (0.55) | 1xair, 2xground | Above Crop |
| 45 | 2CC_2x1.0_ground_2_CAColeCropRLF_V2 | 2CC Broccoli Rotation | CAColeCropRLF_V2.scn | 1/16, 1/21, 6/16, 6/21 | 4x1.00 (1.12) | 4x0.49 (0.55) | ground | Above Crop |
| 46 | 2CC_2x5.51+1x0.98_ground_2_FLturfSTD | 2CC Turf Rotation | FLturfSTD.scn | 3/16, 3/30, 4/13, 9/16, 9/30, 10/14 | 2x5.51+ 1x0.98 (6.17, 1.23) | 2x2.70+0.48 (3.02, 0.54) | ground | Above Crop |
| 47 | 2CC_2x5.51+1x0.98_ground_2_PAturfSTD | 2CC Turf Rotation | PAturfSTD.scn | 4/16, 4/30, 5/14, 9/16, 9/30, 10/14 | 2x5.51+ 1x0.98 (6.17, 1.10) | 2x2.70+0.48 (3.02, 0.54) | ground | Above Crop |
| 48 | 2CC_2x5.51+1x0.98_aerial_2_FLturfSTD | 2CC Turf Rotation | FLturfSTD.scn | 3/16, 3/30, 4/13, 9/16, 9/30, 10/14 | 2x5.51+ 1x0.98 (6.17, 1.23) | 2x2.70+0.48 (3.02, 0.54) | aerial | Above Crop |
| 49 | 2CC_2x5.51+1x0.98_aerial_2_PAturfSTD | 2CC Turf Rotation | PAturfSTD.scn | 4/16, 4/30, 5/14, 9/16, 9/30, 10/14 | 2x5.51+ 1x0.98 (6.17, 1.10) | 2x2.70+0.48 (3.02, 0.54) | aerial | Above Crop |

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) | | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum | | | |
| | | | | | Iprodione | 3,5-DCA | | |
| 50 | 1CC_6x4.00_ground_2_CAnurserySTD_V2 | Ornamentals | CAnurserySTD_V2.scn | 0, 14, 28, 42, 56, 70 | 6x4.00 (4.48) | 4x1.96 (2.20) | ground | Above Crop |
| 51 | 1CC_6x4.00_ground_2_FLnurserySTD_V2 | Ornamentals | FLnurserySTD_V2.scn | 0, 14, 28, 42, 56, 70 | 6x4.00 (4.48) | 4x1.96 (2.20) | ground | Above Crop |
| 52 | 1CC_6x4.00_ground_2_MInurserySTD_V2 | Ornamentals | MInurserySTD_V2.scn | 0, 14, 28, 42, 56, 70 | 6x4.00 (4.48) | 4x1.96 (2.20) | ground | Above Crop |
| 53 | 1CC_6x4.00_ground_2_NJnurserySTD_V2 | Ornamentals | NJnurserySTD_V2.scn | 0, 14, 28, 42, 56, 70 | 6x4.00 (4.48) | 4x1.96 (2.20) | ground | Above Crop |
| 54 | 1CC_6x4.00_ground_2_ORnurserySTD_V2 | Ornamentals | ORnurserySTD_V2.scn | 0, 14, 28, 42, 56, 70 | 6x4.00 (4.48) | 4x1.96 (2.20) | ground | Above Crop |
| 55 | 1CC_6x4.00_ground_2_TNnurserySTD_V2 | Ornamentals | TNnurserySTD_V2.scn | 0, 14, 28, 42, 56, 70 | 6x4.00 (4.48) | 4x1.96 (2.20) | ground | Above Crop |

[1] All application dates are calendar dates except for ornamentals, which are set relative to the emergence date in the PWC scenario
[2] Application type determines the spray drift parameters for the modeling run based on **Table 8-3**
[3] App method indicates to the application method option in PWC.

**Table E-2. PWC Input Parameters Specific to Use Patterns for Iprodione, Average Application Rate (Applications Tab and Crop/land Tab)**

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|
| | | | | | Average | | |
| | | | | | Iprodione | | |
| 1 | 1CC_4x0.50_aerial_2_CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | aerial | Above Crop |
| 2 | 1CC_2x1.0_aerial_2_CAfruit_WirrigSTD | Stone Fruit Apricot | Cafruit_Wirrigstd.scn | 1/16, 1/21 | 2x0.75 (0.84) | aerial | Above Crop |

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|
| | | | | | Average | | |
| | | | | | Iprodione | | |
| 3 | 1CC_2x1.0_aerial_2_GA PeachesSTD | Stone Fruit Peaches | GAPeachesSTD.scn | 3/16, 3/21 | 2x0.68 (0.76) | aerial | Above Crop |
| 4 | 1CC_2x1.0_aerial_2_MI CherriesSTD | Stone Fruit Cherries | MIcherriesstd.scn | 4/16, 4/21 | 2x0.78 (0.87) | aerial | Above Crop |
| 5 | 1CC_4x1.0_aerial_2_FLc arrotSTD | Carrots Broadcast | FLcarrotstd.scn | 10/16, 10/23, 10/23, 11/6 | 4x0.89 (1.00) | aerial | Above Crop |
| 6 | 1CC_4x1.0_aerial_2_CA onion_WirrigSTD | Onion CA CO | CAonion_Wirrigstd.scn | 2/16, 2/23, 3/2, 3/9 | 4x0.64 (0.72) | aerial | Above Crop |
| 7 | 1CC_5x1.0_aerial_2_GA Onion_WirrigSTD | Onion GA | GAOnion_WirrigSTD.scn | 9/16, 9/30, 10/14, 10/28, 11/11 | 5x0.64 (0.72) | aerial | Above Crop |
| 8 | 1CC_4x1.0_aerial_2_ID Npotato_WirrigSTD | Potato | IDNpotato_WirrigSTD.scn | 5/16, 5/26, 6/5, 6/15 | 4x0.88 (0.99) | aerial | Above Crop |
| 9 | 1CC_4x1.0_aerial_2_ME potatoSTD | Potato | MEpotatostd.scn | 5/16, 5/26, 6/5, 6/15 | 4x0.88 (0.99) | aerial | Above Crop |
| 10 | 1CC_4x0.50_aerial_2_C Agrapes_WirrigSTD | Grapes | CAgrapes_Wirrigstd.scn | 5/1, 5/8, 5/15, 5/22 | 4x0.50 (0.56) | aerial | Above Crop |
| 11 | 1CC_4x0.50_aerial_2_N YGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | aerial | Above Crop |
| 12 | 1CC_4x0.50_ground_2_ CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | ground | Above Crop |
| 13 | 1CC_2x1.0_ground_2_C Afruit_WirrigSTD | Stone Fruit Apricot | Cafruit_Wirrigstd.scn | 1/16, 1/21 | 2x0.75 (0.84) | ground | Above Crop |
| 14 | 1CC_2x1.0_ground_2_G APeachesSTD | Stone Fruit Peaches | GAPeachesSTD.scn | 3/16, 3/21 | 2x0.68 (0.76) | ground | Above Crop |
| 15 | 1CC_2x1.0_ground_2_ MICherriesSTD | Stone Fruit Cherries | MIcherriesstd.scn | 4/16, 4/21 | 2x0.78 (0.87) | ground | Above Crop |

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|
| | | | | | Average | | |
| | | | | | Iprodione | | |
| 16 | 1CC_4x1.0_ground_2_FLcarrotSTD | Carrots Broadcast | FLcarrotstd.scn | 10/16, 10/23, 10/23, 11/6 | 4x0.89 (1.00) | ground | Above Crop |
| 17 | 1CC_1_ground_2_CAonion_WirrigSTD | Onion CA CO | CAonion_Wirrigstd.scn | 2/16, 2/23, 3/2, 3/9 | 4x0.64 (0.72) | ground | Above Crop |
| 18 | 1CC_5x1_ground_2_GAOnion_WirrigSTD | Onion GA | GAOnion_WirrigSTD.scn | 9/16, 9/30, 10/14, 10/28, 11/11 | 5x0.64 (0.72) | ground | Above Crop |
| 19 | 1CC_2x1.0_ground_2_CAColeCropRLF_V2 | Broccoli | CAlettuceSTD.scn | 1/16, 1/23 | 2x0.75 (0.84) | ground | Above Crop |
| 20 | 1CC_4x1.0_ground_2_IDNpotato_WirrigSTD | Potato | IDNpotato_WirrigSTD.scn | 5/16, 5/26, 5/6, 5/16 | 4x0.88 (0.99) | ground | Above Crop |
| 21 | 1CC_4x1.0_ground_2_MEpotatoSTD | Potato | MEpotatostd.scn | 5/16, 5/26, 5/6, 5/16 | 4x0.88 (0.99) | ground | Above Crop |
| 22 | 1CC_4x0.50_ground_2_CAgrapes_WirrigSTD | Grapes | CAgrapes_Wirrigstd.scn | 5/1, 5/8, 5/15, 5/22 | 4x0.50 (0.56) | ground | Above Crop |
| 23 | 1CC_4x0.50_ground_2_NYGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | ground | Above Crop |
| 24 | 1CC_4x0.50_airblast_2_CAalmond_WirrigSTD | Almonds | CAalmond_Wirrigstd.scn | 2/16, 2/21, 2/26, 3/3 | 4x0.50 (0.56) | airblast | Above Crop |
| 25 | 1CC_2x1.0_airblast_2_CAfruit_WirrigSTD | Stone Fruit Apricot | Cafruit_Wirrigstd.scn | 1/16, 1/21 | 2x0.75 (0.84) | airblast | Above Crop |
| 26 | 1CC_2x1.0_airblast_2_GAPeachesSTD | Stone Fruit Peaches | GAPeachesSTD.scn | 3/16, 3/21 | 2x0.68 (0.76) | airblast | Above Crop |
| 27 | 1CC_2x1.0_airblast_2_MICherriesSTD | Stone Fruit Cherries | MIcherriesstd.scn | 4/16, 4/21 | 2x0.78 (0.87) | airblast | Above Crop |
| 28 | 1CC_4x0.50_airblast_2_CAgrapes_WirrigSTD | Grapes | CAgrapes_Wirrigstd.scn | 5/1, 5/8, 5/15, 5/22 | 4x0.50 (0.56) | airblast | Above Crop |

| Run Number | Run Name | Use Site | PWC Scenario | Application Dates[1] | App. Rate in lbs a.i./A (kg a.i./ha) | App. Type[2] | App Method[3] (depth) |
|---|---|---|---|---|---|---|---|
| | | | | | Average | | |
| | | | | | Iprodione | | |
| 29 | 1CC_4x0.50_airblast_2_NYGrapesSTD | Grapes | NYgrapesstd.scn | 6/1, 6/8, 6/15, 6/22 | 4x0.50 (0.56) | airblast | Above Crop |
| 30 | 1CC_3x1.0_1xair_2xground_2_CAlettuceSTD | Lettuce | CAlettuceSTD.scn | 2/16, 2/26, 3/8 | 3x0.96 (1.08) | 1xair, 2xground | Above Crop |
| 31 | 3CC_rotation_3x1.0+2x1+3x1.0_air_ground_2_CAlettuceSTD | 3CC Let Broc Let Rotation | CAlettuceSTD.scn | 1/15, 1/25, 2/4, 4/26, 5/3, 9/1, 9/11, 9/21 | 3x0.96, 2x0.75 3x0.96 (1.08, 0.84) | 1xaerial+2xground, 2xground, 1xaerial+2xground | Above Crop |
| 32 | 2CC_3x1.0_aerial_ground_2_CAlettuceSTD | 2CC LettuceRotation | CAlettuceSTD.scn | 2/16, 2/26, 3/8, 7/16, 7/26, 8/5 | 6x0.96 (1.08) | 1xair, 2xground | Above Crop |
| 33 | 2CC_2x1.0_ground_2_CAColeCropRLF_V2 | 2CC Broccoli Rotation | CAColeCropRLF_V2.scn | 1/16, 1/21, 6/16, 6/21 | 4x1.00 (1.12) | ground | Above Crop |

[1] All application dates are calendar dates except for ornamentals, which are set relative to the emergence date in the PWC scenario

[2] Application type determines the spray drift parameters for the modeling run based on **Table 8-3**

[3] App method indicates to the application method option in PWC.

## Appendix F. Example Aquatic Modeling Output and Input Batch Files

All modeling calculations, inputs, and results are available in the water modeling Excel files that are attached to the final pdf. Below is an example output summary file from iprodione parent, Iprodione SSD, and 3,5-DCA PWC modeling simulations.

Iprodione DW DCA Max Rate Input Files

Iprodione ECO Modeling Results 2-

Iprodione Eco ROC Max Rate Input Files.x

Iprodione Eco ROC Input Files.xlsx

Iprodione Eco Parent Max Rate Input Files.x

Iprodione Eco Parent Input Files.xlsx

# Summary of Water Modeling of PATurfParent and the USEPA Standard Pond

Estimated Environmental Concentrations for PATurfParent are presented in Table 1 for the USEPA standard pond with the PAturfSTD field scenario. A graphical presentation of the year-to-year peaks is presented in Figure 1. These values were generated with the Pesticide Water Calculator (PWC), Version 1.52. Critical input values for the model are summarized in Tables 2 and 3.

This model estimates that about 1.2% of PATurfParent applied to the field eventually reaches the water body. The main mechanism of transport from the field to the water body is by spray drift ( 74% of the total transport), followed by runoff (25.6%) and erosion (0.36%).

In the water body, pesticide dissipates with an effective water column half-life of 17.4 days. (This value does not include dissipation by transport to the benthic region; it includes only processes that result in removal of pesticide from the complete system.) The main source of dissipation in the water column is metabolism (effective average half-life = 17.4 days) followed by photolysis (8607.3 days) and volatilization (34234.5 days).

In the benthic region, pesticide dissipates (23.8 days). The main source of dissipation in the benthic region is metabolism (effective average half-life = 23.8 days). The vast majority of the pesticide in the benthic region (97.87%) is sorbed to sediment rather than in the pore water.

**Table 1. Estimated Environmental Concentrations (ppb) for PATurfParent.**

| | |
|---|---|
| Peak (1-in-10 yr) | 126. |
| 4-day Avg (1-in-10 yr) | 114. |
| 21-day Avg (1-in-10 yr) | 79.9 |
| 60-day Avg (1-in-10 yr) | 51.2 |
| 365-day Avg (1-in-10 yr) | 10.6 |
| Entire Simulation Mean | 8.35 |

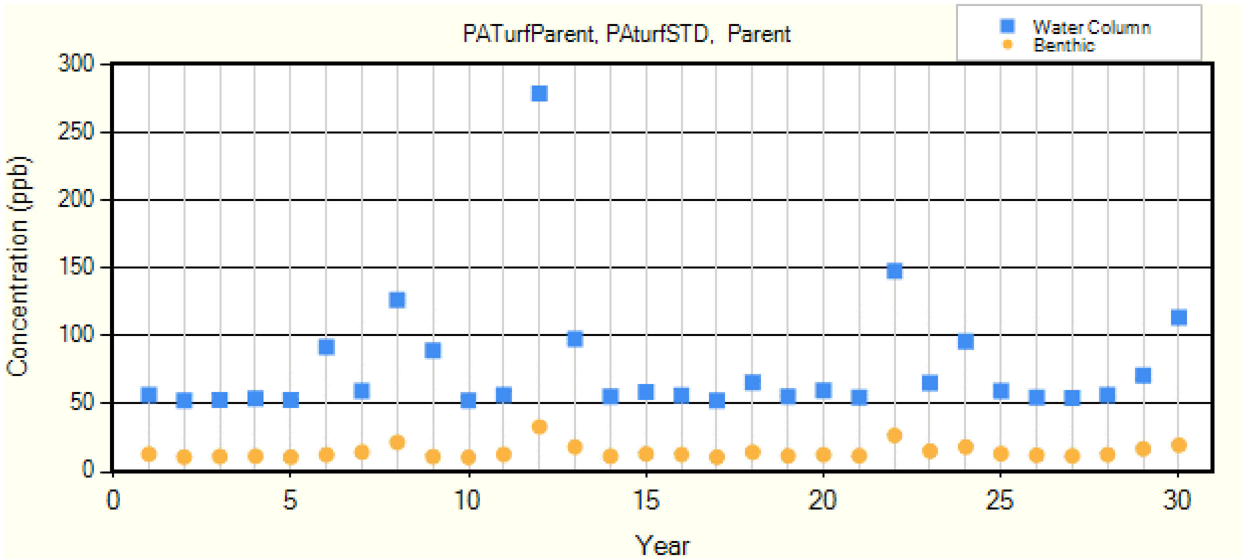
**Table 2. Summary of Model Inputs for PATurfParent.**

| | |
|---|---|
| Scenario | PAturfSTD |
| Cropped Area Fraction | 1 |
| Koc (ml/g) | 426 |
| Water Half-Life (days) @ 20 °C | 11.7 |
| Benthic Half-Life (days) @ 20 °C | 16 |
| Photolysis Half-Life (days) @ 28 °Lat | 64 |
| Hydrolysis Half-Life (days) | 0 |
| Soil Half-Life (days) @ 20 °C | 261 |
| Foliar Half-Life (days) | 0 |
| Molecular Weight | 330.2 |
| Vapor Pressure (torr) | 2.7E-7 |
| Solubility (mg/l) | 13 |
| Henry's Constant | 3.69E-07 |

**Table 3. Application Schedule for PATurfParent.**

| Date (Mon/Day) | Type | Amount (kg/ha) | Eff. | Drift |
|---|---|---|---|---|
| 4/16 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 4/30 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 5/14 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 5/28 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 6/11 | Above Crop (Foliar) | 2.22 | .95 | .0916 |

**Figure 1. Yearly Peak Concentrations**




## Summary of Water Modeling of PATurfROC and the USEPA Standard Pond

Estimated Environmental Concentrations for PATurfROC are presented in Table 1 for the USEPA standard pond with the PAturfSTD field scenario. A graphical presentation of the year-to-year peaks is presented in Figure 1. These values were generated with the Pesticide Water Calculator (PWC), Version 1.52. Critical input values for the model are summarized in Tables 2 and 3.

This model estimates that about 1.3% of PATurfROC applied to the field eventually reaches the water body. The main mechanism of transport from the field to the water body is by spray drift (73.3% of the total transport), followed by runoff (26.4%) and erosion (0.36%).

