Proposed Registration Decision PRD2016-20

Mandipropamid

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Overview

Proposed Registration Decision for Mandipropamid

Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing full registration for the sale and use of Mandipropamid Technical Fungicide and Revus Fungicide, containing the technical grade active ingredient mandipropamid, as a seed treatment on potato seed pieces to control late blight.

Mandipropamid Technical Fungicide (Registration Number 29073) and Revus Fungicide (Registration Number 29074) are fully registered in Canada for foliar use on a variety of crops. The detailed review for the foliar uses can be found in Evaluation Report ERC2009-01, *Mandipropamid Technical Fungicide*, Proposed Registration Decision PRD2012-23, *Mandipropamid* and Registration Decision RD2013-13, *Mandipropamid*. The current applications were to add a new use for mandipropamid as a seed treatment on potatoes.

An evaluation of available scientific information found that, under the approved conditions of use, the product has value and does not present an unacceptable risk to human health or the environment.

This Overview describes the key points of the evaluation, while the Science Evaluation provides detailed technical information on the human health, environmental and value assessments of Mandipropamid Technical Fungicide and Revus Fungicide.

What Does Health Canada Consider When Making a Registration Decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable[1] if there is reasonable certainty that no harm to human health, future generations or the environment will result from use or exposure to the product under its proposed conditions of registration. The Act also requires that products have value[2] when used according to the label directions. Conditions of registration may include special precautionary measures on the product label to further reduce risk.

To reach its decisions, the PMRA applies modern, rigorous risk-assessment methods and policies. These methods consider the unique characteristics of sensitive subpopulations in humans (for example, children) as well as organisms in the environment. These methods and policies also consider the nature of the effects observed and the uncertainties when predicting the

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1 "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act.*

2 "Value" as defined by subsection 2(1) of the *Pest Control Products Act*: "… the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (*a*) efficacy; (*b*) effect on host organisms in connection with which it is intended to be used; and (*c*) health, safety and environmental benefits and social and economic impact."

impact of pesticides. For more information on how the PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the Pesticides and Pest Management portion of Health Canada's website at healthcanada.gc.ca/pmra.

Before making a final registration decision on mandipropamid, the PMRA will consider any comments received from the public in response to this consultation document.[3] The PMRA will then publish a Registration Decision[4] on mandipropamid, which will include the decision, the reasons for it, a summary of comments received on the proposed final registration decision and the PMRA's response to these comments.

For more details on the information presented in this Overview, please refer to the Science Evaluation of this consultation document.

What Is Mandipropamid?

Mandipropamid is a fungicide that is active against several plant diseases, including late blight caused by the pathogen, *Phytophthora infestans*, which is a major disease of potato.

Health Considerations

Can Approved Uses of Mandipropamid Affect Human Health?

Products containing mandipropamid are unlikely to affect your health when used according to the label directions.

Potential exposure to mandipropamid may occur through the diet (food and water) or when handling and applying the products or when entering treated sites. When assessing health risks, two key factors are considered: the levels where no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). Only uses for which the exposure is well below levels that cause no effects in animal testing are considered acceptable for registration.

Toxicology studies in laboratory animals describe potential health effects from varying levels of exposure to a chemical and identify the dose where no effects are observed. The health effects noted in laboratory animals occur at doses more than 100-times higher (and often much higher) than levels to which humans are normally exposed when pesticide products are used according to label directions.

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3 "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

4 "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

In laboratory animals, mandipropamid was of low acute oral, dermal and inhalation toxicity. It was minimally irritating to the eyes and skin and did not cause an allergic skin reaction.

The acute toxicity of the end-use product, Revus Fungicide, in laboratory animals was low via the oral, dermal and inhalation routes of exposure. It was minimally irritating to the eye and skin and did not cause an allergic skin reaction.

Short-term and long-term (lifetime) animal toxicity tests were assessed for the potential of mandipropamid to cause neurotoxicity, immunotoxicity, chronic toxicity, cancer, reproductive and developmental toxicity, genetic damage, and various other effects. The most sensitive endpoints for risk assessment included effects on body weight and the liver. There was no evidence that the young were more sensitive to mandipropamid than the adult animal. The risk assessment protects against these effects and other potential effects by ensuring that the level of human exposure is well below the lowest dose at which these effects occurred in animal tests.