In the water body, pesticide dissipates with an effective water column half-life of 3146.1 days. (This value does not include dissipation by transport to the benthic region; it includes only processes that result in removal of pesticide from the complete system.) The main source of dissipation in the water column is metabolism (effective average half-life = 5798.4 days) followed by photolysis (8607.3 days) and volatilization (34234.5 days).

In the benthic region, pesticide dissipation is negligible (1332.1 days). The main source of dissipation in the benthic region is metabolism (effective average half-life = 1332.1 days). The vast majority of the pesticide in the benthic region (97.87%) is sorbed to sediment rather than in the pore water.

**Table 1. Estimated Environmental Concentrations (ppb) for PATurfROC.**

| | |
|---|---|
| Peak (1-in-10 yr) | 932. |
| 4-day Avg (1-in-10 yr) | 929. |
| 21-day Avg (1-in-10 yr) | 921. |
| 60-day Avg (1-in-10 yr) | 902. |

| | |
|---|---|
| 365-day Avg (1-in-10 yr) | 835. |
| Entire Simulation Mean | 653. |

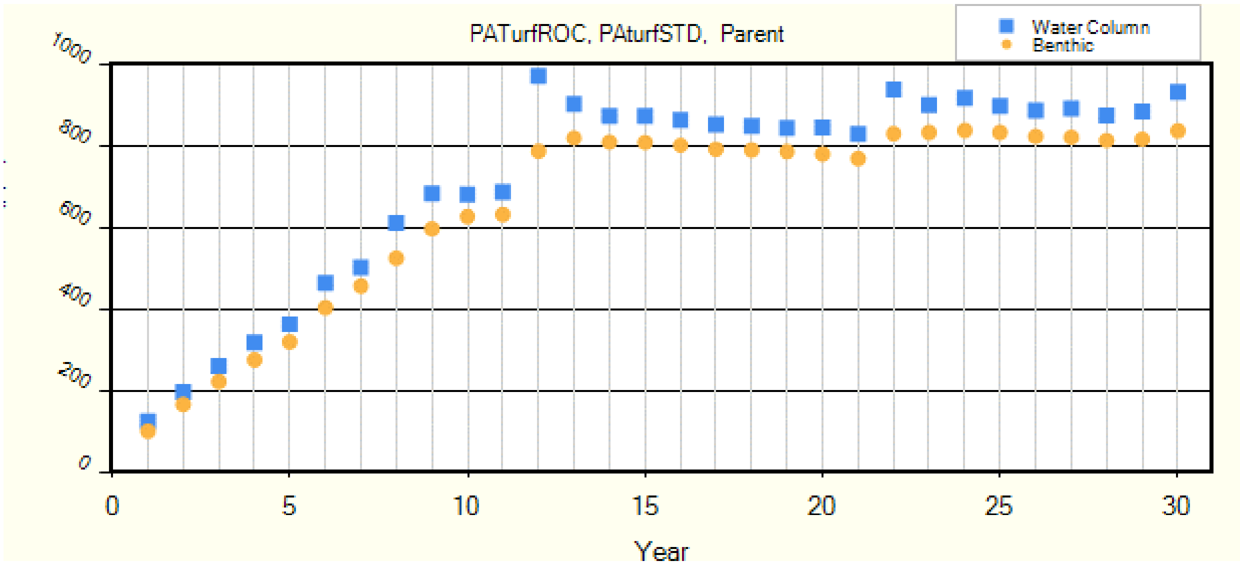
**Table 2. Summary of Model Inputs for PATurfROC.**

| Scenario | PAturfSTD |
|---|---|
| Cropped Area Fraction | 1 |
| Koc (ml/g) | 426 |
| Water Half-Life (days) @ 20 °C | 3900 |
| Benthic Half-Life (days) @ 20 °C | 896 |
| Photolysis Half-Life (days) @ 28 °Lat | 64 |
| Hydrolysis Half-Life (days) | 0 |
| Soil Half-Life (days) @ 20 °C | 490 |
| Foliar Half-Life (days) | 0 |
| Molecular Weight | 330.2 |
| Vapor Pressure (torr) | 2.7E-7 |
| Solubility (mg/l) | 13 |
| Henry's Constant | 3.69E-07 |

**Table 3. Application Schedule for PATurfROC.**

| Date (Mon/Day) | Type | Amount (kg/ha) | Eff. | Drift |
|---|---|---|---|---|
| 4/16 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 4/30 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 5/14 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 5/28 | Above Crop (Foliar) | 6.17 | .95 | .0916 |
| 6/11 | Above Crop (Foliar) | 2.20 | .95 | .0916 |

**Figure 1. Yearly Peak Concentrations**




## Summary of Water Modeling of PATurfDCA and the USEPA Standard Pond

Estimated Environmental Concentrations for PATurfDCA are presented in Table 1 for the USEPA standard pond with the PAturfSTD field scenario. A graphical presentation of the year-to-year peaks is presented in Figure 1. These values were generated with the Pesticide Water Calculator (PWC), Version 1.52. Critical input values for the model are summarized in Tables 2 and 3.

This model estimates that about 1% of PATurfDCA applied to the field eventually reaches the water body. The main mechanism of transport from the field to the water body is by spray drift (90.6% of the total transport), followed by runoff (8.84%) and erosion (0.58%).

In the water body, pesticide dissipates with an effective water column half-life of 17.4 days. (This value does not include dissipation by transport to the benthic region; it includes only processes that result in removal of pesticide from the complete system.) The main source of dissipation in the water column is photolysis (effective average half-life = 22.9 days) followed by volatilization (96.7 days) and metabolism (284 days).

In the benthic region, pesticide dissipation is negligible (1790.1 days). The main source of dissipation in the benthic region is metabolism (effective average half-life = 1790.1 days). The vast majority of the pesticide in the benthic region (98.62%) is sorbed to sediment rather than in the pore water.

**Table 1. Estimated Environmental Concentrations (ppb) for PATurfDCA.**

| | |
|---|---|
| Peak (1-in-10 yr) | 31.3 |
| 4-day Avg (1-in-10 yr) | 27.8 |
| 21-day Avg (1-in-10 yr) | 19.2 |
| 60-day Avg (1-in-10 yr) | 13.8 |
| 365-day Avg (1-in-10 yr) | 3.50 |

| | |
|---|---|
| Entire Simulation Mean | 2.98 |

**Table 2. Summary of Model Inputs for PATurfDCA.**

| | |
|---|---|
| Scenario | PAturfSTD |
| Cropped Area Fraction | 1 |
| Koc (ml/g) | 664 |
| Water Half-Life (days) @ 20 °C | 191 |
| Benthic Half-Life (days) @ 20 °C | 1204 |
| Photolysis Half-Life (days) @ 33 °Lat | 0.18 |
| Hydrolysis Half-Life (days) | 0 |
| Soil Half-Life (days) @ 20 °C | 7.87 |
| Foliar Half-Life (days) | 0 |
| Molecular Weight | 162.01 |
| Vapor Pressure (torr) | 8.51E-3 |
| Solubility (mg/l) | 759 |
| Henry's Constant | 9.77E-05 |

**Table 3. Application Schedule for PATurfDCA.**

| Date (Mon/Day) | Type | Amount (kg/ha) | Eff. | Drift |
|---|---|---|---|---|
| 4/16 | Above Crop (Foliar) | 2.27 | .95 | .0916 |
| 4/30 | Above Crop (Foliar) | 2.27 | .95 | .0916 |
| 5/14 | Above Crop (Foliar) | 2.27 | .95 | .0916 |
| 5/28 | Above Crop (Foliar) | 2.27 | .95 | .0916 |
| 6/11 | Above Crop (Foliar) | 0.72 | .95 | .0916 |

**Figure 1. Yearly Peak Concentrations**

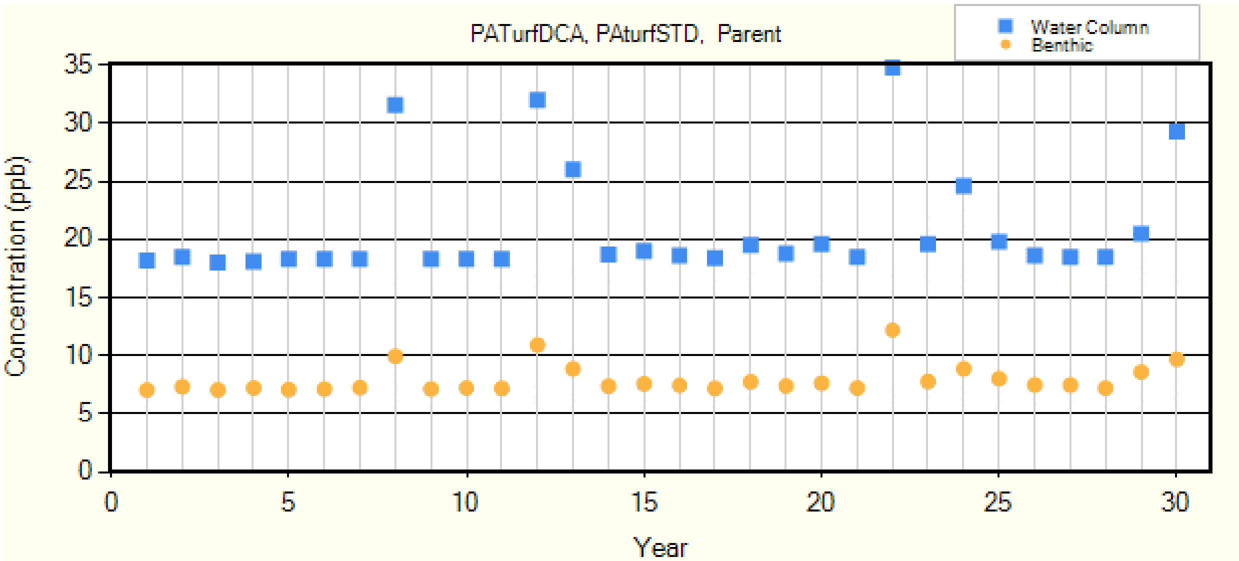

PATurfDCA, PAturfSTD, Parent
Water Column
Benthic
Concentration (ppb)
35
30
25
20
15
10
5
0
0
5
10
15
20
25
30
Year

**Table F-1. Surface Water EECs for Parent Iprodione Estimated Using PWC version 1.52 Based on Average Application Rates**

| Run Name[1] | Use | PWC Scenario | Annual App Rate lbs a.i./A, App type | 1-in-10 year mean EEC | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Water Column (µg/L) | | | Pore-Water (µg/L) | |
| | | | | 1-day | 21-day | 60-day | 1-day | 21-day |
| Broccoli-1 (1CC) | Broccoli | CAColeCropRLF_V2 | 1.5, ground | 20 | 16 | 10 | 4.4 | 4.3 |
| Broccoli-2 (2CC) | | | 3.0, ground | 30 | 23 | 13 | 5.8 | 5.6 |
| Let-Bro-Let Rtn | Lettuce – Broccoli – Lettuce Rotation | CAlettuceSTD | 7.26, aerial and ground | 77 | 58 | 39 | 17 | 16 |
| Carrots-1 | Carrots | FLcarrotsSTD | 3.56, aerial | 87 | 53 | 26 | 9.6 | 8.8 |
| Carrots-2 | | | 3.56, ground | **90** | **54** | **27** | **9.8** | **9.0** |
| Lettuce-1 (1AER,2GRD) | Lettuce | CAlettuceSTD | 2.88, aerial and ground | 34 | 26 | 16 | 6.7 | 6.6 |
| Lettuce-2 (1AER,2GRD) (2CC) | | | 5.76, aerial and ground | 43 | 31 | 21 | 9.6 | 9.4 |
| Onion-1 | Onion | GAOnion_WirrigSTD | 3.2, aerial | 23 | 15 | 12 | 4.0 | 4.2 |
| Onion-2 | | | 3.2, ground | 21 | 13 | 11 | 3.7 | 3.8 |
| Potato-1 | Potato | MEpotatoSTD | 3.52, aerial | 23 | 17 | 13 | 11 | 10 |
| Potato-2 | | | 3.52, ground | 17 | 12 | 9.5 | 10 | 9.3 |
| Stone Fruit-1 | Stone Fruit | MICherriesSTD | 1.56, aerial | 9.7 | 7.9 | 5.5 | 2.6 | 2.5 |
| Stone Fruit-2 | | | 1.56, ground | 5.7 | 4.3 | 2.9 | 1.6 | 1.6 |
| Stone Fruit-3 | | | 1.56, air blast | 5.1 | 3.8 | 2.4 | 1.4 | 1.4 |

Maximum EECs are shown in bold.

[1] The ‘Run Name’ in this table corresponds to the run name in **Table E-2**

[2] The benthic conversion factor is 17.4 and the fraction organic carbon (foc) is 0.04 in the EPA pond.

**Table F-2. Surface Water EECs for Iprodione SSD Estimated Using PWC version 1.52 Based on Average Application Rates**

| Run Name[1] | Use | PWC Scenario | Annual App Rate lbs a.i./A, App type | 1-in-10 year mean EEC | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Water Column (µg/L) | | | Pore-Water (µg/L) | |
| | | | | 1-day | 21-day | 60-day | 1-day | 21-day |
| Broccoli-1 (1CC) | Broccoli | CAColeCropRLF_V2 | 1.5, ground | 116 | 115 | 113 | 108 | 108 |
| Broccoli-2 (2CC) | | | 3.0, ground | 222 | 221 | 220 | 212 | 212 |
| Let-Bro-Let Rtn | Lettuce – Broccoli – Lettuce Rotation | CAlettuceSTD | 7.26, aerial and ground | **718** | **713** | **706** | **664** | **664** |
| Carrots-1 | Carrots | FLcarrotsSTD | 3.56, aerial | 314 | 309 | 300 | 273 | 272 |
| Carrots-2 | | | 3.56, ground | 321 | 316 | 307 | 279 | 279 |
| Lettuce-1 (1AER,2GRD) | Lettuce | CAlettuceSTD | 2.88, aerial and ground | 196 | 194 | 192 | 182 | 182 |
| Lettuce-2 (1AER,2GRD) (2CC) | | | 5.76, aerial and ground | 441 | 439 | 436 | 421 | 421 |
| Onion-1 | Onion | GAOnion_WirrigSTD | 3.2, aerial | 144 | 143 | 141 | 131 | 131 |
| Onion-2 | | | 3.2, ground | 106 | 105 | 104 | 96.2 | 96.1 |
| Potato-1 | Potato | MEpotatoSTD | 3.52, aerial | 332 | 330 | 329 | 319 | 319 |
| Potato-2 | | | 3.52, ground | 242 | 241 | 241 | 237 | 237 |
| Stone Fruit-1 | Stone Fruit | MICherriesSTD | 1.56, aerial | 84.5 | 83.8 | 82.8 | 79.3 | 79.3 |
| Stone Fruit-2 | | | 1.56, ground | 47.4 | 46.9 | 46.3 | 43.8 | 43.8 |
| Stone Fruit-3 | | | 1.56, air blast | 40.5 | 40 | 39.4 | 37.2 | 37.2 |

Maximum EECs are shown in bold.

[1] The 'Run Name' in this table corresponds to the run name in **Table E-2**.

[2] The benthic conversion factor is 17.4 and the fraction organic carbon (foc) is 0.04 in the EPA pond.

**Table F-3. Summary of 3,5-DCA Estimated Environmental Concentrations (EECS) for Surface Water Based on Maximum Application Rates**

| Run Descriptor | Line Batch Run ID | 3,5-DCA Estimated Environmental Concentration (µg/) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 75% Formation Assumption | | | 30% Formation Assumption | | |
| | | 1-day | 21-day | 60-day | 1-day | 21-day | 60-day |
| Almonds | 1 35-DCA_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 5.07 | 3.44 | 2.23 | 2.03 | 1.38 | 0.89 |
| Stone Fruit Apricot | 2 35-DCA_1CC_2x1.0_aerial_7_CAfruit_WirrigSTD | 5.76 | 4.00 | 2.47 | 2.30 | 1.60 | 0.99 |
| Stone Fruit Peaches | 3 35-DCA_1CC_2x1.0_aerial_7_GAPeachesSTD | 6.13 | 4.10 | 2.40 | 2.45 | 1.64 | 0.96 |
| Stone Fruit Cherries | 4 35-DCA_1CC_2x1.0_aerial_7_MICherriesSTD | 5.54 | 4.12 | 2.60 | 2.22 | 1.65 | 1.04 |
| Carrots Broadcast | 5 35-DCA_1CC_4x1.0_aerial_7_FLcarrotSTD | 46.6 | 32.4 | 18.8 | 18.6 | 13.0 | 7.52 |
| Onion CA CO | 6 35-DCA_1CC_4x1.0_aerial_7_CAonion_WirrigSTD | 6.77 | 5.12 | 3.48 | 2.71 | 2.05 | 1.39 |
| Onion GA | 7 35-DCA_1CC_5x1.0_aerial_7_GAOnion_WirrigSTD | 15.6 | 11.5 | 8.87 | 6.24 | 4.60 | 3.55 |
| Crucifer For Seed | 8 35-DCA_1CC_5x1_aerial_7_CAColeCropRLF_V2 | 10.2 | 8.1 | 5.06 | 4.08 | 3.22 | 2.02 |
| Crucifer For Seed | 9 35-DCA_1CC_3x2_aerial_7_CAColeCropRLF_V2 | 15.9 | 11.4 | 6.91 | 6.36 | 4.56 | 2.76 |
| Potato | 10 35-DCA_1CC_4x1.0_aerial_7_IDNpotato_WirrigSTD | 6.79 | 5.11 | 3.89 | 2.72 | 2.04 | 1.56 |
| Potato | 11 35-DCA_1CC_4x1.0_aerial_7_MEpotatoSTD | 11.3 | 9.22 | 7.12 | 4.52 | 3.69 | 2.85 |
| Turf | 12 35-DCA_1CC_4x5.51+1x1.98_aerial_7_FLturfSTD | 25.3 | 18.2 | 13.9 | 10.1 | 7.28 | 5.56 |
| Turf | 13 35-DCA_1CC_4x5.51+1x1.98_aerial_7_PAturfSTD | 40.1 | 27.0 | 18.1 | 16.0 | 10.8 | 7.24 |
| Grapes | 14 35-DCA_1CC_4x0.50_aerial_7_CAgrapes_WirrigSTD | 3.11 | 2.31 | 1.57 | 1.24 | 0.92 | 0.63 |
| Grapes | 15 35-DCA_1CC_4x0.50_aerial_7_NYGrapesSTD | 6.10 | 4.53 | 3.28 | 2.44 | 1.81 | 1.31 |
| Almonds | 16 35-DCA_1CC_4x0.50_ground_7_CAalmond_WirrigSTD | 2.74 | 1.89 | 1.21 | 1.10 | 0.76 | 0.48 |
| Stone Fruit Apricot | 17 35-DCA_1CC_2x1.0_ground_7_CAfruit_WirrigSTD | 2.94 | 2.09 | 1.35 | 1.18 | 0.84 | 0.54 |
| Stone Fruit Peaches | 18 35-DCA_1CC_2x1.0_ground_7_GAPeachesSTD | 3.77 | 2.33 | 1.32 | 1.51 | 0.93 | 0.53 |
| Stone Fruit Cherries | 19 35-DCA_1CC_2x1.0_ground_7_MICherriesSTD | 2.78 | 2.07 | 1.31 | 1.11 | 0.83 | 0.52 |
| Carrots Broadcast | 20 35-DCA_1CC_4x1.0_ground_7_FLcarrotSTD | 44.8 | 30.8 | 18.0 | 17.9 | 12.3 | 7.20 |
| Carrots Seed | 21 35-DCA_1CC_1x0.62_seed_treatment_7_FLcarrotSTD | 19.9 | 13.2 | 7.48 | 7.96 | 5.28 | 2.99 |
| Onion CA CO | 22 35-DCA_1CC_1_ground_7_CAonion_WirrigSTD | 2.48 | 1.98 | 1.32 | 0.99 | 0.79 | 0.53 |
| Onion GA | 23 35-DCA_1CC_5x1_ground_7_GAOnion_WirrigSTD | 13.60 | 9.58 | 7.68 | 5.44 | 3.83 | 3.07 |
| Crucifer For Seed | 24 35-DCA_1CC_5x1_ground_7_CAColeCropRLF_V2 | 6.08 | 4.51 | 2.65 | 2.43 | 1.80 | 1.06 |
| Crucifer For Seed | 25 35-DCA_1CC_3x2_ground_7_CAColeCropRLF_V2 | 9.35 | 6.45 | 3.97 | 3.74 | 2.58 | 1.59 |

| Run Descriptor | Line Batch Run ID | 3,5-DCA Estimated Environmental Concentration (µg/) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 75% Formation Assumption | | | 30% Formation Assumption | | |
| | | 1-day | 21-day | 60-day | 1-day | 21-day | 60-day |
| Broccoli | 26 35-DCA_1CC_2x1.0_ground_7_CAColeCropRLF_V2 | 9.42 | 6.98 | 4.44 | 3.77 | 2.79 | 1.78 |
| Potato | 27 35-DCA_1CC_4x1.0_ground_7_IDNpotato_WirrigSTD | 3.10 | 2.34 | 1.78 | 1.24 | 0.94 | 0.71 |
| Potato | 28 35-DCA_1CC_4x1.0_ground_7_MEpotatoSTD | 9.04 | 6.87 | 5.14 | 3.62 | 2.75 | 2.06 |
| Turf | 29 35-DCA_1CC_4x5.51+1x1.98_ground_7_FLturfSTD | 15.4 | 9.86 | 6.27 | 6.16 | 3.94 | 2.51 |
| Turf | 30 35-DCA_1CC_4x5.51+1x1.98_ground_7_PAturfSTD | 28.7 | 20.6 | 11.40 | 11.5 | 8.24 | 4.56 |
| Grapes | 31 35-DCA_1CC_4x0.50_ground_7_CAgrapes_WirrigSTD | 1.09 | 0.72 | 0.49 | 0.44 | 0.29 | 0.20 |
| Grapes | 32 35-DCA_1CC_4x0.50_ground_7_NYGrapesSTD | 4.85 | 3.39 | 2.48 | 1.94 | 1.36 | 0.99 |
| Cotton | 33 35-DCA_1CC_1x0.27_In_Furrow_7_CAcotton_WirrigSTD | 0.32 | 0.20 | 0.11 | 0.13 | 0.08 | 0.05 |
| Cotton | 34 35-DCA_1CC_1x0.27_In_Furrow_7_MScottonSTD | 0.97 | 0.64 | 0.39 | 0.39 | 0.25 | 0.16 |
| Cotton | 35 35-DCA_1CC_1x0.27_In_Furrow_7_NCcottonSTD | 0.43 | 0.28 | 0.18 | 0.17 | 0.11 | 0.07 |
| Almonds | 36 35-DCA_1CC_4x0.50_airblast_7_CAalmond_WirrigSTD | 2.50 | 1.72 | 1.06 | 1.00 | 0.69 | 0.42 |
| Stone Fruit Apricot | 37 35-DCA_1CC_2x1.0_airblast_7_CAfruit_WirrigSTD | 2.74 | 1.83 | 1.14 | 1.10 | 0.73 | 0.46 |
| Stone Fruit Peaches | 38 35-DCA_1CC_2x1.0_airblast_7_GAPeachesSTD | 3.33 | 2.05 | 1.12 | 1.33 | 0.82 | 0.45 |
| Stone Fruit Cherries | 39 35-DCA_1CC_2x1.0_airblast_7_MICherriesSTD | 2.54 | 1.93 | 1.16 | 1.02 | 0.77 | 0.46 |
| Grapes | 40 35-DCA_1CC_4x0.50_airblast_7_CAgrapes_WirrigSTD | 1.03 | 0.63 | 0.35 | 0.41 | 0.25 | 0.14 |
| Grapes | 41 35-DCA_1CC_4x0.50_airblast_7_NYGrapesSTD | 4.55 | 3.20 | 2.39 | 1.82 | 1.28 | 0.96 |
| Lettuce | 42 35-DCA_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 13.5 | 9.28 | 5.66 | 5.40 | 3.71 | 2.26 |
| 3CC Let Broc Let Rotation | 43 35-DCA_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 29.2 | 22.6 | 14.8 | 11.7 | 9.04 | 5.92 |
| 2CC LettuceRotation | 44 35-DCA_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 14.3 | 9.72 | 6.02 | 5.72 | 3.89 | 2.41 |
| 2CC Broccoli Rotation | 45 35-DCA_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 11.4 | 8.29 | 5.26 | 4.56 | 3.32 | 2.10 |
| 2CC Turf Rotation | 46 35-DCA_2CC_2x5.51+1x0.98_ground_7_FLturfSTD | 16.4 | 10.5 | 5.98 | 6.56 | 4.20 | 2.39 |
| 2CC Turf Rotation | 47 35-DCA_2CC_2x5.51+1x0.98_ground_7_PAturfSTD | 22.6 | 15.4 | 9.02 | 9.04 | 6.16 | 3.61 |
| 2CC Turf Rotation | 48 35-DCA_2CC_2x5.51+1x0.98_aerial_7_FLturfSTD | 23.6 | 15.7 | 10.7 | 9.44 | 6.28 | 4.28 |
| 2CC Turf Rotation | 49 35-DCA_2CC_2x5.51+1x0.98_aerial_7_PAturfSTD | 28.5 | 18.6 | 11.6 | 11.4 | 7.44 | 4.64 |
| Ornamentals | 50 35-DCA_1CC_6x4.00_ground_7_CAnurserySTD_V2 | 19.9 | 13.7 | 9.88 | 7.96 | 5.48 | 3.95 |

| Run Descriptor | Line Batch Run ID | 3,5-DCA Estimated Environmental Concentration (µg/) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 75% Formation Assumption | | | 30% Formation Assumption | | |
| | | 1-day | 21-day | 60-day | 1-day | 21-day | 60-day |
| Ornamentals | 51 35-DCA_1CC_6x4.00_ground_7_FLnurserySTD_V2 | 50.8 | 34.8 | 27.6 | 20.3 | 13.9 | 11.0 |
| Ornamentals | 52 35-DCA_1CC_6x4.00_ground_7_MInurserySTD_V2 | 34.9 | 28.0 | 21.5 | 14.0 | 11.2 | 8.60 |
| **Ornamentals** | **53 35-DCA_1CC_6x4.00_ground_7_NJnurserySTD_V2** | **78.8** | **61.3** | **40.0** | **31.5** | **24.5** | **16.0** |
| Ornamentals | 54 35-DCA_1CC_6x4.00_ground_7_ORnurserySTD_V2 | 25.4 | 18.8 | 16.1 | 10.2 | 7.52 | 6.44 |
| Ornamentals | 55 35-DCA_1CC_6x4.00_ground_7_TNnurserySTD_V2 | 59.9 | 40.4 | 30.8 | 24.0 | 16.2 | 12.3 |

## **Appendix G.** Additional Aquatic Risk Quotients (RQs) Based on Refinements

**Table G-1 Acute and Chronic Risk Quotients (RQs) for Non-listed Vertebrate Species Exposed to Iprodione SSD Based on Maximum Application Rates.**

| Use Sites | Run Name[1] | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|---|
| | | | | Freshwater | | Estuarine/Marine | |
| | | Daily Mean | 21-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2,3] |
| | | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Almonds - AER | ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 69 | 67 | 0.01 | 0.26 | N/A[3] | **1.2** |
| Almonds - GRD | ROC_1CC_4x0.50_ground_7_CAalmond_WirrigSTD | 33 | 32 | 0.01 | 0.12 | | 0.56 |
| Almonds - AB | ROC_1CC_4x0.50_airblast_7_CAalmond_WirrigSTD | 26 | 26 | <0.01 | 0.10 | | 0.45 |
| Broccoli - GRD (1 CC) | ROC_1CC_2x1.0_ground_7_CAColeCropRLF_V2 | 155 | 151 | 0.03 | 0.58 | | **2.6** |
| Broccoli - GRD (2 CC) | ROC_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 296 | 293 | 0.05 | **1.1** | | **5.1** |
| Lettuce-Broccoli-Lettuce Rotation | ROC_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 778 | 762 | 0.13 | **2.9** | | **13** |
| Carrots - AER | ROC_1CC_4x1.0_aerial_7_FLcarrotSTD | 352 | 336 | 0.06 | **1.3** | | **5.9** |
| Carrots - GRD | ROC_1CC_4x1.0_ground_7_FLcarrotSTD | 360 | 343 | 0.06 | **1.2** | | **6.0** |
| Carrots - Seed | ROC_1CC_1x0.62_seed_treatment_7_FLcarrotSTD | 114 | 113 | 0.02 | 0.43 | | **2.0** |
| Cotton - In_furrow | ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 8.9 | 8.68 | <0.01 | 0.03 | | 0.15 |
| Crucifer for Seed - AER | ROC_1CC_3x2_aerial_7_CAColeCropRLF_V2 | 490 | 482 | 0.08 | **1.9** | | **8.4** |
| Crucifer for Seed - GRD | ROC_1CC_3x2_ground_7_CAColeCropRLF_V2 | 389 | 386 | 0.06 | **1.5** | | **6.7** |
| Grapes - AER | ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 145 | 144 | 0.02 | 0.55 | | **2.5** |
| Grapes - GRD | ROC_1CC_4x0.50_ground_7_NYGrapesSTD | 103 | 101 | 0.02 | 0.39 | | **1.8** |
| Grapes - AB | ROC_1CC_4x0.50_airblast_7_NYGrapesSTD | 95 | 93 | 0.02 | 0.36 | | **1.6** |
| Lettuce - AERx1, GRDx2 | ROC_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 203 | 199 | 0.03 | 0.77 | | **3.5** |
| Lettuce - AER1x, GRDx2 (2 CC) | ROC_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 296 | 293 | 0.05 | **1.1** | | **5.1** |
| Onion - AER | ROC_1CC_5x1.0_aerial_7_GAOnion_WirrigSTD | 224 | 220 | 0.04 | 0.85 | | **3.8** |
| Onion - GRD | ROC_1CC_5x1_ground_7_GAOnion_WirrigSTD | 165 | 161 | 0.03 | 0.62 | | **2.8** |

| Use Sites | Run Name[1] | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|---|
| | | | | Freshwater | | Estuarine/Marine | |
| | | Daily Mean | 21-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2,3] |
| | | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Ornamentals - GRD | ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 900 | 887 | 0.15 | **3.4** | | **15** |
| Potato - AER | ROC_1CC_4x1.0_aerial_7_MEpotatoSTD | 375 | 372 | 0.06 | **1.4** | | **6.5** |
| Potato - GRD | ROC_1CC_4x1.0_ground_7_MEpotatoSTD | 274 | 272 | 0.04 | **1.1** | | **4.7** |
| Stone Fruit - AER | ROC_1CC_2x1.0_aerial_7_MICherriesSTD | 109 | 107 | 0.02 | 0.41 | | **1.9** |
| Stone Fruit - GRD | ROC_1CC_2x1.0_ground_7_MICherriesSTD | 61 | 60 | 0.01 | 0.23 | | **1.0** |
| Stone Fruit - AB | ROC_1CC_2x1.0_airblast_7_MICherriesSTD | 52 | 51 | 0.01 | 0.20 | | 0.88 |
| Turf - AER (1 CC) | ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 962 | 929 | 0.16 | **3.6** | | **16** |
| Turf - GRD (1 CC) | ROC_1CC_4x5.51+1x1.96_ground_7_PAturfSTD | 503 | 490 | 0.08 | **1.9** | | **8.5** |
| Turf - AER (2 CC) | ROC_2CC_2x5.51+1x0.98_aerial_7_PAturfSTD | 853 | 839 | 0.14 | **3.2** | | **15** |
| Turf - GRD (2 CC) | ROC_2CC_2x5.51+1x0.98_ground_7_PAturfSTD | 387 | 378 | 0.06 | **1.5** | | **6.6** |

**Bolded** values exceed the acute risk to non-listed species level of concern (LOC) of 0.5 or the chronic risk LOC of 1.0. The toxicity endpoints listed in the table are those used to calculate the RQ.
CC = Crop Cycle; AER = Aerial; GRD = Ground; AB = Air Blast.
[1] Run Name corresponds to the model input information in **Table 8-8**
[2]The EECs used to calculate these RQs are based on the 1-in-10-year daily average value from **Table 8-8.**
[3] The EECs used to calculate these RQs are based on the 1-in-10-year 21-day average value from **Table 8-8**.
[4] In the acute toxicity study with the Sheepshead Minnow (MRID 49526510), there were no adverse effects (mortality or sublethal behavioral effects) up to 8,140 µg a.i./L, resulting in a 96-h LC50 >8,140 µg a.i./L; non-definitive endpoints cannot be used to calculate risk quotients.

### Table G-2. Acute and Chronic Vertebrate Risk Quotients for Species Exposed to Iprodione plus RP32088 Based on Average Application Rates

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 60-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ = >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Broccoli - GRD (1 CC) | 116 | 113 | 0.02 | 0.42 | N/A | **2.0** |
| Broccoli - GRD (2 CC) | 222 | 220 | 0.04 | 0.80 | | **3.8** |
| Lettuce-Broccoli-Lettuce Rotation | 718 | 706 | 0.12 | **2.6** | | **12** |

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 60-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ = >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Carrots - AER | 314 | 300 | 0.05 | **1.1** | | **5.2** |
| Carrots - GRD | 321 | 307 | 0.05 | **1.0** | | **5.4** |
| Lettuce - AERx1, GRDx2 | 196 | 192 | 0.03 | 0.71 | | **3.3** |
| Lettuce - AER1x, GRDx2 (2 CC) | 441 | 436 | 0.07 | **1.6** | | **7.6** |
| Onion - AER | 144 | 141 | 0.02 | 0.53 | | **2.5** |
| Onion - GRD | 106 | 104 | 0.02 | 0.39 | | **1.8** |
| Potato - AER | 332 | 329 | 0.05 | **1.2** | | **5.7** |
| Potato - GRD | 242 | 241 | 0.04 | 0.89 | | **4.2** |
| Stone Fruit - AER | 85 | 83 | 0.01 | 0.41 | | **1.4** |
| Stone Fruit - GRD | 47 | 46 | 0.01 | 0.23 | | 0.81 |
| Stone Fruit - AB | 41 | 39 | 0.01 | 0.20 | | 0.69 |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or the chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1] The EECs used to calculate these RQs are based on the 1-in-10-year peak 1-day average value from **Table F-2.**

[2] The EECs used to calculate these RQs are based on the 1-in-10-year 60-day average value from **Table F-2.**

### Table G-3. Acute and Chronic Vertebrate Risk Quotients for Species Exposed to Parent Iprodione Based on Maximum Application Rates

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 60-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ = >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Almonds-AER | 12 | 5.5 | <0.01 | 0.02 | N/A | 0.10 |
| Almonds-GRD | 6.2 | 2.9 | <0.01 | 0.01 | | 0.05 |
| Almonds-AB | 5.6 | 2.6 | <0.01 | 0.01 | | 0.04 |
| Broccoli - GRD (1 CC) | 26 | 13 | <0.01 | 0.05 | | 0.23 |
| Broccoli - GRD (2 CC) | 40 | 17 | 0.01 | 0.07 | | 0.30 |
| Lettuce-Broccoli-Lettuce Rotation | 85 | 40 | 0.01 | 0.15 | | 0.70 |
| Carrots - AER | 97 | 29 | 0.02 | 0.11 | | 0.51 |
| Carrots - GRD | 101 | 31 | 0.02 | 0.11 | | 0.51 |
| Carrots - Seed | 42 | 11 | 0.01 | 0.04 | | 0.19 |
| Cotton - In_furrow | 2.4 | 0.83 | <0.01 | <0.01 | | 0.01 |
| Crucifer for Seed - AER | 48 | 19 | 0.01 | 0.07 | | 0.33 |

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 60-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ = >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Crucifer for Seed - GRD | 39 | 18 | 0.01 | 0.07 | | 0.31 |
| Grapes - AER | 12 | 5.4 | <0.01 | 0.02 | | 0.09 |
| Grapes - GRD | 9.8 | 3.6 | <0.01 | 0.01 | | 0.06 |
| Grapes - AB | 9.2 | 3.4 | <0.01 | 0.01 | | 0.06 |
| Lettuce - AERx1, GRDx2 | 35 | 16 | 0.01 | 0.06 | | 0.28 |
| Lettuce - AER1x, GRDx2 (2 CC) | 45 | 22 | 0.01 | 0.08 | | 0.38 |
| Onion - AER | 36 | 19 | 0.01 | 0.07 | | 0.33 |
| Onion - GRD | 33 | 16 | 0.01 | 0.06 | | 0.28 |
| Ornamentals - GRD | 166 | 94 | 0.03 | 0.36 | | **1.6** |
| Potato - AER | 26 | 15 | <0.01 | 0.06 | | 0.26 |
| Potato - GRD | 20 | 11 | <0.01 | 0.04 | | 0.19 |
| Stone Fruit - AER | 12.4 | 7.1 | <0.01 | 0.03 | | 0.12 |
| Stone Fruit - GRD | 7.27 | 3.7 | <0.01 | 0.01 | | 0.06 |
| Stone Fruit - AB | 6.56 | 3.1 | <0.01 | 0.01 | | 0.05 |
| Turf - AER (1 CC) | 123 | 51 | 0.02 | 0.20 | | 0.89 |
| Turf - GRD (1 CC) | 91 | 29 | 0.01 | 0.11 | | 0.51 |
| Turf - AER (2 CC) | 68 | 32 | 0.01 | 0.12 | | 0.56 |
| Turf - GRD (2 CC) | 56 | 19 | 0.01 | 0.07 | | 0.33 |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or the chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1] The EECs used to calculate these RQs are based on the 1-in-10-year peak 1-day average value from **Table F-1.**

[2] The EECs used to calculate these RQs are based on the 1-in-10-year 60-day average value from **Table F-1**.