Residues in Water and Food

Dietary risks from food and drinking water are not of health concern.

Aggregate dietary intake estimates (food plus drinking water) revealed that the general population and children one to two years old, the subpopulation which would ingest the most mandipropamid relative to body weight, are expected to be exposed to less than 6.3% of the acceptable daily intake. Based on these estimates, the chronic dietary risk from mandipropamid is not of health concern for all population subgroups.

Animal studies revealed no acute health effects. Consequently, a single dose of mandipropamid is not likely to cause acute health effects in the general population (including infants and children).

The *Food and Drugs Act* prohibits the sale of adulterated food, that is, food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act*. Food containing a pesticide residue that does not exceed the established MRL does not pose an unacceptable health risk.

Residue trials conducted throughout Canada (and the United States) using mandipropamid on potatoes are acceptable. The MRL for this active ingredient can be found in the Science Evaluation of this consultation document.

Occupational Risks From Handling Revus Fungicide

Occupational risks are not of concern when Revus Fungicide is used according to the proposed label directions, which include protective measures.

Workers treating potato seed pieces with Revus Fungicide in commercial treatment facilities and on-farm and those handling and planting treated potato seed pieces can come into direct contact with mandipropamid residues on the skin and through inhalation. Therefore, the label specifies

that workers must wear coveralls over long-sleeved shirt, long pants, chemical-resistant gloves, socks and boots during mixing, loading, application, clean-up, and repair. Workers handling or planting treated potato seed pieces or those working with or around equipment used to transport treated potato seed pieces, must wear a long-sleeved shirt, long pants, gloves, socks and boots. It is also recommended to wear a NIOSH-approved N95 (minimum) filtering face piece respirator (dust mask) that is properly fit tested during all job activities given that there can be direct contact through inhalation not to mention its utility for good hygiene purposes. Taking into consideration these label statements, and the exposure period for handlers and workers, the risk to these individuals is not a concern.

For bystanders, exposure is considered negligible. Therefore, health risks to bystanders are not of concern.

Environmental Considerations

What Happens When Mandipropamid is Introduced Into the Environment?

When used according to the label directions as a seed treatment for potatoes, mandipropamid is not expected to pose risks of concern to the environment.

Mandipropamid can enter the environment when used as a fungicide on seed potatoes. Mandipropamid is broken down readily in soil, water and sediment, mainly by bacteria. Mandipropamid is not expected to enter the atmosphere and be transported to areas far from where it was applied. No major breakdown products of mandipropamid were identified in the soil laboratory studies, but some were identified in studies conducted in water. Mandipropamid can enter the aquatic environment through runoff from the area where it is being used. Limited runoff of mandipropamid and its breakdown products is expected based on the environmental fate characteristics of these chemicals and the proposed use pattern as a potato seed piece treatment. If mandipropamid enters the water, it will rapidly move from the water layer to the sediments where it will be broken down by microorganisms. Exposure to sunlight will also contribute to its breakdown in water. Mandipropamid is not expected to move downward through the soil to enter groundwater, and is not expected to accumulate in the tissues of organisms.

Major breakdown products of mandipropamid are not expected to be present in runoff but may be found in water if large enough quantities of mandipropamid were to enter the aquatic environment. Mandipropamid is not expected to pose risks of environmental concern to terrestrial or aquatic organisms.

Value Considerations

What Is the Value of Revus Fungicide?

A single application of Revus Fungicide provides control of seed-borne late blight when applied to potato seed pieces prior to disease development. Mandipropamid has a different mode of action and a lower risk of resistance development than fenamidone, the only other fungicide active ingredient registered to control seed-borne late blight.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law.

The key risk-reduction measures being proposed on the label of Revus Fungicide to address the potential risks identified in this assessment are as follows.