### Table G-4. Acute and Chronic Vertebrate Risk Quotients for Species Exposed to Parent Iprodione Based on Average Application Rates

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 60-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ = >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Broccoli - GRD (1 CC) | 20 | 10 | <0.01 | 0.04 | | 0.17 |
| Broccoli - GRD (2 CC) | 30 | 13 | <0.01 | 0.05 | | 0.23 |
| Lettuce-Broccoli-Lettuce Rotation | 77 | 39 | 0.01 | 0.15 | N/A | 0.66 |
| Carrots - AER | 87 | 26 | 0.01 | 0.10 | | 0.45 |
| Carrots - GRD | 90 | 27 | 0.01 | 0.10 | | 0.45 |

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 60-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 6,160 µg a.i./L | NOAEC = 260 µg a.i./L | $LC_{50}$ = >8,140 µg a.i./L | NOAEC = 57.4 µg a.i./L |
| Lettuce - AERx1, GRDx2 | 34 | 16 | 0.01 | 0.06 | | 0.28 |
| Lettuce - AER1x, GRDx2 (2 CC) | 43 | 21 | 0.01 | 0.08 | | 0.37 |
| Onion - AER | 23 | 12 | <0.01 | 0.05 | | 0.21 |
| Onion - GRD | 21 | 11 | <0.01 | 0.04 | | 0.19 |
| Potato - AER | 23 | 13 | <0.01 | 0.05 | | 0.23 |
| Potato - GRD | 17 | 9.5 | <0.01 | 0.04 | | 0.17 |
| Stone Fruit - AER | 9.7 | 5.5 | <0.01 | 0.02 | | 0.10 |
| Stone Fruit - GRD | 5.7 | 2.9 | <0.01 | 0.01 | | 0.05 |
| Stone Fruit - AB | 5.1 | 2.4 | <0.01 | 0.01 | | 0.04 |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or the chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.
[1] The EECs used to calculate these RQs are based on the 1-in-10-year peak 1-day average value from **Table F-2**
[2] The EECs used to calculate these RQs are based on the 1-in-10-year 60-day average value from **Table F-2**

**Table G-5 Acute and Chronic Risk Quotients (RQs) for Non-listed Invertebrate (In the water column) Based on Iprodione SSD From Maximum Label Application Rates.**

| Use Sites | Run Name[1] | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|---|
| | | | | Freshwater | | Estuarine/Marine | |
| | | Daily Mean | 21-day Mean | Acute[2] | Chronic[3] | Acute[2] | Chronic[3] |
| | | | | $LC_{50}$ = 240 µg a.i./L | NOAEC = 288 µg a.i./L | $LC_{50}$ = 2240 µg a.i./L | NOAEC = 7.5 µg a.i./L |
| Almonds - AER | ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 69 | 68 | 0.29 | 0.24 | 0.03 | **9.1** |
| Almonds - GRD | ROC_1CC_4x0.50_ground_7_CAalmond_WirrigSTD | 33 | 32 | 0.14 | 0.11 | 0.01 | **4.3** |
| Almonds - AB | ROC_1CC_4x0.50_airblast_7_CAalmond_WirrigSTD | 26 | 26 | 0.11 | 0.09 | 0.01 | **3.5** |
| Broccoli - GRD (1 CC) | ROC_1CC_2x1.0_ground_7_CAColeCropRLF_V2 | 155 | 153 | **0.65** | 0.53 | 0.07 | **20** |
| Broccoli - GRD (2 CC) | ROC_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 296 | 294 | **1.2** | **1.0** | 0.13 | **39** |
| Lettuce-Broccoli-Lettuce Rotation | ROC_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 778 | 771 | **3.2** | **2.7** | 0.35 | **103** |
| Carrots - AER | ROC_1CC_4x1.0_aerial_7_FLcarrotSTD | 352 | 346 | **1.5** | **1.2** | 0.16 | **46** |
| Carrots - GRD | ROC_1CC_4x1.0_ground_7_FLcarrotSTD | 360 | 353 | **1.5** | **1.2** | 0.16 | **47** |
| Carrots - Seed | ROC_1CC_1x0.62_seed_treatment_7_FLcarrotSTD | 114 | 112 | 0.48 | 0.39 | 0.05 | **15** |

| Use Sites | Run Name[1] | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|---|
| | | | | Freshwater | | Estuarine/Marine | |
| | | Daily Mean | 21-day Mean | Acute[2] | Chronic[3] | Acute[2] | Chronic[3] |
| | | | | $LC_{50}$ = 240 µg a.i./L | NOAEC = 288 µg a.i./L | $LC_{50}$ = 2240 µg a.i./L | NOAEC = 7.5 µg a.i./L |
| Cotton - In_furrow | ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 8.9 | 8.8 | 0.04 | 0.03 | <0.01 | **1.2** |
| Crucifer for Seed - AER | ROC_1CC_3x2_aerial_7_CAColeCropRLF_V2 | 490 | 486 | **2.0** | **1.7** | 0.22 | **65** |
| Crucifer for Seed - GRD | ROC_1CC_3x2_ground_7_CAColeCropRLF_V2 | 389 | 386 | **1.6** | **1.3** | 0.17 | **51** |
| Grapes - AER | ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 145 | 144 | **0.60** | 0.50 | 0.06 | **19** |
| Grapes - GRD | ROC_1CC_4x0.50_ground_7_NYGrapesSTD | 103 | 102 | 0.43 | 0.35 | 0.05 | **14** |
| Grapes - AB | ROC_1CC_4x0.50_airblast_7_NYGrapesSTD | 95 | 94 | 0.39 | 0.33 | 0.04 | **13** |
| Lettuce - AERx1, GRDx2 | ROC_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 203 | 201 | **0.85** | 0.70 | 0.09 | **27** |
| Lettuce - AER1x, GRDx2 (2 CC) | ROC_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 296 | 294 | **1.2** | **1.0** | 0.13 | **39** |
| Onion - AER | ROC_1CC_5x1.0_aerial_7_GAOnion_WirrigSTD | 224 | 223 | **0.93** | 0.77 | 0.10 | **30** |
| Onion - GRD | ROC_1CC_5x1_ground_7_GAOnion_WirrigSTD | 165 | 164 | **0.69** | 0.57 | 0.07 | **22** |
| Ornamentals - GRD | ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 900 | 893 | **3.8** | **3.1** | 0.40 | **119** |
| Potato - AER | ROC_1CC_4x1.0_aerial_7_MEpotatoSTD | 375 | 374 | **1.6** | **1.3** | 0.17 | **50** |
| Potato - GRD | ROC_1CC_4x1.0_ground_7_MEpotatoSTD | 274 | 273 | **1.1** | 0.95 | 0.12 | **36** |
| Stone Fruit - AER | ROC_1CC_2x1.0_aerial_7_MICherriesSTD | 109 | 108 | 0.45 | 0.38 | 0.05 | **14** |
| Stone Fruit - GRD | ROC_1CC_2x1.0_ground_7_MICherriesSTD | 61 | 60 | 0.25 | 0.21 | 0.03 | **8.1** |
| Stone Fruit - AB | ROC_1CC_2x1.0_airblast_7_MICherriesSTD | 52 | 52 | 0.22 | 0.18 | 0.02 | **6.9** |
| Turf - AER (1 CC) | ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 962 | 952 | **4.0** | **3.3** | 0.43 | **127** |
| Turf - GRD (1 CC) | ROC_1CC_4x5.51+1x1.96_ground_7_PAturfSTD | 503 | 498 | **2.1** | **1.7** | 0.22 | **66** |
| Turf - AER (2 CC) | ROC_2CC_2x5.51+1x0.98_aerial_7_PAturfSTD | 853 | 848 | **3.6** | **2.9** | 0.38 | **113** |
| Turf - GRD (2 CC) | ROC_2CC_2x5.51+1x0.98_ground_7_PAturfSTD | 387 | 383 | **1.6** | **1.3** | 0.17 | **51** |

**Bolded** values exceed the acute risk to non-listed species LOC of 0.5 or the chronic risk LOC of 1.0. The toxicity endpoints listed in the table are those used to calculate the RQ.
CC = Crop Cycle
[1] Run Name corresponds to the model input information in **Appendix F**.

**Table G-6. Acute and Chronic Invertebrate (In the water column) Risk Quotients for Iprodione SSD Based on Average Application Rates**

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 21-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 240 µg a.i./L | NOAEC = 288 µg a.i./L | $LC_{50}$ = 2240 µg a.i./L | NOAEC = 7.5 µg a.i./L |
| Broccoli - GRD (1 CC) | 116 | 115 | 0.48 | 0.40 | 0.05 | **15** |
| Broccoli - GRD (2 CC) | 222 | 221 | **0.93** | 0.77 | 0.10 | **29** |
| Lettuce-Broccoli-Lettuce Rotation | 718 | 713 | **3.0** | **2.5** | 0.32 | **95** |
| Carrots - AER | 314 | 309 | **1.3** | **1.1** | 0.14 | **41** |
| Carrots - GRD | 321 | 316 | **1.3** | **1.1** | 0.14 | **42** |
| Lettuce - AERx1, GRDx2 | 196 | 194 | **0.82** | 0.67 | 0.09 | **26** |
| Lettuce - AER1x, GRDx2 (2 CC) | 441 | 439 | **1.8** | **1.5** | 0.20 | **59** |
| Onion - AER | 144 | 143 | **0.60** | 0.50 | 0.06 | **19** |
| Onion - GRD | 106 | 105 | 0.44 | 0.36 | 0.05 | **14** |
| Potato - AER | 332 | 330 | **1.4** | **1.2** | 0.15 | **44** |
| Potato - GRD | 242 | 241 | **1.0** | 0.84 | 0.11 | **32** |
| Stone Fruit - AER | 85 | 84 | 0.35 | 0.29 | 0.04 | **11** |
| Stone Fruit - GRD | 47 | 47 | 0.20 | 0.16 | 0.02 | **6.3** |
| Stone Fruit - AB | 41 | 40 | 0.17 | 0.14 | 0.02 | **5.3** |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or the chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1] The EECs used to calculate this RQ are based on the 1-in-10-year peak 1-day average value from **Table F-2**

[2] The EECs used to calculate this RQ are based on the 1-in-10-year 21-day average value from **Table F-2**

**Table G-7. Acute and Chronic Invertebrate Risk Quotients for Species Exposed to Parent Iprodione (In the water column) Based on Maximum Application Rates**

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 21-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 240 µg a.i./L | NOAEC = 288 µg a.i./L | $LC_{50}$ = 2240 µg a.i./L | NOAEC = 7.5 µg a.i./L |
| Almonds - AER | 12 | 8.4 | 0.05 | 0.03 | 0.01 | **1.1** |
| Almonds - GRD | 6.2 | 4.5 | 0.03 | 0.02 | <0.01 | 0.61 |
| Almonds - AB | 5.6 | 4.1 | 0.02 | 0.01 | <0.01 | 0.55 |
| Broccoli - GRD (1 CC) | 26 | 21 | 0.11 | 0.07 | 0.01 | **2.8** |

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 21-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 240 µg a.i./L | NOAEC = 288 µg a.i./L | $LC_{50}$ = 2240 µg a.i./L | NOAEC = 7.5 µg a.i./L |
| Broccoli - GRD (2 CC) | 40 | 30 | 0.17 | 0.10 | 0.02 | **4.0** |
| Lettuce-Broccoli-Lettuce Rotation | 85 | 61 | 0.36 | 0.21 | 0.04 | **8.1** |
| Carrots - AER | 97 | 60 | 0.40 | 0.21 | 0.04 | **8.0** |
| Carrots - GRD | 101 | 61 | 0.42 | 0.21 | 0.05 | **8.1** |
| Carrots - Seed | 42 | 24 | 0.17 | 0.08 | 0.02 | **3.2** |
| Cotton - In_furrow | 2.4 | 1.6 | 0.01 | 0.01 | <0.01 | 0.21 |
| Crucifer for Seed - AER | 48 | 32 | 0.20 | 0.11 | 0.02 | **4.3** |
| Crucifer for Seed - GRD | 39 | 26 | 0.16 | 0.09 | 0.02 | **3.5** |
| Grapes - AER | 12 | 8.0 | 0.05 | 0.03 | 0.01 | **1.1** |
| Grapes - GRD | 9.8 | 6.0 | 0.04 | 0.02 | <0.01 | 0.79 |
| Grapes - AB | 9.2 | 5.7 | 0.04 | 0.02 | <0.01 | 0.75 |
| Lettuce - AERx1, GRDx2 | 35 | 27 | 0.15 | 0.09 | 0.02 | **3.6** |
| Lettuce - AER1x, GRDx2 (2 CC) | 45 | 32 | 0.19 | 0.11 | 0.02 | **4.3** |
| Onion - AER | 36 | 23 | 0.15 | 0.08 | 0.02 | **3.1** |
| Onion - GRD | 33 | 21 | 0.14 | 0.07 | 0.01 | **2.8** |
| Ornamentals - GRD | 166 | 134 | **0.69** | 0.47 | 0.07 | **18** |
| Potato - AER | 26 | 20 | 0.11 | 0.07 | 0.01 | **2.6** |
| Potato - GRD | 20 | 14 | 0.08 | 0.05 | 0.01 | **1.8** |
| Stone Fruit - AER | 12 | 10 | 0.05 | 0.04 | 0.01 | **1.4** |
| Stone Fruit - GRD | 7.3 | 5.5 | 0.03 | 0.02 | <0.01 | 0.73 |
| Stone Fruit - AB | 6.6 | 4.9 | 0.03 | 0.02 | <0.01 | 0.65 |
| Turf - AER (1 CC) | 123 | 80 | **0.51** | 0.28 | 0.05 | **11** |
| Turf - GRD (1 CC) | 91 | 56 | 0.38 | 0.19 | 0.04 | **7.4** |
| Turf - AER (2 CC) | 68 | 47 | 0.28 | 0.16 | 0.03 | **6.2** |
| Turf - GRD (2 CC) | 56 | 34 | 0.24 | 0.12 | 0.03 | **4.6** |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or the chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1] The EECs used to calculate this RQ are based on the 1-in-10-year peak 1-day average value from **Table F-1**

[2] The EECs used to calculate this RQ are based on the 1-in-10-year 21-day average value from **Table F-1**.

**Table G-8. Acute and Chronic Invertebrate (In the water column) Risk Quotients for Parent Iprodione Based on Average Application Rates**

| Use Sites | 1-in-10 Yr EEC (µg/L) | | Risk Quotient | | | |
|---|---|---|---|---|---|---|
| | | | Freshwater | | Estuarine/Marine | |
| | Daily Mean | 21-day Mean | Acute[1] | Chronic[2] | Acute[1] | Chronic[2] |
| | | | $LC_{50}$ = 240 µg a.i./L | NOAEC = 288 µg a.i./L | $LC_{50}$ = 2240 µg a.i./L | NOAEC = 7.5 µg a.i./L |
| Broccoli - GRD (1 CC) | 20 | 16 | 0.08 | 0.05 | 0.01 | **2.1** |
| Broccoli - GRD (2 CC) | 30 | 23 | 0.12 | 0.08 | 0.01 | **3.0** |
| Lettuce-Broccoli-Lettuce Rotation | 77 | 58 | 0.32 | 0.20 | 0.03 | **7.8** |
| Carrots - AER | 87 | 53 | 0.36 | 0.19 | 0.04 | **7.1** |
| Carrots - GRD | 90 | 54 | 0.38 | 0.19 | 0.04 | **7.2** |
| Lettuce - AERx1, GRDx2 | 34 | 26 | 0.14 | 0.09 | 0.02 | **3.4** |
| Lettuce - AER1x, GRDx2 (2 CC) | 43 | 31 | 0.18 | 0.11 | 0.02 | **4.1** |
| Onion - AER | 23 | 15 | 0.10 | 0.05 | 0.01 | **2.0** |
| Onion - GRD | 21 | 13 | 0.09 | 0.05 | 0.01 | **1.8** |
| Potato - AER | 23 | 17 | 0.10 | 0.06 | 0.01 | **2.3** |
| Potato - GRD | 17 | 12 | 0.07 | 0.04 | 0.01 | **1.6** |
| Stone Fruit - AER | 9.7 | 7.9 | 0.04 | 0.03 | <0.01 | **1.1** |
| Stone Fruit - GRD | 5.7 | 4.3 | 0.02 | 0.01 | <0.01 | 0.57 |
| Stone Fruit - AB | 5.1 | 3.8 | 0.02 | 0.01 | <0.01 | 0.51 |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or the chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1] The EECs used to calculate this RQ are based on the 1-in-10-year peak 1-day average value from **Table F-2**

[2] The EECs used to calculate this RQ are based on the 1-in-10-year 21-day average value from **Table F-1**.

**Table G-9 Risk Quotients (RQs) for Non-listed Aquatic Plant Species Exposed to Iprodione SSD Based on Maximum Application Rates**

| Use Sites | Run Name[1] | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|---|
| | | | Vascular | Non-vascular |
| | | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Almonds - AER | ROC_1CC_4x0.50_aerial_7_CAalmond_WirrigSTD | 69 | N/A | 0.21 |
| Almonds - GRD | ROC_1CC_4x0.50_ground_7_CAalmond_WirrigSTD | 33 | | 0.10 |
| Almonds - AB | ROC_1CC_4x0.50_airblast_7_CAalmond_WirrigSTD | 26 | | 0.08 |

| Use Sites | Run Name[1] | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|---|
| | | | Vascular | Non-vascular |
| | | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Broccoli - GRD (1 CC) | ROC_1CC_2x1.0_ground_7_CAColeCropRLF_V2 | 155 | | 0.47 |
| Broccoli - GRD (2 CC) | ROC_2CC_2x1.0_ground_7_CAColeCropRLF_V2 | 296 | | 0.90 |
| Lettuce-Broccoli-Lettuce Rotation | ROC_3CC_rotation_3x1.0+2x1+3x1.0_air_ground_7_CAlettuceSTD | 778 | | **2.4** |
| Carrots - AER | ROC_1CC_4x1.0_aerial_7_FLcarrotSTD | 352 | | **1.1** |
| Carrots - GRD | ROC_1CC_4x1.0_ground_7_FLcarrotSTD | 360 | | **1.1** |
| Carrots - Seed | ROC_1CC_1x0.62_seed_treatment_7_FLcarrotSTD | 114 | | 0.35 |
| Cotton - In_furrow | ROC_1CC_1x0.27_In_Furrow_7_MScottonSTD | 8.9 | | 0.03 |
| Crucifer for Seed - AER | ROC_1CC_3x2_aerial_7_CAColeCropRLF_V2 | 490 | | **1.5** |
| Crucifer for Seed - GRD | ROC_1CC_3x2_ground_7_CAColeCropRLF_V2 | 389 | | **1.2** |
| Grapes - AER | ROC_1CC_4x0.50_aerial_7_NYGrapesSTD | 145 | | 0.44 |
| Grapes - GRD | ROC_1CC_4x0.50_ground_7_NYGrapesSTD | 103 | | 0.31 |
| Grapes - AB | ROC_1CC_4x0.50_airblast_7_NYGrapesSTD | 95 | | 0.29 |
| Lettuce - AERx1, GRDx2 | ROC_1CC_3x1.0_1xair_2xground_7_CAlettuceSTD | 203 | | 0.62 |
| Lettuce - AER1x, GRDx2 (2 CC) | ROC_2CC_3x1.0_aerial_ground_7_CAlettuceSTD | 296 | | 0.90 |
| Onion - AER | ROC_1CC_5x1.0_aerial_7_GAOnion_WirrigSTD | 224 | | 0.68 |
| Onion - GRD | ROC_1CC_5x1_ground_7_GAOnion_WirrigSTD | 165 | | 0.50 |
| Ornamentals - GRD | ROC_1CC_6x4.00_ground_7_NJnurserySTD_V2 | 900 | | **2.7** |
| Potato - AER | ROC_1CC_4x1.0_aerial_7_MEpotatoSTD | 375 | | **1.1** |
| Potato - GRD | ROC_1CC_4x1.0_ground_7_MEpotatoSTD | 274 | | 0.83 |
| Stone Fruit - AER | ROC_1CC_2x1.0_aerial_7_MICherriesSTD | 109 | | 0.33 |
| Stone Fruit - GRD | ROC_1CC_2x1.0_ground_7_MICherriesSTD | 61 | | 0.18 |
| Stone Fruit - AB | ROC_1CC_2x1.0_airblast_7_MICherriesSTD | 52 | | 0.16 |

| Use Sites | Run Name[1] | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|---|
| | | | Vascular | Non-vascular |
| | | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Turf - AER (1 CC) | ROC_1CC_4x5.51+1x1.96_aerial_7_PAturfSTD | 962 | | **2.9** |
| Turf - GRD (1 CC) | ROC_1CC_4x5.51+1x1.96_ground_7_PAturfSTD | 503 | | **1.5** |
| Turf - AER (2 CC) | ROC_2CC_2x5.51+1x0.98_aerial_7_PAturfSTD | 853 | | **2.6** |
| Turf - GRD (2 CC) | ROC_2CC_2x5.51+1x0.98_ground_7_PAturfSTD | 387 | | **1.2** |

The LOC for non-listed plants is 1. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1] Run Name corresponds to the model input information in **Appendix F**.

### Table G-10. Aquatic Plant Risk Quotients for Species Exposed to Iprodione SSD Based on Average Application Rates

| Use Sites | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|
| | | Vascular | Non-vascular |
| | | Acute | Acute |
| | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Broccoli - GRD (1 CC) | 116 | N/A | 0.35 |
| Broccoli - GRD (2 CC) | 222 | | 0.67 |
| Lettuce-Broccoli-Lettuce Rotation | 718 | | **2.2** |
| Carrots - AER | 314 | | 0.95 |
| Carrots - GRD | 321 | | 0.97 |
| Lettuce - AERx1, GRDx2 | 196 | | 0.59 |
| Lettuce - AER1x, GRDx2 (2 CC) | 441 | | **1.3** |
| Onion - AER | 144 | | 0.44 |
| Onion - GRD | 106 | | 0.32 |
| Potato - AER | 332 | | **1.0** |
| Potato - GRD | 242 | | 0.73 |
| Stone Fruit - AER | 85 | | 0.26 |
| Stone Fruit - GRD | 47 | | 0.14 |
| Stone Fruit - AB | 41 | | 0.12 |

The LOC for non-listed plants is 1. The endpoints listed in the table are the endpoint used to calculate the RQ.

### Table G-11. Aquatic Plant Risk Quotients for Species Exposed to Parent Iprodione Based on Maximum Application Rates

| Use Sites | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|
| | | Vascular | Non-vascular |
| | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Almonds - AER | 12 | | 0.04 |
| Almonds - GRD | 6.2 | | 0.02 |
| Almonds - AB | 5.6 | | 0.02 |
| Broccoli - GRD (1 CC) | 26 | | 0.08 |
| Broccoli - GRD (2 CC) | 40 | | 0.12 |

| Use Sites | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|
| | | Vascular | Non-vascular |
| | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Lettuce-Broccoli-Lettuce Rotation | 85 | N/A | 0.26 |
| Carrots - AER | 97 | | 0.29 |
| Carrots - GRD | 101 | | 0.31 |
| Carrots - Seed | 42 | | 0.13 |
| Cotton - In_furrow | 2.4 | | 0.01 |
| Crucifer for Seed - AER | 48 | | 0.15 |
| Crucifer for Seed - GRD | 39 | | 0.12 |
| Grapes - AER | 12 | | 0.04 |
| Grapes - GRD | 9.8 | | 0.03 |
| Grapes - AB | 9.2 | | 0.03 |
| Lettuce - AERx1, GRDx2 | 35 | | 0.11 |
| Lettuce - AER1x, GRDx2 (2 CC) | 45 | | 0.14 |
| Onion - AER | 36 | | 0.11 |
| Onion - GRD | 33 | | 0.10 |
| Ornamentals - GRD | 166 | | 0.50 |
| Potato - AER | 26 | | 0.08 |
| Potato - GRD | 20 | | 0.06 |
| Stone Fruit - AER | 12 | | 0.04 |
| Stone Fruit - GRD | 7.3 | | 0.02 |
| Stone Fruit - AB | 6.6 | | 0.02 |
| Turf - AER (1 CC) | 123 | | 0.37 |
| Turf - GRD (1 CC) | 91 | | 0.28 |
| Turf - AER (2 CC) | 68 | | 0.21 |
| Turf - GRD (2 CC) | 56 | | 0.17 |

The LOC for non-listed plants is 1. The endpoints listed in the table are the endpoint used to calculate the RQ.

### Table G-12. Aquatic Plant Risk Quotients for Species Exposed to Parent Iprodione Based on Average Application Rates

| Use Sites | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|
| | | Vascular | Non-vascular |
| | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Broccoli - GRD (1 CC) | 20 | N/A | 0.06 |
| Broccoli - GRD (2 CC) | 30 | | 0.09 |
| Lettuce-Broccoli-Lettuce Rotation | 77 | | 0.23 |
| Carrots - AER | 87 | | 0.26 |
| Carrots - GRD | 90 | | 0.27 |
| Lettuce - AERx1, GRDx2 | 34 | | 0.10 |
| Lettuce - AER1x, GRDx2 (2 CC) | 43 | | 0.13 |
| Onion - AER | 23 | | 0.07 |
| Onion - GRD | 21 | | 0.06 |
| Potato - AER | 23 | | 0.07 |
| Potato - GRD | 17 | | 0.05 |
| Stone Fruit - AER | 9.7 | | 0.03 |

| Use Sites | 1-in-10 Year Daily Mean EEC (µg/L) | Risk Quotients | |
|---|---|---|---|
| | | Vascular | Non-vascular |
| | | $IC_{50}$ = >12,600 µg a.i./L | $IC_{50}$ = 330 µg a.i./L |
| Stone Fruit - GRD | 5.7 | | 0.02 |
| Stone Fruit - AB | 5.1 | | 0.02 |

The LOC for non-listed plants is 1. The endpoints listed in the table are the endpoint used to calculate the RQ.

## **Appendix H.** Example Inputs and Output for T-REX Modeling

### Upper Bound Kenaga Residues For RQ Calculation

| | | |
|---|---|---|
| Chemical Name: | Iprodione | |
| Use | foliar | |
| Formulation | 0 | |
| Application Rate | 2 | lbs a.i./acre |
| Half-life | 35 | days |
| Application Interval | 5 | days |
| Maximum # Apps./Year | 3 | |
| Length of Simulation | 1 | year |
| Variable application rates? | no | |

| Endpoints | | | |
|---|---|---|---|
| Avian | Bobwhite quail | LD50 (mg/kg-bw) | 930.00 |
| | Zebra Finch | LC50 (mg/kg-diet) | 1800.00 |
| | Bobwhite quail | NOAEL(mg/kg-bw) | 0.00 |
| | Mallard duck | NOAEC (mg/kg-diet) | 300.00 |
| Mammals | | LD50 (mg/kg-bw) | 1160.00 |
| | | LC50 (mg/kg-diet) | 0.00 |
| | | NOAEL (mg/kg-bw) | 15.00 |
| | | NOAEC (mg/kg-diet) | 300.00 |

| Dietary-based EECs (ppm) | Kenaga Values |
|---|---|
| Short Grass | 1308.51 |
| Tall Grass | 599.73 |
| Broadleaf plants | 736.04 |
| Fruits/pods/seeds | 81.78 |
| Arthropods | 512.50 |

## Avian Results

| Avian Class | Body Weight (g) | Ingestion (Fdry) (g bw/day) | Ingestion (Fwet) (g/day) | % body wgt consumed | FI (kg-diet/day) |
|---|---|---|---|---|---|
| Small | 20 | 5 | 23 | 114 | 2.28E-02 |
| Mid | 100 | 13 | 65 | 65 | 6.49E-02 |
| Large | 1000 | 58 | 291 | 29 | 2.91E-01 |
| Granivores | 20 | 5 | 5 | 25 | 5.06E-03 |
| | 100 | 13 | 14 | 14 | 1.44E-02 |
| | 1000 | 58 | 65 | 6 | 6.46E-02 |

| Avian Body Weight (g) | Adjusted LD50 (mg/kg-bw) |
|---|---|
| 20 | 670.00 |
| 100 | 852.94 |
| 1000 | 1204.81 |

| **Dose-based EECs** (mg/kg-bw) | Avian Classes and Body Weights (grams) | | |
|---|---|---|---|
| | small 20 | mid 100 | large 1000 |
| Short Grass | 1896.44 | 1081.43 | 484.17 |
| Tall Grass | 869.20 | 495.65 | 221.91 |
| Broadleaf plants | 1066.75 | 608.30 | 272.35 |
| Fruits/pods | 118.53 | 67.59 | 30.26 |
| Arthropods | 742.77 | 423.56 | 189.63 |
| Seeds | 26.34 | 15.02 | 6.72 |

| **Dose-based RQs** (Dose-based EEC/adjusted LD50) | Avian Acute RQs Size Class (grams) | | |
|---|---|---|---|
| | 20 | 100 | 1000 |
| Short Grass | 2.83 | 1.27 | 0.40 |
| Tall Grass | 1.30 | 0.58 | 0.18 |
| Broadleaf plants | 1.59 | 0.71 | 0.23 |
| Fruits/pods | 0.18 | 0.08 | 0.03 |
| Arthropods | 1.11 | 0.50 | 0.16 |
| Seeds | 0.04 | 0.02 | 0.01 |

| **Dietary-based RQs** (Dietary-based EEC/LC50 or NOAEC) | RQs | |
|---|---|---|
| | Acute | Chronic |
| Short Grass | 0.93 | 5.55 |
| Tall Grass | 0.42 | 2.54 |
| Broadleaf plants | 0.52 | 3.12 |
| Fruits/pods/seeds | 0.06 | 0.35 |
| Arthropods | 0.36 | 2.17 |

## Mammalian Results

| Mammalian Class | Body Weight | Ingestion (Fdry) (g bwt/day) | Ingestion (Fwet) (g/day) | % body wgt consumed | FI (kg-diet/day) |
|---|---|---|---|---|---|
| | 15 | 3 | 14 | 95 | 1.43E-02 |
| Herbivores/ insectivores | 35 | 5 | 23 | 66 | 2.31E-02 |
| | 1000 | 31 | 153 | 15 | 1.53E-01 |
| | 15 | 3 | 3 | 21 | 3.18E-03 |
| Grainvores | 35 | 5 | 5 | 15 | 5.13E-03 |
| | 1000 | 31 | 34 | 3 | 3.40E-02 |

| Mammalian Class | Body Weight | Adjusted LD50 | Adjusted NOAEL |
|---|---|---|---|
| | 15 | 2549.48 | 32.97 |
| Herbivores/ insectivores | 35 | 2062.80 | 26.67 |
| | 1000 | 892.23 | 11.54 |
| | 15 | 2549.48 | 32.97 |
| Granivores | 35 | 2062.80 | 26.67 |
| | 1000 | 892.23 | 11.54 |

| Dose-Based EECs (mg/kg-bw) | Mammalian Classes and Body weight (grams) | | |
|---|---|---|---|
| | 15 | 35 | 1000 |
| Short Grass | 1587.59 | 1097.24 | 254.40 |
| Tall Grass | 727.65 | 502.90 | 116.60 |
| Broadleaf plants | 893.02 | 617.20 | 143.10 |
| Fruits/pods | 99.22 | 68.58 | 15.90 |
| Arthropods | 621.81 | 429.75 | 99.64 |
| Seeds | 22.05 | 15.24 | 3.53 |

| Dose-based RQs (Dose-based EEC/LD50 or | Small mammal 15 grams | | Medium mammal 35 grams | | Large mammal 1000 grams | |
|---|---|---|---|---|---|---|
| | Acute | Chronic | Acute | Chronic | Acute | Chronic |
| Short Grass | 0.62 | 48.16 | 0.53 | 41.13 | 0.29 | 22.05 |
| Tall Grass | 0.29 | 22.07 | 0.24 | 18.85 | 0.13 | 10.11 |
| Broadleaf plants | 0.35 | 27.09 | 0.30 | 23.14 | 0.16 | 12.40 |
| Fruits/pods | 0.04 | 3.01 | 0.03 | 2.57 | 0.02 | 1.38 |
| Arthropods | 0.24 | 18.86 | 0.21 | 16.11 | 0.11 | 8.64 |
| Seeds | 0.01 | 0.67 | 0.01 | 0.57 | 0.00 | 0.31 |

| Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC) | Mammal RQs | |
|---|---|---|
| | Acute | Chronic |
| Short Grass | #DIV/0! | 5.55 |
| Tall Grass | #DIV/0! | 2.54 |
| Broadleaf plants | #DIV/0! | 3.12 |
| Fruits/pods/seeds | #DIV/0! | 0.35 |
| Arthropods | #DIV/0! | 2.17 |