Key Risk-Reduction Measures

Human Health

Because workers can come into direct contact with Revus Fungicide on the skin or through inhalation, personal protective equipment is required. Workers must wear coveralls over long-sleeved shirt, long pants, chemical-resistant gloves, socks and boots during mixing, loading, application, clean-up, and repair. Workers handling or planting treated potato seed pieces or those working with or around equipment used to transport treated potato seed pieces, must wear a long-sleeved shirt, long pants, gloves, socks and boots. It is also recommended to wear a NIOSH-approved N95 (minimum) filtering face piece respirator (dust mask) that is properly fit tested during all job activities given that there can be direct contact through inhalation not to mention its utility for good hygiene purposes.

Next Steps

Before making a final registration decision on mandipropamid as a seed treatment on potatoes, the PMRA will consider any comments received from the public in response to this consultation document. The PMRA will accept written comments on this proposal up to 45 days from the date of publication of this document. Please note that, to comply with Canada's international trade obligations, consultation on the proposed MRLs will also be conducted internationally via a notification to the World Trade Organization. Please forward all comments to Publications (contact information on the cover page of this document). The PMRA will then publish a Registration Decision, which will include its decision, the reasons for it, a summary of comments received on the proposed final decision and the Agency’s response to these comments.

Other Information

When the PMRA makes its registration decision, it will publish a Registration Decision on mandipropamid as a seed treatment on potatoes (based on the Science Evaluation of this consultation document). In addition, the test data referenced in this consultation document will be available for public inspection, upon application, in the PMRA’s Reading Room (located in Ottawa).

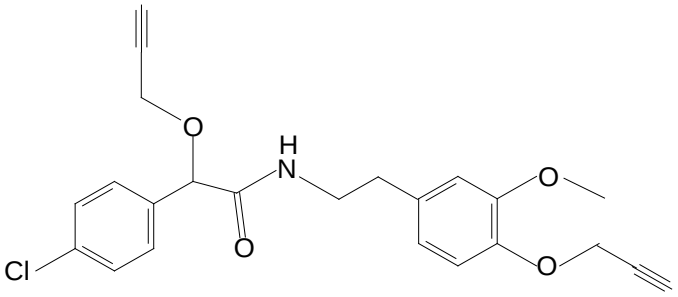
Science Evaluation

Mandipropamid

Mandipropamid Technical Fungicide and Revus Fungicide are currently registered for use as a foliar treatment on a variety of crops. The detailed review for the foliar uses can be found in Evaluation Report ERC2009-01, *Mandipropamid Technical Fungicide,* Proposed Registration Decision PRD2012-23, *Mandipropamid* and Registration Decision RD2013-13, *Mandipropamid*.

1.0 The Active Ingredient, Its Properties and Uses

1.1 Identity of the Active Ingredient

Active substance	Mandipropamid
Function	Fungicide
Chemical name	
1. International Union of Pure and Applied Chemistry (IUPAC)	(*RS*)-2-(4-chlorophenyl)-*N*-[3-methoxy-4-(prop-2-ynyloxy)phenethyl]-2-(prop-2-ynyloxy)acetamide
2. Chemical Abstracts Service (CAS)	4-chloro-*N*-[2-[3-methoxy-4-(2-propynyloxy)phenyl]ethyl]-α-(2-propynyloxy)benzeneacetamide
CAS number	374726-62-2
Molecular formula	$C_{23}H_{22}ClNO_4$
Molecular weight	411.9
Structural formula	
Purity of the active ingredient	96% nominal

1.2 Physical and Chemical Properties of the Active Ingredients and End-Use Product

Technical Product—Mandipropamid Technical Fungicide

Property	Result
Colour and physical state	Light beige powder
Odour	Odourless
Melting range	96.4-97.3°C
Boiling point	Not applicable for a solid
Density	1.24 g/cm^3
Vapour pressure at 20°C	< 9.4×10^{-7} Pa
Henry's law constant at 25°C	< 9.2×10^{-5} Pa m^3 / mol < 9.1×10^{-10} atm m^3/mol
Ultraviolet (UV)-visible spectrum	λ_{max} at 223 nm and 276 nm, with no other absorbance maxima observed between 350 and 750 nm
Solubility in water at 25°C	4.2 mg/L
Solubility in organic solvents at 25°C	Solvent — Solubility (g/L) acetone 300 dichloromethane 400 ethyl acetate 120 methanol 66 n-hexane 42 toluene 29 n-octanol 4.8
n-Octanol-water partition coefficient (K_{ow})	pH — log K_{ow} 7.5-7.7 — 3.2
Dissociation constant (pK_a)	No dissociation between pH 1 and 12
Stability (temperature, metal)	Stable to metals and elevated temperature