## Appendix I. Estimated Environmental Concentrations and Risk Quotient Refinements for Terrestrial Vertebrates

**Table I-0-1 Summary of Dietary- (mg a.i./kg-diet) and Dose-based Estimated Environmental Concentrations (EECs; mg a.i./kg-bw) as Food Residues for Birds, Reptiles, Terrestrial-Phase Amphibians and Mammals from Labeled Uses of Iprodione (T-REX v. 1.5.2, Upper Bound Kenaga).**

| Food Type | Dietary-Based EEC (mg/kg-diet) | Dose-Based EEC (mg/kg-body weight) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Birds | | | Mammals | | |
| | | Small (20 g) | Medium (100 g) | Large (1000 g) | Small (15 g) | Medium (35 g) | Large (1000 g) |
| **Almonds (0.50 lb a.i./acre, 4x, 5-day interval)** | | | | | | | |
| Short grass | 416 | 474 | 270 | 121 | 397 | 274 | 64 |
| Tall grass | 191 | 217 | 124 | 55 | 182 | 126 | 29 |
| Broadleaf plants/small insects | 234 | 267 | 152 | 68 | 223 | 154 | 36 |
| Fruits/pods/seeds (dietary only) | 26 | 30 | 17 | 7.6 | 25 | 17 | 4.0 |
| Arthropods | 163 | 186 | 106 | 47 | 155 | 107 | 25 |
| Seeds (granivore)[1] | N/A | 6.6 | 308 | 1.7 | 5.5 | 3.8 | 0.88 |
| **Lettuce – Broccoli - Lettuce (1.00 lbs ai/A, 3x, 10-day interval – 2x, 5-day interval – 3x, 10-day interval)** | | | | | | | |
| Short grass | 632 | 719 | 410 | 184 | 602 | 416 | 97 |
| Tall grass | 290 | 330 | 188 | 84 | 276 | 191 | 44 |
| Broadleaf plants/small insects | 356 | 405 | 231 | 103 | 339 | 234 | 54 |
| Fruits/pods/seeds (dietary only) | 39 | 45 | 26 | 11 | 38 | 26 | 6.0 |
| Arthropods | 247 | 282 | 161 | 72 | 236 | 163 | 38 |
| Seeds (granivore)[1] | N/A | 10 | 5.7 | 2.6 | 8.4 | 5.8 | 1.3 |
| **Lettuce (1.00 lb a.i./A, 3x, 10-day interval)** | | | | | | | |
| Short grass | 560 | 637 | 364 | 163 | 534 | 369 | 86 |
| Tall grass | 257 | 292 | 167 | 75 | 244 | 169 | 39 |
| Broadleaf plants/small insects | 315 | 359 | 204 | 92 | 300 | 207 | 48 |
| Fruits/pods/seeds (dietary only) | 35 | 40 | 23 | 10 | 33 | 23 | 5.3 |
| Arthropods | 219 | 250 | 142 | 64 | 209 | 144 | 33 |
| Seeds (granivore)[1] | N/A | 8.9 | 5.1 | 2.3 | 7.4 | 5.1 | 1.2 |
| **Broccoli (1.00 lb a.i./A, 2x, 5-day interval)** | | | | | | | |
| Short grass | 457 | 521 | 297 | 133 | 436 | 301 | 70 |
| Tall grass | 210 | 239 | 136 | 61 | 200 | 138 | 32 |
| Broadleaf plants/small insects | 257 | 293 | 167 | 75 | 245 | 170 | 39 |
| Fruits/pods/seeds (dietary only) | 29 | 33 | 19 | 8.3 | 27 | 19 | 4.4 |

| Food Type | Dietary-Based EEC (mg/kg-diet) | Dose-Based EEC (mg/kg-body weight) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Birds | | | Mammals | | |
| | | Small (20 g) | Medium (100 g) | Large (1000 g) | Small (15 g) | Medium (35 g) | Large (1000 g) |
| Arthropods | 179 | 204 | 116 | 52 | 171 | 118 | 27 |
| Seeds (granivore)[1] | N/A | 7.2 | 4.1 | 1.9 | 6.1 | 4.2 | 0.97 |
| **Crucifer for Seed (2.00 lbs a.i./A, 3x, 5-day interval)** | | | | | | | |
| Short grass | 1309 | 1490 | 850 | 380 | 1248 | 862 | 200 |
| Tall grass | 600 | 683 | 390 | 174 | 572 | 395 | 92 |
| Broadleaf plants/small insects | 736 | 838 | 478 | 214 | 702 | 485 | 112 |
| Fruits/pods/seeds (dietary only) | 82 | 93 | 53 | 24 | 78 | 54 | 12 |
| Arthropods | 513 | 584 | 333 | 149 | 489 | 338 | 78 |
| Seeds (granivore)[1] | N/A | 21 | 12 | 5.3 | 17 | 12 | 2.8 |
| **Grapes (1.00 lb a.i./A, 4x, 5-day interval)** | | | | | | | |
| Short grass | 833 | 948 | 541 | 242 | 794 | 549 | 127 |
| Tall grass | 382 | 435 | 248 | 111 | 364 | 251 | 58 |
| Broadleaf plants/small insects | 468 | 533 | 304 | 136 | 447 | 309 | 72 |
| Fruits/pods/seeds (dietary only) | 52 | 59 | 34 | 15 | 50 | 34 | 8.0 |
| Arthropods | 326 | 371 | 212 | 95 | 311 | 215 | 50 |
| Seeds (granivore)[1] | N/A | 13 | 7.5 | 3.4 | 11 | 7.6 | 1.8 |
| **Onion (1.00 lb a.i./A, 4x, 7-day interval)** | | | | | | | |
| Short grass | 789 | 899 | 513 | 229 | 752 | 520 | 121 |
| Tall grass | 362 | 412 | 235 | 105 | 345 | 238 | 55 |
| Broadleaf plants/small insects | 444 | 506 | 288 | 129 | 423 | 293 | 68 |
| Fruits/pods/seeds (dietary only) | 49 | 56 | 32 | 14 | 47 | 33 | 7.5 |
| Arthropods | 309 | 352 | 201 | 90 | 295 | 204 | 47 |
| Seeds (granivore)[1] | NA | 12 | 7.1 | 3.2 | 10 | 7.2 | 1.7 |
| **Potato (2.00 lbs a.i./A, 4x, 5-day interval)** | | | | | | | |
| Short grass | 1665 | 1896 | 1081 | 484 | 1588 | 1097 | 254 |
| Tall grass | 763 | 869 | 496 | 222 | 728 | 503 | 117 |
| Broadleaf plants/small insects | 937 | 1067 | 608 | 272 | 893 | 617 | 143 |
| Fruits/pods/seeds (dietary only) | 104 | 119 | 68 | 30 | 99 | 69 | 16 |
| Arthropods | 652 | 743 | 424 | 190 | 622 | 430 | 100 |
| Seeds (granivore)[1] | N/A | 26 | 15 | 6.7 | 22 | 15 | 3.5 |
| **Turf (5.51 lbs a.i./A, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr, modeled as 4 appl. at 5.51 + 1 appl. at 1.96 lbs a.i./A** | | | | | | | |
| Short grass | 3660 | 4168 | 2377 | 1064 | 3489 | 2412 | 559 |
| Tall grass | 1677 | 1910 | 1089 | 488 | 1599 | 1105 | 256 |

| Food Type | Dietary-Based EEC (mg/kg-diet) | Dose-Based EEC (mg/kg-body weight) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Birds | | | Mammals | | |
| | | Small (20 g) | Medium (100 g) | Large (1000 g) | Small (15 g) | Medium (35 g) | Large (1000 g) |
| Broadleaf plants/small insects | 2059 | 2345 | 1337 | 599 | 1963 | 1357 | 315 |
| Fruits/pods/seeds (dietary only) | 229 | 261 | 149 | 67 | 218 | 151 | 35 |
| Arthropods | 1433 | 1632 | 931 | 417 | 1367 | 945 | 219 |
| Seeds (granivore)[1] | NA | 58 | 33 | 15 | 48 | 33 | 7.8 |
| **Cotton, in furrow (0.272 lbs a.i./A, 1x, 40 in. row spacing, 1 in. bandwidth)** | | | | | | | |
| Short grass | 65 | 74 | 42 | 19 | 62 | 43 | 10 |
| Tall grass | 30 | 34 | 19 | 8.7 | 29 | 20 | 4.6 |
| Broadleaf plants/small insects | 37 | 42 | 24 | 11 | 35 | 24 | 5.6 |
| Fruits/pods/seeds (dietary only) | 4.1 | 4.7 | 2.7 | 1.2 | 3.9 | 2.7 | 0.62 |
| Arthropods | 26 | 29 | 17 | 7.4 | 24 | 17 | 3.9 |
| Seeds (granivore)[1] | NA | 1.0 | 0.59 | 0.26 | 0.86 | 0.60 | 0.14 |
| **Ornamentals, drench (4.0 lbs a.i./A, 6x, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr** | | | | | | | |
| Short grass | 3213 | 3660 | 2087 | 934 | 3064 | 2117 | 491 |
| Tall grass | 1473 | 1677 | 957 | 428 | 1404 | 971 | 225 |
| Broadleaf plants/small insects | 1808 | 2059 | 1174 | 526 | 1723 | 1191 | 276 |
| Fruits/pods/seeds (dietary only) | 201 | 229 | 130 | 58 | 191 | 132 | 31 |
| Arthropods | 1259 | 1433 | 817 | 366 | 1200 | 829 | 192 |
| Seeds (granivore)[1] | NA | 51 | 29 | 13 | 43 | 29 | 6.8 |

[1] Seeds presented separately for dose – based EECs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

**Table I-2. Acute RQ values for Mammals from Labeled Uses of Iprodione (T-REX v. 1.5.2, Mean Kenaga)**

| Food Type | Acute Dose-Based RQ $LD_{50}$ = 1160 mg/kg-bw | | |
|---|---|---|---|
| | **Small (15 g)** | **Medium (35 g)** | **Large (1000 g)** |
| **Almonds (0.50 lb a.i./acre, 4x, 5-day interval)** | | | |
| **Potato (2.00 lbs ai/A, 4x, 5-day interval)** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.22 | 0.19 | 0.10 |
| Tall grass | 0.09 | 0.08 | 0.04 |
| Broadleaf plants | 0.12 | 0.10 | 0.05 |
| Fruits/pods/seeds | 0.02 | 0.02 | 0.01 |
| Arthropods | 0.17 | 0.14 | 0.08 |
| Granivores | | | |
| Seeds[1] | <0.01 | <0.01 | <0.01 |
| **Turf (5.51 lbs a.i./A, 6x, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.48 | 0.41 | 0.22 |
| Tall grass | 0.21 | 0.18 | 0.09 |
| Broadleaf plants | 0.26 | 0.22 | 0.12 |
| Fruits/pods/seeds | 0.04 | 0.03 | 0.02 |
| Arthropods | 0.37 | 0.32 | 0.17 |
| Granivores | | | |
| Seeds[1] | 0.01 | 0.01 | <0.01 |
| **Ornamentals, Drench (4.00 lbs a.i./A, 6x, 15-day interval) – Max application rate = 24 lbs a.i./A/yr** | | | |
| Herbivores/Insectivores | | | |
| Short grass | 0.43 | 0.36 | 0.19 |
| Tall grass | 0.18 | 0.15 | 0.08 |
| Broadleaf plants | 0.23 | 0.19 | 0.10 |
| Fruits/pods/seeds | 0.04 | 0.03 | 0.02 |
| Arthropods | 0.33 | 0.28 | 0.15 |
| Granivores | | | |
| Seeds[1] | 0.01 | 0.01 | <0.01 |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.
[1] Seeds presented separately for dose – based EECs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

**Table I-3. Chronic RQ values for Mammals from Labeled Uses of Iprodione (T-REX v. 1.5.2, Mean Kenaga)**

| Food Type | Chronic Dose-Based RQ NOAEC = 15 mg/kg-bw[1] | | | Chronic Dietary-Based RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|
| | Small (15 g) | Medium (35 g) | Large (1000 g) | |
| **Almonds (0.50 lb a.i./acre, 4x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **4.3** | **3.6** | **2.0** | 0.49 |
| Tall grass | **1.8** | **1.5** | **0.83** | 0.21 |
| Broadleaf plants | **2.3** | **1.9** | **1.0** | 0.26 |
| Fruits/pods/seeds | 0.35 | 0.3 | 0.16 | 0.04 |
| Arthropods | **3.3** | **2.8** | **1.5** | 0.38 |
| Granivores | | | | |
| Seeds[2] | 0.08 | 0.07 | 0.04 | N/A |
| **Lettuce – Broccoli - Lettuce (1.00 lbs ai/A, 3x, 10-day interval – 2x, 5-day interval – 3x, 10-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **6.5** | **5.5** | **3.0** | 0.75 |
| Tall grass | **2.7** | **2.3** | **1.3** | 0.32 |
| Broadleaf plants | **3.4** | **2.9** | **1.6** | 0.39 |
| Fruits/pods/seeds | 0.53 | 0.46 | 0.24 | 0.06 |
| Arthropods | **5.0** | **4.2** | **2.3** | 0.57 |
| Granivores | | | | |
| Seeds[2] | 0.12 | 0.10 | 0.05 | N/A |
| **Lettuce (1.00 lb ai/A, 3x, 10-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **5.7** | **4.9** | **2.6** | 0.66 |
| Tall grass | **2.4** | **2.1** | **1.1** | 0.28 |
| Broadleaf plants | **3.0** | **2.6** | **1.4** | 0.35 |
| Fruits/pods/seeds | 0.47 | 0.40 | 0.22 | 0.05 |
| Arthropods | **4.4** | **3.7** | **2.0** | 0.51 |
| Granivores | | | | |
| Seeds[2] | 0.10 | 0.09 | 0.05 | N/A |
| **Broccoli (1.00 lb ai/A, 2x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **4.7** | **4.0** | **2.2** | 0.54 |
| Tall grass | **2.0** | **1.7** | 0.91 | 0.23 |
| Broadleaf plants | **2.5** | **2.1** | **1.1** | 0.29 |
| Fruits/pods/seeds | 0.39 | 0.33 | 0.18 | 0.04 |
| Arthropods | **3.6** | **3.1** | **1.6** | 0.41 |
| Granivores | | | | |
| Seeds[2] | 0.09 | 0.07 | 0.04 | N/A |
| **Crucifer for Seed (2.00 lbs a.i./A, 3x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **13** | **11** | **6.1** | **1.5** |
| Tall grass | **5.7** | **4.9** | **2.6** | 0.65 |
| Broadleaf plants | **7.1** | **6.1** | **3.3** | 0.82 |
| Fruits/pods/seeds | **1.1** | 0.94 | 0.51 | 0.13 |
| Arthropods | **10** | **8.8** | **4.7** | **1.2** |
| Granivores | | | | |

| | | | | |
|---|---|---|---|---|
| Seeds[2] | 0.25 | 0.21 | 0.11 | N/A |
| **Grapes (1.00 lb a.i./A, 4x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **8.5** | **7.3** | **3.9** | 0.98 |
| Tall grass | **3.6** | **3.1** | **1.7** | 0.42 |
| Broadleaf plants | **4.5** | **3.9** | **2.1** | 0.52 |
| Fruits/pods/seeds | 0.70 | 0.60 | 0.32 | 0.08 |
| Arthropods | **6.5** | **5.6** | **3.0** | 0.75 |
| Granivores | | | | |
| Seeds[2] | 0.16 | 0.13 | 0.07 | N/A |
| **Onion (1.00 lb a.i./A, 4x, 7-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **8.1** | **6.9** | **3.7** | 0.93 |
| Tall grass | **3.4** | **2.9** | **1.6** | 0.39 |
| Broadleaf plants | **4.3** | **3.7** | **2.0** | 0.49 |
| Fruits/pods/seeds | 0.67 | 0.57 | 0.30 | 0.08 |
| Arthropods | **6.2** | **5.3** | **2.8** | 0.71 |
| Granivore | | | | |
| Seeds[2] | 0.15 | 0.13 | 0.07 | N/A |
| **Potato (2.00 lbs ai/A, 4x, 5-day interval)** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **17** | **15** | **7.8** | **2.0** |
| Tall grass | **7.2** | **6.2** | **3.3** | 0.83 |
| Broadleaf plants | **9.0** | **7.7** | **4.1** | **1.0** |
| Fruits/pods/seeds | **1.4** | **1.2** | 0.64 | 0.16 |
| Arthropods | **13** | **11** | **6.0** | **1.5** |
| Granivores | | | | |
| Seeds[2] | 0.31 | 0.27 | 0.14 | N/A |
| **Turf (5.51 lbs a.i./A, 6x, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **37** | **32** | **17** | **4.3** |
| Tall grass | **16** | **14** | **7.3** | **1.8** |
| Broadleaf plants | **20** | **17** | **9.1** | **2.3** |
| Fruits/pods/seeds | **3.1** | **2.6** | **1.4** | 0.36 |
| Arthropods | **29** | **24** | **13** | **3.3** |
| Granivores | | | | |
| Seeds[2] | 0.69 | 0.59 | 0.31 | N/A |
| **Ornamentals, Drench (4.00 lbs a.i./A, 6x, 15-day interval) – Max application rate = 24 lbs a.i./A/yr** | | | | |
| Herbivores/Insectivores | | | | |
| Short grass | **33** | **28** | **15** | **3.8** |
| Tall grass | **14** | **12** | **6.4** | **1.6** |
| Broadleaf plants | **17** | **15** | **8.0** | **2.0** |
| Fruits/pods/seeds | **2.7** | **2.3** | **1.2** | 0.31 |
| Arthropods | **25** | **22** | **12** | **2.9** |
| Granivores | | | | |
| Seeds[2] | 0.60 | 0.51 | 0.28 | N/A |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1]Based on estimated chronic daily dose equivalent to the reported chronic dietary endpoint.

[2] Seeds presented separately for dose – based EECs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

## Table I-4. Acute and Chronic RQ values for Birds, Reptiles, and Terrestrial-Phase Amphibians from Labeled Uses of Iprodione (T-REX v. 1.5.2, Mean Kenaga)

| Food Type | Acute Dose-Based RQ $LD_{50}$ = 930 mg a.i./kg-bw | | | Acute Dietary-Based RQ $LC_{50}$ = 1800 mg a.i./kg-diet | Chronic Dietary RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|---|
| | Small (20 g) | Medium (100 g) | Large (1000 g) | | |
| **Almonds (0.50 lb a.i./acre, 4x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | 0.25 | 0.11 | 0.04 | 0.08 | 0.49 |
| Tall grass | 0.11 | 0.05 | 0.02 | 0.03 | 0.21 |
| Broadleaf plants | 0.13 | 0.06 | 0.02 | 0.04 | 0.26 |
| Fruits/pods/seeds | 0.02 | 0.01 | <0.01 | 0.01 | 0.04 |
| Arthropods | 0.19 | 0.09 | 0.03 | 0.06 | 0.38 |
| Granivores | | | | | |
| Seeds[1] | <0.01 | <0.01 | <0.01 | N/A | N/A |
| **Lettuce – Broccoli - Lettuce (1.00 lbs ai/A, 3x, 10-day interval – 2x, 5-day interval – 3x, 10-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | 0.38 | 0.17 | 0.05 | 0.12 | 0.75 |
| Tall grass | 0.16 | 0.07 | 0.02 | 0.05 | 0.32 |
| Broadleaf plants | 0.20 | 0.09 | 0.03 | 0.07 | 0.39 |
| Fruits/pods/seeds | 0.03 | 0.01 | <0.01 | 0.01 | 0.06 |
| Arthropods | 0.29 | 0.13 | 0.04 | 0.10 | 0.57 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | <0.01 | <0.01 | N/A | N/A |
| **Lettuce (1.00 lbs ai/A, 3x, 10-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | 0.34 | 0.15 | 0.05 | 0.11 | 0.66 |
| Tall grass | 0.14 | 0.06 | 0.02 | 0.05 | 0.28 |
| Broadleaf plants | 0.18 | 0.08 | 0.03 | 0.06 | 0.35 |
| Fruits/pods/seeds | 0.03 | 0.01 | <0.01 | 0.01 | 0.05 |
| Arthropods | 0.26 | 0.12 | 0.04 | 0.08 | 0.51 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | <0.01 | <0.01 | N/A | N/A |
| **Broccoli (1.00 lb ai/A, 2x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | 0.28 | 0.12 | 0.04 | 0.09 | 0.54 |
| Tall grass | 0.12 | 0.05 | 0.02 | 0.04 | 0.23 |
| Broadleaf plants | 0.15 | 0.07 | 0.02 | 0.05 | 0.29 |
| Fruits/pods/seeds | 0.02 | 0.01 | <0.01 | 0.01 | 0.04 |
| Arthropods | 0.21 | 0.09 | 0.03 | 0.07 | 0.41 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | <0.01 | <0.01 | N/A | N/A |
| **Crucifer for Seed (2.00 lbs a.i./A, 3x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **0.79** | 0.35 | 0.11 | 0.26 | **1.5** |
| Tall grass | 0.33 | 0.15 | 0.05 | 0.11 | 0.65 |

| Food Type | Acute Dose-Based RQ LD$_{50}$ = 930 mg a.i./kg-bw | | | Acute Dietary-Based RQ LC$_{50}$ = 1800 mg a.i./kg-diet | Chronic Dietary RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|---|
| | Small (20 g) | Medium (100 g) | Large (1000 g) | | |
| Broadleaf plants | 0.42 | 0.19 | 0.06 | 0.14 | 0.82 |
| Fruits/pods/seeds | 0.06 | 0.03 | 0.01 | 0.02 | 0.13 |
| Arthropods | **0.60** | 0.27 | 0.09 | 0.20 | **1.2** |
| Granivores | | | | | |
| Seeds[1] | 0.01 | 0.01 | <0.01 | N/A | N/A |
| **Grapes (1.00 lb a.i./A, 4x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **0.50** | 0.22 | 0.07 | 0.16 | 0.98 |
| Tall grass | 0.21 | 0.10 | 0.03 | 0.07 | 0.42 |
| Broadleaf plants | 0.27 | 0.12 | 0.04 | 0.09 | 0.52 |
| Fruits/pods/seeds | 0.04 | 0.02 | 0.01 | 0.01 | 0.08 |
| Arthropods | 0.38 | 0.17 | 0.05 | 0.13 | 0.75 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | <0.01 | <0.01 | N/A | N/A |
| **Onion (1.00 lb a.i./A, 4x, 7-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | 0.48 | 0.21 | 0.07 | 0.16 | 0.93 |
| Tall grass | 0.20 | 0.09 | 0.03 | 0.07 | 0.39 |
| Broadleaf plants | 0.25 | 0.11 | 0.04 | 0.08 | 0.49 |
| Fruits/pods/seeds | 0.04 | 0.02 | 0.01 | 0.01 | 0.08 |
| Arthropods | 0.36 | 0.16 | 0.05 | 0.12 | 0.71 |
| Granivores | | | | | |
| Seeds[1] | 0.01 | <0.01 | <0.01 | N/A | N/A |
| **Potato (2.00 lbs ai/A, 4x, 5-day interval)** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **1.0** | 0.45 | 0.14 | 0.33 | **2.0** |
| Tall grass | 0.42 | 0.19 | 0.06 | 0.14 | 0.83 |
| Broadleaf plants | **0.53** | 0.24 | 0.08 | 0.17 | **1.0** |
| Fruits/pods/seeds | 0.08 | 0.04 | 0.01 | 0.03 | 0.16 |
| Arthropods | **0.77** | 0.34 | 0.11 | 0.25 | **1.5** |
| Granivores | | | | | |
| Seeds[1] | 0.02 | 0.01 | <0.01 | N/A | N/A |
| **Turf (5.51 lbs a.i./A, 6x, 14-day interval) – Max annual application rate = 24 lbs a.i./A/yr** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **2.2** | **0.99** | 0.31 | **0.72** | **4.3** |
| Tall grass | **0.93** | 0.42 | 0.13 | 0.30 | **1.8** |
| Broadleaf plants | **1.2** | **0.52** | 0.17 | 0.38 | **2.3** |
| Fruits/pods/seeds | 0.18 | 0.08 | 0.03 | 0.06 | 0.36 |
| Arthropods | **1.7** | **0.75** | 0.24 | **0.55** | **3.3** |
| Granivores | | | | | |
| Seeds[1] | 0.04 | 0.02 | 0.01 | N/A | N/A |
| **Ornamentals, Drench (4.00 lbs a.i./A, 6x, 15-day interval) – Max application rate = 24 lbs a.i./A/yr** | | | | | |
| Herbivores/Insectivores | | | | | |
| Short grass | **1.9** | **0.87** | 0.27 | **0.63** | **3.8** |
| Tall grass | **0.82** | 0.37 | 0.12 | 0.27 | **1.6** |
| Broadleaf plants | **1.0** | 0.46 | 0.15 | 0.33 | **2.0** |
| Fruits/pods/seeds | 0.16 | 0.07 | 0.02 | 0.05 | 0.31 |

| Food Type | Acute Dose-Based RQ LD$_{50}$ = 930 mg a.i./kg-bw | | | Acute Dietary-Based RQ LC$_{50}$ = 1800 mg a.i./kg-diet | Chronic Dietary RQ NOAEC = 300 mg a.i./kg-diet |
|---|---|---|---|---|---|
| | Small (20 g) | Medium (100 g) | Large (1000 g) | | |
| Arthropods | **1.5** | **0.66** | 0.21 | 0.48 | **2.9** |
| Granivores | | | | | |
| Seeds[1] | 0.04 | 0.02 | 0.01 | N/A | N/A |

**Bolded** values exceed the LOC for acute risk to non-listed species of 0.5 or the chronic risk LOC of 1.0. The endpoints listed in the table are the endpoint used to calculate the RQ.

[1] Seeds presented separately for dose – based RQs due to difference in food intake of granivores compared with herbivores and insectivores. This difference reflects the difference in the assumed mass fraction of water in their diets.

## Appendix J. Formation Decline Model Input Parameters

To better characterize the effects of the different fate parameters of iprodione and RP30228, EFED calculated iprodione plus RP30228 EECs for turf and 3 crop cycle lettuce-broccoli-lettuce crop rotation applications using the Formation-Decline method described in the 2020 iprodione Drinking Water Assessment (DP Barcode 457547). The model input parameters are given in **Table J-1 and J-2.** These parameters are the single system model inputs from the iprodione fate studies selected to generate upper bound EEC values when using the Formation-Decline routine in PWC. The application parameter (*e.g.* application rate, application date, spray drift parameters) are identical to the values used in the Total Residues modeling approach found in **Sectopm 8.1.1**.

**Table J-1. Iprodione SSD Aquatic Modeling Input Half-Lives and Formation Fractions for the PWC Chemical Tab.**

| Study | System Details | Model Input Parameters | | | Source/Study Classification/Comment |
|---|---|---|---|---|---|
| | | Iprodione | RP30228 | | |
| | | Half-Life (d) | Half-Life (d) | FF | |
| Abiotic Hydrolysis | pH 7, 25 °C | 0 (stable) | 0 (stable) | - | MRID 41885401. Acceptable Hydrolysis set to 0 (stable) to prevent double counting |
| Aqueous Photolysis | pH 5, 25ºC 28 °N sunlight (Florida) | 64 | ND | 0 | MRID 41861901. Acceptable |
| Aerobic Soil Metabolism | Loam, pH 4.2, 20 °C | 103 | 52.63 | 0.131 | MRID 49726502[N]. Supplemental |
| Aerobic Aquatic Metabolism | Sandy clay loam sediment, pH 7.5, 20 °C | 4.83 | 0 (stable) | 0.848 | MRID 49726503[N]. Supplemental |
| Anaerobic Aquatic Metabolism | Sandy clay loam sediment pH 6.7, 20 °C | 8.54 | 1551 | 0.859 | MRID 49726505[N]. Supplemental |

FF = Formation Fraction

**Table J-2. Additional Aquatic Modeling Input Parameters for the PWC Chemical Tab for Iprodione SSD.**

| Parameter (units) | Value | | Source | Comments |
|---|---|---|---|---|
| | Parent | RP30228 | | |
| $K_{OC}$ | 426 | 5492 | MRIDs 43349202 (Iprodione)<br><br>50586101 (RP30228) | Average organic carbon normalized sorption value. The coefficient of variation (CV) for the parent was 53% for $K_{OC}$ and 62% for $k_d$, indicating that $k_{OC}$ is a better predictor of the variability in sorption than $k_d$. The coefficient of variation for the RP30228 was 39% for $K_{OC}$ and 128% for $k_d$, indicating that $k_{OC}$ is a better predictor of the variability in sorption than $k_d$ |
| Foliar Half-life (days) | 0 (Stable) | 0 (Stable) | - | No data available. Assumed to be stable |
| Molecular Weight (g/mol) | 330.2 | 330.2 | - | Parent value based on chemical structure |
| Vapor Pressure (Torr) at 25°C | $2.7 \times 10^{-7}$ | $1.12 \times 10^{-11}$ | MRID 4777880 (parent value) | Degradate values estimated with Estimation Program Interface (EPI)Web Version 4.1. |
| Solubility in Water (mg/L) | 13 | 13.9 | MRID 47778802 (parent value) | Degradate values estimated with Estimation Program Interface (EPI)Web Version 4.1. |
| Unitless Henry's Law Constant | $3.69 \times 10^{-7}$ | -- | - | Calculated in PWC from the molecular weight, vapor pressure, and water solubility. |

Molecular weight, vapor pressure, and solubility in water were obtained from an EPISuite simulation using the SMILES code in the ROCKS table. EPIsuite predictions for parent were similar to the measured values.

## Appendix K. KABAM Inputs and Outputs

| Table 1. Chemical characteristics of Iprodione. | | |
|---|---|---|
| **Characteristic** | **Value** | **Comments/Guidance** |
| Pesticide Name | **Iprodione** | **Required input** |
| Log $K_{OW}$ | **3.24** | **Required input**<br>Enter value from acceptable or supplemental study submitted by registrant or available in scientific literature. |
| $K_{OW}$ | **1738** | No input necessary. This value is calculated automatically from the Log $K_{OW}$ value entered above. |
| $K_{OC}$ (L/kg OC) | **426** | **Required input**<br>Input value used in PRZM/EXAMS to derive EECs. Follow input parameter guidance for deriving this parameter value (USEPA 2002). |
| Time to steady state ($T_S$; days) | **3** | No input necessary. This value is calculated automatically from the Log $K_{OW}$ value entered above. |
| Pore water EEC (µg/L) | **251** | **Required input**<br>Enter value generated by PRZM/EXAMS benthic file. PRZM/EXAMS EEC represents the freely dissolved concentration of the pesticide in the pore water of the sediment. The appropriate averaging period of the EEC is dependent on the specific pesticide being modeled and is based on the time it takes for the chemical to reach steady state. Select the EEC generated by PRZM/EXAMS which has an averaging period closest to the time to steady state calculated above. In cases where the time to steady state exceeds 365 days, the user should select the EEC representing the average of yearly averages. The peak EEC should not be used. |
| Water Column EEC (µg/L) | **251** | **Required input**<br>Enter value generated by PRZM/EXAMS water column file. PRZM/EXAMS EEC represents the freely dissolved concentration of the pesticide in the water column. The appropriate averaging period of the EEC is dependent on the specific pesticide being modeled and is based on the time it takes for the chemical to reach steady state. The averaging period used for the water column EEC should be the same as the one selected for the pore water EEC (discussed above). |

| Table 11. Estimated concentrations of Iprodione in ecosystem components. | | | | |
|---|---|---|---|---|
| **Ecosystem Component** | **Total concentration (µg/kg-ww)** | **Lipid normalized concentration (µg/kg-lipid)** | **Contribution due to diet (µg/kg-ww)** | **Contribution due to respiration (µg/kg-ww)** |

| | | | | |
|---|---|---|---|---|
| Water (total)* | 251 | N/A | N/A | N/A |
| Water (freely dissolved)* | 251 | N/A | N/A | N/A |
| Sediment (pore water)* | 251 | N/A | N/A | N/A |
| Sediment (in solid)** | 4,277 | N/A | N/A | N/A |
| Phytoplankton | 20,603 | 1030136 | N/A | 20,602.72 |
| Zooplankton | 15,139 | 504621 | 9.26 | 15,129.37 |
| Benthic Invertebrates | 16,503 | 550094 | 25.82 | 16,477.01 |
| Filter Feeders | 10,935 | 546753 | 16.76 | 10,918.31 |
| Small Fish | 21,224 | 530611 | 99.30 | 21,125.13 |
| Medium Fish | 21,298 | 532459 | 187.53 | 21,110.81 |
| Large Fish | 21,425 | 535623 | 335.24 | 21,089.67 |
| * Units: µg/L; **Units: µg/kg-dw | | | | |

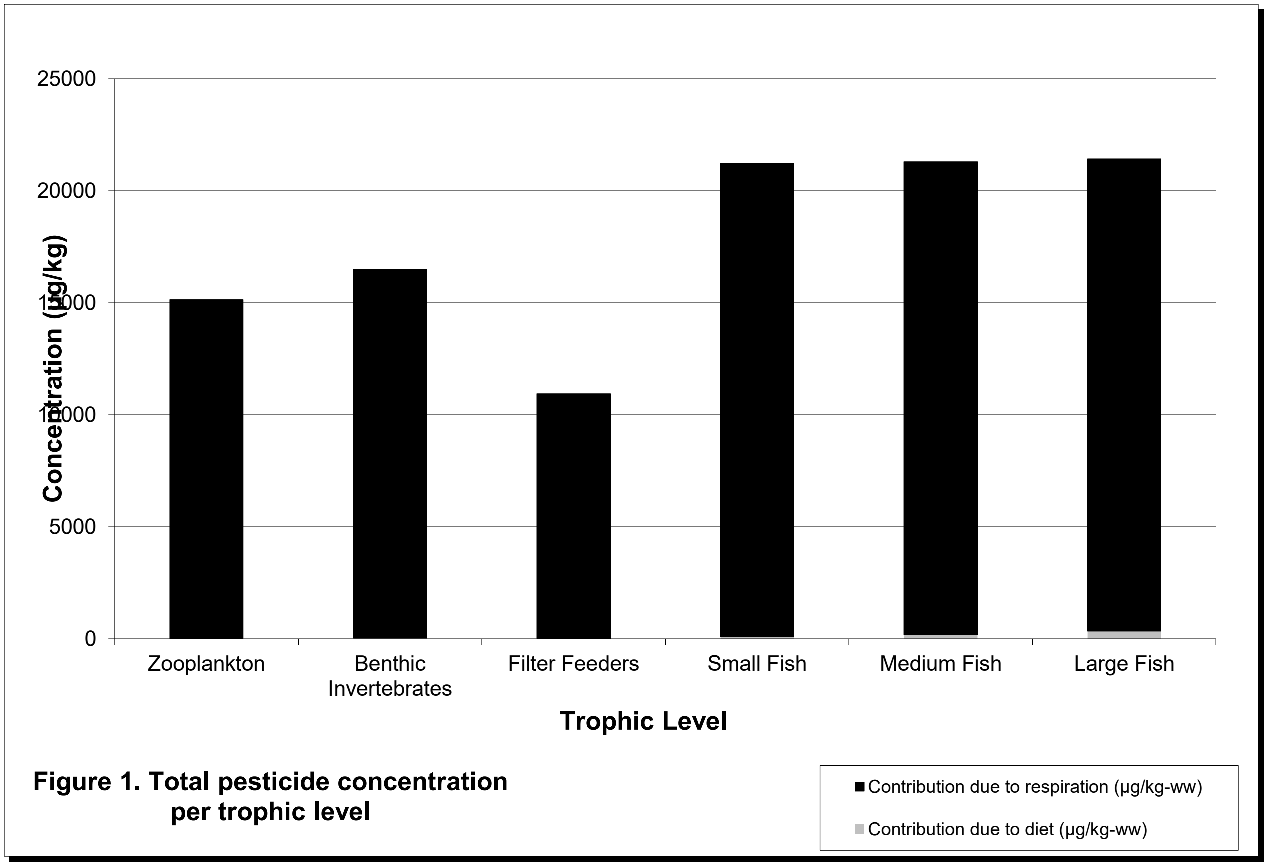



**Figure 1. Total pesticide concentration per trophic level**

| **Table 12. Total BCFand BAF values of Iprodione in aquatic trophic levels.** | | |
|---|---|---|
| **Trophic Level** | **Total BCF (µg/kg-ww)/(µg/L)** | **Total BAF (µg/kg-ww)/(µg/L)** |
| Phytoplankton | 84 | 82 |
| Zooplankton | 60 | 60 |

| | | |
|---|---|---|
| Benthic Invertebrates | 66 | 66 |
| Filter Feeders | 44 | 44 |
| Small Fish | 84 | 85 |
| Medium Fish | 84 | 85 |
| Large Fish | 84 | 85 |

**Table 13. Lipid-normalized BCF, BAF, BMF and BSAF values of Iprodione in aquatic trophic levels.**

| Trophic Level | BCF (µg/kg-lipid)/(µg/L) | BAF (µg/kg-lipid)/(µg/L) | BMF (µg/kg-lipid)/(µg/kg-lipid) | BSAF (µg/kg-lipid)/(µg/kg-OC) |
|---|---|---|---|---|
| Phytoplankton | 4216 | 4104 | N/A | 10 |
| Zooplankton | 2009 | 2010 | 0.49 | 5 |
| Benthic Invertebrates | 2189 | 2192 | 1.09 | 5 |
| Filter Feeders | 2176 | 2178 | 1.08 | 5 |
| Small Fish | 2106 | 2114 | 1.01 | 5 |
| Medium Fish | 2106 | 2121 | 0.99 | 5 |
| Large Fish | 2106 | 2134 | 1.01 | 5 |

**Table 14. Calculation of EECs for mammals and birds consuming fish contaminated by Iprodione.**

| Wildlife Species | Biological Parameters | | | | EECs (pesticide intake) | |
|---|---|---|---|---|---|---|
| | Body Weight (kg) | Dry Food Ingestion Rate (kg-dry food/kg-bw/day) | Wet Food Ingestion Rate (kg-wet food/kg-bw/day) | Drinking Water Intake (L/d) | Dose Based (mg/kg-bw/d) | Dietary Based (ppm) |
| **Mammalian** | | | | | | |
| fog/water shrew | 0.02 | 0.140 | 0.585 | 0.003 | 9.695 | 16.50 |
| rice rat/star-nosed mole | 0.1 | 0.107 | 0.484 | 0.011 | 7.881 | 16.22 |
| small mink | 0.5 | 0.079 | 0.293 | 0.048 | 6.274 | 21.30 |
| large mink | 1.8 | 0.062 | 0.229 | 0.168 | 4.904 | 21.30 |
| small river otter | 5.0 | 0.052 | 0.191 | 0.421 | 4.090 | 21.30 |
| large river otter | 15.0 | 0.042 | 0.157 | 1.133 | 3.385 | 21.42 |
| **Avian** | | | | | | |
| sandpipers | 0.0 | 0.228 | 1.034 | 0.004 | 16.8753 | 16.27 |
| cranes | 6.7 | 0.030 | 0.136 | 0.211 | 2.2225 | 16.30 |

| | | | | | | |
|---|---|---|---|---|---|---|
| rails | 0.1 | 0.147 | 0.577 | 0.010 | 10.9266 | 18.86 |
| herons | 2.9 | 0.040 | 0.157 | 0.120 | 2.9854 | 18.90 |
| small osprey | 1.3 | 0.054 | 0.199 | 0.069 | 4.2608 | 21.30 |
| white pelican | 7.5 | 0.029 | 0.107 | 0.228 | 2.2936 | 21.42 |