End-Use Product— Revus Fungicide

Property	Result
Colour	Light beige
Odour	No particular odour
Physical state	Liquid
Formulation type	Suspension
Guarantee	250 g/L nominal
Container material and description	HDPE (non-fluorinated and fluorinated), PET or COEX material, in sizes 250 mL to bulk
Density	1.07 g/mL
pH of 1% dispersion in water	6-8
Oxidizing or reducing action	Not an oxidizing substance
Storage stability	Stable in commercial packaging for one year at 20ºC
Corrosion characteristics	Not corrosive to commercial packaging over one year at 20ºC
Explodability	Not explosive

1.3 Directions for Use

Revus Fungicide may be applied once to one lot of potato seed pieces at 13-26 g product/100 kg seed, equivalent to 3.25 to 6.5 kg a.i./100 kg seed. The higher end of the rate range is for use under conditions favouring development of heavy late blight disease pressure. Revus Fungicide is applied using standard seed treatment equipment that provides uniform coverage.

1.4 Mode of Action

Mandipropamid inhibits the synthesis of cellulose in oomycetous fungi, including *Phytophthora infestans*, which results in the inhibition of cell wall synthesis and prevents fungal spores from germinating.

2.0 Methods of Analysis

2.1 Methods for Analysis of the Active Ingredient

The methods provided for the analysis of the active ingredient and the impurities in Mandipropamid Technical Fungicide have been validated and assessed to be acceptable for the determinations.

2.2 Method for Formulation Analysis

The method provided for the analysis of the active ingredient in the formulation has been validated and assessed to be acceptable for use as an enforcement analytical method.

2.3 Methods for Residue Analysis

Refer to ERC2009-01and PRD2012-23 for a summary of the analytical methods previously reviewed for mandipropamid and the rationale for the regulatory decision.

An acceptable data gathering method was developed for the determination of SYN 500003 in/on potato tubers and processed commodities. The high performance liquid chromatography method with tandem mass spectrometric detection (HPLC-MS/MS; Method GRM001.01A) fulfilled the requirements with regards to specificity, accuracy and precision at the limit of quantitation of the metabolite SYN 500003.

3.0 Impact on Human and Animal Health

Refer to ERC2009-01 for a detailed assessment of the impact on human health.

3.1 Toxicology Summary

A detailed review of the toxicological database for mandipropamid was previously conducted and published under ERC2009-01. The database is complete, consisting of the full array of toxicity studies currently required for hazard assessment purposes. The studies were carried out in accordance with currently accepted international testing protocols and Good Laboratory

Practices. The scientific quality of the data is high and the database is considered adequate to define the majority of the toxic effects that may result from exposure to mandipropamid. For the toxicological summary, see ERC2009-01.

In ERC2009-01, the long term dermal endpoint was correctly identified in the text under Section 3.4.1, but incorrectly identified as a short term dermal endpoint in Table 4 of ERC2009-01. This error had no impact on the risk assessment. The updated toxicological endpoint table is included in this document in Appendix I, Table 2.

Incident Reports

As of 17 December 2015, one environmental incident and four scientific studies related to mandipropamid were submitted to the PMRA through the Incident Reporting Program. The environmental incident involved a fish kill in a creek following a fire at a chemical warehouse where mandipropamid was one of many pesticides stored; it was considered unlikely that mandipropamid contributed to the fish kill. The scientific studies were incorporated into the evaluation of mandipropamid and did not impact the label hazard statements.

3.2 Occupational and Residential Risk Assessment

3.2.1 Toxicological Endpoints

Occupational exposure to mandipropamid is characterized as short-term in duration and predominantly by the dermal and inhalation routes.

3.2.1.1 Dermal Absorption

A dermal absorption value was not established as an endpoint for dermal exposure was chosen based on a 28-day dermal toxicity study in rats.

3.2.2 Occupational Exposure and Risk

Potato seed pieces can be treated with Revus Fungicide in commercial facilities and on-farm using a closed treatment system with open mixing and loading.

3.2.2.1 Treater/Cutter/Sorter Exposure and Risk Assessment

Individuals have potential for exposure to mandipropamid while treating potato seed pieces in commercial treatment facilities and on-farm. Chemical specific data for assessing human exposure during potato seed treatment were not submitted. As such, a surrogate exposure study was used to estimate risk to workers while treating in commercial facilities and on-farm.

The amount of potato seed pieces treated was estimated at 290,400 kg/day for large treatment facilities and farms. Dermal exposure was estimated by coupling the unit exposure values with the amount of active ingredient handled per day. Inhalation exposure was estimated by combining the unit exposure values with the amount of active ingredient handled per day with

100% inhalation absorption. Exposure was normalized to mg/kg bw/day by using 80 kg adult body weight.

Exposure estimates were compared to the NOAEL to obtain the margin of exposure (MOE; Appendix I, Tables 3 and 4). Exposure to the treater/cutter/sorter is not expected to result in risks of concern when mandipropamid is used according to label directions.

3.2.2.2 Exposure and Risk Assessment for Workers Handling and Planting Treated Potato Seed Pieces

Individuals have potential for exposure to Revus Fungicide while handling, planting or transporting treated potato seed pieces. Chemical specific data for assessing human exposure during planting of treated potato seed pieces were not submitted. However, a surrogate exposure study was submitted to estimate risks to workers planting and transporting treated potato seed pieces.

The surrogate study monitored the exposure of 16 worker monitoring units (MUs) to the active ingredient difenconazole during loading and transport of trucks with treated potato seed, loading treated potato seed pieces into the planter and the activities associated with directly planting the treated seed pieces into the field, including driving the tractor and standing near, on or in the planter. The MUs wore the equivalent of a single layer of personal protective equipment (PPE) over the whole body dosimeter. Dermal dosimetry included inner whole-body dosimeters, hand washes and face/neck wipes. Inhalation monitoring utilized an OSHA Versatile Sampler (OVS) air sampling tube with XAD-2 sorbent attached to a personal air sampling pump. Total dermal exposure was determined by summing the residues on the inner dosimeter, face/neck wipes and hand washes. For inhalation exposure, the front and back sorbent sections of each OVS tube sample was summed to calculate the total residues in the sample. The field sample data were corrected based on the recoveries from field fortification samples conducted at two locations at or close to the test sites. Average field fortification recoveries below 95% were used to correct the test sample recoveries. For workers loading and driving the planter, a dermal unit exposure value based on a single layer of PPE with gloves was established at 367 µg/kg a.i. handled (arithmetic mean) and the inhalation unit exposure value was established at 18.45 µg/kg a.i. handled (arithmetic mean). Dermal and inhalation exposures for the worker driving the planter are considered representative of a closed cab tractor. For workers at the back of the planter, dermal and inhalation unit exposures were based on the 90^{th} percentile value because of the low number of replicates (n = 5). The dermal unit exposure value for a single layer of PPE with gloves was determined to be 2853 µg/kg a.i. handled and the inhalation unit exposure value was determined to be 62.39 µg/kg a.i. handled.

The amount of potato seed pieces planted in one day was estimated at 120,800 kg/day for large farms. Dermal exposure was estimated by coupling the unit exposure values with the amount of active ingredient handled per day. Inhalation exposure was estimated by combining the unit exposure values with the amount of active ingredient handled per day with 100% inhalation absorption. Exposure was normalized to mg/kg bw/day by using 80 kg adult body weight.