**Table 15. Calculation of toxicity values for mammals and birds consuming fish contaminated by Iprodione.**

| Wildlife Species | Toxicity Values | | | |
|---|---|---|---|---|
| | Acute | | Chronic | |
| | Dose Based (mg/kg-bw) | Dietary Based (mg/kg-diet) | Dose Based (mg/kg-bw) | Dietary Based (mg/kg-diet) |
| **Mammalian** | | | | |
| fog/water shrew | 2435.89 | N/A | 31.50 | 300 |
| rice rat/star-nosed mole | 1652.42 | N/A | 21.37 | 300 |
| small mink | 1089.36 | N/A | 14.09 | 300 |
| large mink | 770.29 | N/A | 9.96 | 300 |
| small river otter | 596.67 | N/A | 7.72 | 300 |
| large river otter | 453.37 | N/A | 5.86 | 300 |
| **Avian** | | | | |
| sandpipers | 670.00 | 1800.00 | N/A | 300 |
| cranes | 1602.62 | 1800.00 | N/A | 300 |
| rails | 808.51 | 1800.00 | N/A | 300 |
| herons | 1413.45 | 1800.00 | N/A | 300 |
| small osprey | 1245.82 | 1800.00 | N/A | 300 |
| white pelican | 1629.97 | 1800.00 | N/A | 300 |

**Table 16. Calculation of RQ values for mammals and birds consuming fish contaminated by Iprodione.**

| Wildlife Species | Acute | | Chronic | |
|---|---|---|---|---|
| | Dose Based | Dietary Based | Dose Based | Dietary Based |

| | | | | |
|---|---|---|---|---|
| **Mammalian** | | | | |
| fog/water shrew | 0.004 | N/A | 0.308 | 0.055 |
| rice rat/star-nosed mole | 0.005 | N/A | 0.369 | 0.054 |
| small mink | 0.006 | N/A | 0.445 | 0.071 |
| large mink | 0.006 | N/A | 0.492 | 0.071 |
| small river otter | 0.007 | N/A | 0.530 | 0.071 |
| large river otter | 0.007 | N/A | 0.577 | 0.071 |
| **Avian** | | | | |
| sandpipers | 0.025 | 0.009 | N/A | 0.054 |
| cranes | 0.001 | 0.009 | N/A | 0.054 |
| rails | 0.014 | 0.010 | N/A | 0.063 |
| herons | 0.002 | 0.011 | N/A | 0.063 |
| small osprey | 0.003 | 0.012 | N/A | 0.071 |
| white pelican | 0.001 | 0.012 | N/A | 0.071 |

## **Appendix L.** Supporting information on Extraction Procedures and Unextracted Residues

One of the uncertainties in the iprodione studies are the high amount of unextracted residues formed in the aerobic soil metabolism studies (up to 87%), uncertainty in whether those residues could be available for exposure, and whether those residues may or may not be 3,5-DCA or another residue of concern. Overall, while there is still some uncertainty in whether a portion of the unextracted residues may be available for exposure (especially when the contact time between iprodione or 3,5-DCA and soil is weeks rather than months) the weight of evidence supports the assumption that the unextracted residues in both iprodione and 3,5-DCA studies may be assumed to be unavailable for exposure and not a major uncertainty in the risk assessment.

The registrant conducted an analysis of extraction solvents and procedures for 3,5-DCA aged with soil for 30-days (MRID 47870501). The total amount of radioactivity removed using a range of solvents was near 30% applied radioactivity, and approximately 20 to 30% of applied radioactivity is extracted consistently across the aerobic soil studies for both 3,5-DCA and iprodione. While acetonitrile:water (8:2) with 1% acetic acid extracted the highest amount of radioactivity across the solvents examined, all of the solvents removed some amount of radioactive material with each extraction.

Most of the fate studies submitted utilized some form of acetonitrile extraction, pure acetonitrile, acetonitrile:water (8:2), and acidified acetonitrile. One aerobic soil study conducted with iprodione showed minimal additional radioactivity was removed when a range of polar and nonpolar solvents were utilized in the 181-day samples (43091002). Additionally, anilines are known to commonly covalently bind to organic matter (Thorn *et al.*, 1996). There remains some uncertainty in the unextracted residues as in a newly submitted study, 2/3 of the unextracted residues present at 7-days after treatment (~14% of 22%AR), were removed with additional extractions (including acetonitrile solvents). These results suggest that in this study, more contact time with the solvents, soxhlet extractions, or additional extractions with the acetonitrile solvents improve extraction recovery. However, considering all lines of evidence, it is defensible to move forward assuming unextracted residues are not a major uncertainty in the exposure assessment. Each of these studies are discussed in more detail below.

The unextracted residue guidance indicates that if a range of polar and non-polar solvents are used in the studies, then the unextracted residues may assumed to be unavailable for exposure. This has historically been a consideration for iprodione. In the 2012 DWA, the majority of the unextracted residues were assumed to be 3,5-DCA, based on data that 3,5-DCA may form covalent bonds with anilines (Thorn *et al.*, 1996). These were assumed to be available for exposure as the unextracted residue guidance was not available at the time to consider the extraction procedures and the availability of the unextracted residues for potential exposure.

The registrant submitted a study examining extraction solvents and recoveries for 3,5-DCA (MRID 47870501) and a range of extraction solvents in a single silt loam soil. First, samples were shaken for 20-minutes in 0.01 M $CaCl_2$, toluene, hexane, or acetonitrile:water (8:2) with 1% acetic acid. These extractions were repeated twice for a total of three 20-minute extractions. Two of the toluene and hexane samples were also used in a 10-minute accelerated solvent extraction (ASE) at 80$^oC$ with 10-minute flushes of toluene or hexane. After the solvent and ASE extractions, the soils were sequentially extracted three times with acetonitrile:water (8:2) with 1% acetic acid with shaking. Finally, samples were also extracted using ASE and the acetonitrile:water (8:2) with 1% acetic acid. The acetonitrile:water (8:2) with 1% acetic acid extracted the greatest total radioactive fraction (6-16% AR) while the toluene and hexane extractions removed 2 to 8% AR. The total extracted radioactivity across all extractions ranged from 29 to 31%. These results suggest that the most successful solvent system for extraction of 3,5-DCA is the acetonitrile:water (8:2) with 1% acetic acid. Small amounts of additional radioactivity may be released with nonpolar solvents (toluene and hexane) as well.

In an aerobic soil metabolism study (MRID 43091002) on the metabolism of iprodione in a sandy loam soil up to 87% unextracted residues remained after using a three-hour Soxhlet extraction with acetonitrile. The 181-day samples were further extracted sequentially with isooctane, methylene chloride, ethyl acetate, and acetonitrile:water:acetic acid (3:1:1) overnight. The additional extractions only released an additional 0.2, 0.8, and 0.9% AR. This indicates that the unextracted residues that were aged for 181-days could be considered unavailable for exposure.

In an aerobic soil metabolism study (MRID 49726502) submitted after the 2012 DWA was completed, metabolism of iprodione on three soils was examined. The soils were extracted three times by shaking at room temperature with acetonitrile for 60 minutes. Unextracted residues comprised maximums of 43 to 61% of the applied. In a preliminary test, 7-day samples were also extracted with 1% acetic acid in acetonitrile, methylene chloride, and ethyl acetate and Soxhlet extractions with acetonitrile, 1% acetic acid in acetonitrile, methylene chloride and ethyl acetate. Most extractions removed an additional 1 to 2% AR; however the Soxhlet extractions with acetonitrile and with 1% acetic acid in acetonitrile each removed an additional 4% AR. In total of an additional 14-15% AR of 21-23% (~2/3) of unextracted residues were available for extraction in these samples. The identity of the extracted materials was not determined. These results indicate that when soils and iprodione are in contact for a short period of time, about 2/3$^{rd}$ of the unextracted residues in the study would still be available for exposure in this study with more robust extractions.

The final evidence to consider when understanding the unextracted residues are the results observed in the aerobic soil metabolism studies conducted with 3,5-DCA as the test material. In these studies, there were similar amounts of unextracted residues (up to 68% of the applied) as those observed in the studies with iprodione as the starting material. The extractions solvents utilized in the studies included acetontrile:water (8:2) or acetonitrile:water (8:2) with 1% acetic acid. When adding the 3,5-DCA and the unextracted residues in the studies, the total radioactivity was 90 to 100%, suggesting that loss of 3,5-DCA mainly occurred via formation of unextracted residues.

Tables L-1 and L-2 provide summaries of the metabolism studies with soil and sediment, including information on the degradation rates, maximum amount of unextracted residues formed, maximum amount of 3,5-DCA formed , and the extraction procedures utilized in the studies.

**Table L-1. Summary of the Extraction Procedures, Formation of 3,5-DCA, and Maximum Unextracted Residues Observed in Fate Studies with Iprodione as the Test Material**

| Study | System Details | Iprodione Degradation (days) (kinetic model)[1] | | Formation-Decline SFO Degradation Half-Life (days) | | Source/Study Classification/Comment | Maximum Amount Formed | | Extraction Summary |
|---|---|---|---|---|---|---|---|---|---|
| | | $DT_{50}$ | $DT_{90}$ | Iprodione | RP30228 | | Unextracted | 3,5-DCA | |
| Aerobic Soil | Sandy loam, pH 5.75, 25°C | 16.3 (SFO) | 54 (SFO) | 16.3 | 68.9 | MRID 43091002. Acceptable | 87% (181-d) | 9% (30-d)<br>ND (276-d) | Soxhlet in ACN for 3 hrs at room temperature; 181-day samples were further extracted sequentially with isooctane, DCM, ethyl acetate, and ACN:water:acetic acid (3:1:1, v:v:v) overnight. Significant additional residues not removed with added solvents. |
| Aerobic Soil | Sandy loam, pH 6.9, 20 °C | 7.96 (SFO) | 26.4 (SFO) | - | - | MRID 49726502[N]. Supplemental Material balance ranged from 61-91% in the sandy loam soil from day 60 onward. | 61%, (101-d) | 30%-(28d)<br>13% (122d) | 3 shaking in ACN at room temperature.<br>See additional info on preliminary extractions of 7-day samples (2/3 of unextracted residues extracted with more 1% acetic acid :ACN). |
| Aerobic Soil | Clay loam, pH 7.3, 20 °C | 9.0 (IORE) | 107 (IORE) | 12.9 | 74.5 | | | | |
| Aerobic Soil | Loam, pH 4.2, 20 °C | 103 (IORE) | 1280 (IORE) | 103 | 52.6 | | | | |
| Aerobic Aquatic | Silt loam sediment, pH 6.3, 20 °C | 9 (SFO-LN) | - | - | - | MRID 41927601/42503801. Supplemental. Study duration was only 30 day, insufficient to assess the persistence of the ROC. | ND | 12% (30-d) | - 3x ACN:methanol: water: hydrochloric acid (50:40:10:0.2,v.v.v.v) with sonication at room temperature<br>- 14, 30-day 2-hr reflux same solvent as above<br>- -0-day acetone: water:phosphoric acid (66:33:1) with sonication and reflux |

| Study | System Details | Iprodione Degradation (days) (kinetic model)[1] | | Formation-Decline SFO Degradation Half-Life (days) | | Source/Study Classification/Comment | Maximum Amount Formed | | Extraction Summary |
|---|---|---|---|---|---|---|---|---|---|
| | | $DT_{50}$ | $DT_{90}$ | Iprodione | RP30228 | | Unextracted | 3,5-DCA | |
| | Sandy clay loam sediment, pH 7.5, 20 °C | 2.51 (IORE) | 32.3 (IORE) | 4.83 | Stable | MRID 49726503[N]. Supplemental | 5% (28-d) | (0.8%, 7 days) | 3x shaking 0.1% formic acid in ACN at room temperature |
| | Clay loam sediment, pH 8.3, 20 °C | 2.74 (IORE) | 39 (IORE) | 4.61 | 2858 | | (25.2%, 102 days) | (1.1%, 102 days) | |
| Anaerobic Aquatic | Sandy clay loam sediment pH 6.7, 20°C | 7.27 (IORE) | 39.0 (IORE) | 8.54 | 1551 | MRID 49726505[N]. Supplemental | 4.4% (101-d) | 1.5% (60-d)<br>0.9 (101-d) | 3x shaking 0.1% formic acid in ACN at room temperature |
| | Clay loam sediment, pH 7.6, 20°C | 5.38 (IORE) | 25.2 (IORE) | 6.01 | 575 | | 9% (101-d) | | |

ACN=acetonitrile; DCM=methylene chloride; SFO=single first order; DFOP=double first order in parallel; IORE=indeterminate order (IORE); SFO $DT_{50}$=single first order half-life; $T_{IORE}$=the half-life of a SFO model that passes through a hypothetical $DT_{90}$ of the IORE fit; DFOP slow $DT_{50}$=slow rate half-life of the DFOP fit, -=not available or applicable; SFO-LN=SFO calculated using natural log transformed data; N/D = parent+material balance kinetics not calculated for this study

[N] Studies submitted since the problem formulation was completed are designated with an N associated with the MRID number.

[1] The model chosen is consistent with that recommended guidance (USEPA, 2015b)

**Table 0-1. Summary of Environmental Degradation Data for 3,5-DCA and 3,5-DCA Plus Material Balances.**

| Study | System Details | Degradation Times (days) (kinetic model)[1] | | | | Source/Study Classification/Comment | Maximum Unextracted | Extraction Procedure |
|---|---|---|---|---|---|---|---|---|
| | | Parent | | Parent+Material Balance[2] | | | | |
| | | $DT_{50}$ | $DT_{90}$ | $DT_{50}$ | $DT_{90}$ | | | |
| Aerobic Soil | Sandy loam, pH 5.75, 25 °C | 50.2 (SFO) | - | - | - | MRID 43091002 Test material: iprodione | 87% (181-d) | Soxhlet in ACN for 3 hrs at room temperature; 181-day samples were further extracted sequentially with isooctane, DCM, ethyl acetate, and ACN:water:acetic acid (3:1:1, v:v:v) overnight. Significant additional residues not removed. |
| Aerobic Soil | Silt Loam, pH 6.9, 25 °C | 17.6 (SFO) | - | - | - | MRID 45239201. Supplemental | 76-81% | - One extraction with acetontile:water (80:20, v:v) for 30 minutes<br>- Soxhlet extraction with methanol for 6 hours<br>- A 4-month sandy loam reserve sample was further extracted with acetone:water:phosphoric acid (90:8:2) |
| Aerobic Soil | Sandy Loam, pH 7.3, 25 °C | 7.9 (SFO) | - | - | - | | 60-66% | |
| Aerobic Soil | silt loam, pH 6.7, 1.5 mg/kg app rate, 20 °C | 39.6 (SFO) | - | - | - | MRID 48219201. Only the highest representative half-life from a soil was used to calculate model input half-life. | 68-69% | Shaking once with 0.01M calcium chloride, shaking once with by acidified (1% acetic acid) acetonitrile:water (8:2, v:v) and ASE with acidified (1% acetic acid) acetonitrile:water (8:2, v:v; p. 23). Shaker table extractions were completed at room temperature. |
| Aerobic Soil | silt loam, pH 6.7, 8.3 mg/kg app rate, 20 °C | 48.8 (SFO) | - | - | - | | | |
| Aerobic Soil | sand, pH 5.7, 1.5 mg/kg app rate, 20 °C | 59 (SFO) | - | - | - | | | |
| Aerobic Soil | sand, pH 5.7, 8.3 mg/kg app rate, 20 °C | 107 (SFO) | - | - | - | | | |
| Aerobic Aquatic | Rio Linda water:sandy loam, pH 6.3, 20 °C | 26.1 (SFO) | 86.7 (SFO) | 78.6 (DFOP) | 341 (DFOP) | MRID 49726504[N]. Supplemental due to material balance issues and inadequate extraction[3]. | 55% | Extracted 3x with 0.1% formic acide in ACN by shaking at room temperature (time not reported in DER). |
| Aerobic Aquatic | Goose River water:clay loam, pH 7.6, 20 °C | 12.3 (IORE) | 355 (IORE) | 113 (DFOP) | 767 (DFOP) | | 40% | |
| Anaerobic Aquatic | Rio Linda water:sandy loam, pH 6.3, 20 °C | 103 (IORE) | 1107 (IORE) | 197 (SFO) | 655 (SFO) | MRID 49726506[N]. Supplemental due to material balance issues and inadequate extraction[4]. | 27% | |
| Anaerobic Aquatic | Goose River water:clay loam, pH 7.6, 20 °C | 91.2 (IORE) | 2525 (IORE) | 192 (SFO) | 636 (SFO) | | 25% | |

ACN=acetonitrile; DCM=methylene chloride; SFO=single first order; DFOP=double first order in parallel; IORE=indeterminate order (IORE); SFO $DT_{50}$=single first order half-life; $T_{IORE}$=the half-life of a SFO model that passes through a hypothetical $DT_{90}$ of the IORE fit; DFOP slow $DT_{50}$=slow rate half-life of the DFOP fit, -=not available or applicable; SFO-LN=SFO calculated using natural log transformed data; N/D = parent+material balance kinetics not calculated for this study

[N] Studies submitted since the problem formulation was completed are designated with an N associated with the MRID number.

[1] The model chosen is consistent with that recommended guidance (USEPA, 2015b).

[2] The calculated half-live values represent residues of 3,5-DCA plus the estimated missing material balance that is assumed to be 3,5-DCA.

[3] Material balance ranged from 56.5-100.9, and was below guideline recommended 90-110% threshold from 14 days after treatment (DAT) onward. Extraction protocol did not utilize multiple solvents with different dielectric constants.

[4] Material balance ranged from 75.6-101.6% and was below guideline 90-110% threshold from 14 days after treatment onward. Extraction protocol did not utilize multiple solvents with different dielectric constants.