Exposure estimates were compared to the toxicological endpoints to obtain the MOE. Exposure to mandipropamid exceeded the target MOE of 100 for workers handling and planting treated seed (Appendix I, Tables 5 and 6); and thus, exposure is not expected to result in risks of concern when mandipropamid is used according to label directions.

Given that the target MOEs for both treaters and planters for large farms are sufficiently above the target MOE, it is expected that on small farms, where the same person may treat and plant, combined MOEs will exceed the target MOE. This is mainly based on the fact that a smaller amount of seed, and therefore active ingredient, is handled in a day.

3.2.3 Bystander Exposure and Risk Assessment

Bystander exposure should be negligible since the potential for drift is expected to be minimal when planting treated potato seed pieces.

3.3 Food Residues Exposure Assessment

3.3.1 Residues in Plant and Animal Foodstuffs

Refer to ERC2009-01 and PRD2012-23 for a summary of the data previously reviewed and the rationale for the regulatory decision. The residue definition for risk assessment and enforcement purposes in plant products is mandipropamid, except for tuberous and corm vegetables, which is mandipropamid and SYN 500003 for risk assessment purposes only. The data gathering analytical methods are valid for the quantitation of mandipropamid and SYN 500003 residues in potato tubers and processed commodities. The residues of mandipropamid and SYN 500003 are stable in potato tubers and processed commodities (flakes/granules) for up to 24 months, and 32 months, respectively when stored in a freezer at [-20°C]. Mandipropamid residues only concentrated in potato wet peel (2.0-fold), and SYN 500003 residues concentrated in potato flakes/granules (1.7-fold), and chips (1.4-fold). Quantifiable residues are not expected to occur in livestock matrices with the current use pattern. Crop field trials conducted throughout Canada and the United States using end-use products containing mandipropamid at approved rates in or on potatoes are sufficient to support the proposed maximum residue limits.

3.3.2 Dietary Risk Assessment

A refined non-cancer chronic dietary risk assessment was conducted using the Dietary Exposure Evaluation Model - Food Commodity Intake Database™ (DEEM-FCID™, Version 4.02, 05-10-c) program which incorporates food consumption data from the National Health and Nutritional Examination Survey, What We Eat in America (NHANES/ WWEIA) dietary survey for the years 2005-2010 available through CDC's National Center for Health Statistics (NCHS).

3.3.2.1 Chronic Dietary Exposure Results and Characterization

The following criteria were applied to the refined chronic non-cancer analysis for mandipropamid: 100% crop treated, default and experimental processing factors (where available), and supervised trial median residue (STMdR) values from treated crops. The refined chronic dietary exposure from all supported mandipropamid food uses (alone) for the total

population, including infants and children, and all representative population subgroups is less than 5.9% of the acceptable daily intake (ADI). Aggregate exposure from food and drinking water is considered acceptable. The PMRA estimates that chronic dietary exposure to mandipropamid from food and drinking water is 3.3% (0.001668 mg/kg bw/day) of the ADI for the total population. The highest exposure and risk estimate is for children 1 to 2 years old at 6.3% (0.003127 mg/kg bw/day) of the ADI.

3.3.3 Aggregate Exposure and Risk

The aggregate risk for mandipropamid consists of exposure from food and drinking water sources only; there are no residential uses.

3.3.4 Maximum Residue Limits

Table 3.3.1 Proposed Maximum Residue Limits

Commodity	Recommended MRL (ppm)
Tuberous and Corm Vegetables (Crop Subgroup 1C)	0.09

Maximum residue limits (MRLs) are proposed for each commodity included in the listed crop groupings in accordance with the Residue Chemistry Crop Groups webpage in the Pesticides and Pest Management section of Health Canada's website.

For additional information on MRLs in terms of the international situation and trade implications, refer to Appendix II.

The nature of the residues in plant matrices, analytical methodologies, field trial data, and chronic dietary risk estimates are summarized in Appendix I, Tables 1, 7 and 8.

4.0 Impact on the Environment

Please refer to ERC2009-01 for a detailed assessment of the environmental impacts of mandipropamid.

4.1 Fate and Behaviour in the Environment

The properties and environmental fate characterization of mandipropamid have been previously reviewed and reported in ERC2009-01.

4.2 Environmental Risk Characterization

The environmental risk assessment integrates the environmental exposure and ecotoxicology information to estimate the potential for adverse effects on non-target species. This integration is achieved by comparing exposure concentrations with concentrations at which adverse effects occur. Estimated environmental exposure concentrations (EECs) are concentrations of pesticide in various environmental media, such as food, water, soil and air. The EECs are estimated using

standard models which take into consideration the application rate(s), chemical properties and environmental fate properties, including the dissipation of the pesticide between applications. Ecotoxicology information includes acute and chronic toxicity data for various organisms or groups of organisms from both terrestrial and aquatic habitats including invertebrates, vertebrates, and plants. Toxicity endpoints used in risk assessments may be adjusted to account for potential differences in species sensitivity as well as varying protection goals (i.e. protection at the community, population, or individual level).

Initially, a screening level risk assessment is performed to identify pesticides and/or specific uses that do not pose a risk to non-target organisms, and to identify those groups of organisms for which there may be a potential risk. The screening level risk assessment uses simple methods, conservative exposure scenarios (for example, direct application at a maximum cumulative application rate) and sensitive toxicity endpoints. A risk quotient (RQ) is calculated by dividing the exposure estimate by an appropriate toxicity value (RQ = exposure/toxicity), and the risk quotient is then compared to the level of concern (LOC). If the screening level risk quotient is below the level of concern, the risk is considered negligible and no further risk characterization is necessary. If the screening level risk quotient is equal to or greater than the level of concern, then a refined risk assessment is performed to further characterize the risk. A refined assessment takes into consideration more realistic exposure scenarios (such as drift to non-target habitats) and might consider different toxicity endpoints. Refinements may include further characterization of risk based on exposure modelling, monitoring data, results from field or mesocosm studies, and probabilistic risk assessment methods. Refinements to the risk assessment may continue until the risk is adequately characterized or no further refinements are possible.

4.2.1 Risks to Terrestrial Organisms

The effects of mandipropamid on terrestrial organisms have been previously reviewed and are reported in ERC2009-01. Mandipropamid and its transformation products did not produce significant adverse effects to earthworms, honeybees, predatory and parasitic beneficial invertebrates, birds, small mammals, and terrestrial plants in the submitted laboratory studies.

For seed treatments, particular attention is given to birds and mammals as these organisms can feed on treated seeds. However, this route of exposure for potato seed pieces is not considered to be of concern. Potatoes are not known to be an attractive food source for birds, and although some small mammals such as voles and mice may occasionally feed on potato seed pieces, it is currently understood that these do not constitute an important part of the diet. Furthermore, given the sporadic nature of this behaviour, it is unlikely to cause a population level effect.

The environmental risk to mandipropamid exposure has been fully characterized for rates higher than those expected with the additional potato seed treatment use (refer to ERC2009-01 for more detail). The proposed potato seed treatment use will not significantly increase environmental exposure to mandipropamid. Therefore, increased risk to terrestrial organisms in the environment is not anticipated.

4.2.2 Risks to Aquatic Organisms

The effects of mandipropamid residues on aquatic organisms have been previously reviewed and reported in ERC2009-01. The rate of application for potato seed piece treatment (when calculated on a per hectare basis) is equivalent to the cumulative rate of application for foliar uses (i.e. 600 mg a.i./ha) previously assessed. Based on this, levels of concern were not exceeded for aquatic invertebrates or fish (marine and freshwater), amphibians, freshwater algae, or aquatic vascular plants.

Furthermore, exposure of aquatic organisms through spray drift will not occur from treatment of potato seed pieces. The potential for run-off of mandipropamid resulting from potato seed pieces will be less than for foliar uses. Thus, the risk to aquatic organisms from exposure to mandipropamid when used as a potato seed piece treatment is not expected to be of concern.

5.0 Value

5.1 Consideration of Benefits

The availability of Revus Fungicide will provide another fungicide option, with a different mode of action, for the control of seed-borne late blight of potato seed pieces when applied prior to disease development. The total amount of Revus Fungicide that may be applied to potatoes per year has not increased with the additional option to treat potato seed pieces. Therefore, where the initial treatment is to potato seed pieces, the maximum number of foliar applications that may be applied to the potato crop in the field has been reduced. The risk of the development of resistance by pathogens to fungicides is typically lower for seed treatments than for field foliar treatments; therefore, the combination of a seed treatment and fewer foliar treatments may lower the overall risk of resistance development by the late blight pathogen to mandipropamid. The resistance risk is further mitigated in that only a fungicide belonging to a different mode of action than Revus Fungicide may be applied as the first foliar application of the season where Revus Fungicide was applied to potato seed pieces. Additionally, mandipropamid has a lower resistance development risk than fenamidone, the only alternative active ingredient available to control seed-borne late blight in potato, and this may reduce the potential for the late blight pathogen to develop resistance to fenamidone.

Revus Fungicide applied as a potato seed treatment can be expected to reduce *P. infestans* inoculum that may result in early infection of the planted crop, which may reduce the total number of fungicide applications that are necessary to manage this economically important disease by delaying the initial foliar application.

5.2 Effectiveness Against Pests

Performance data generated in three U.S. field trials were submitted to support the proposed claim of control of seed-borne late blight. Treatments were inoculated with the US-8 strain of *P. infestans*. While there was no increased efficacy (as implied by shoot emergence after planting) in the high rate treatment over the mid-rate treatment, the high rate is supported since there may be potential for emerging new strains of *P. infestans* to have similar or greater

virulence to those currently present in Canada and that may also exhibit reduced sensitivity to Revus Fungicide. It is known that the sensitivity of this pathogen to mandipropamid varies by strain.

Adequate information was submitted to support the efficacy claims that are summarized in Table 5.2.1.

Table 5.2.1 Efficacy Claims for Revus Fungicide

Timing	Product Rate	Disease Claim
Prior to disease development	One application at 13-26 g/100 kg seed, equivalent to 3.25 to 6.5 kg a.i./100 kg seed. The higher end of the rate range is for use under conditions favouring development of heavy disease pressure of potato seed pieces.	Control of seed-borne late blight caused by *Phytophthora infestans* in seed potato pieces

5.3 Phytotoxicity to Host Plants

Based on observations made in performance assessment trials and the product's known performance when applied foliarly to potato crops in the field, the application of Revus Fungicide applied in accordance with the label would not be anticipated to result in any injurious effects to seed potato.

Adequate information was submitted to demonstrate that seed potato exhibits an adequate margin of tolerance to Revus Fungicide applied in accordance with the label instructions.

6.0 Pest Control Product Policy Considerations

6.1 Toxic Substances Management Policy Considerations

Please refer to Evaluation Report ERC2009-01 for a detailed assessment of pest control product policy considerations.

6.2 Formulants and Contaminants of Health or Environmental Concern

During the review process, contaminants in the technical and formulants and contaminants in the end-use products are compared against the *List of Pest Control Product Formulants and Contaminants of Health or Environment Concern* maintained in the *Canada Gazette*.[5] The list is

[5] *Canada Gazette*, Part II, Volume 139, Number 24, SI/2005-114 (2005-11-30) pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* and in the order amending this list in the *Canada Gazette*, Part II, Volume 142, Number 13, SI/2008-67 (2008-06-25) pages 1611-1613. *Part 1 Formulants of Health or Environmental Concern, Part 2 Formulants of Health or Environmental Concern that are Allergens Known to Cause Anaphylactic-Type Reactions and Part 3 Contaminants of Health or Environmental Concern.*

used as described in the PMRA Notice of Intent NOI2005-01[6] and is based on existing policies and regulations including DIR99-03[7] and DIR2006-02,[8] and taking into consideration the Ozone-depleting Substance Regulations, 1998, of the *Canadian Environmental Protection Act* (substances designated under the Montreal Protocol). The PMRA has reached the following conclusions:

> Technical grade mandipropamid does not contain any formulants or contaminants of health or environmental concern identified in the *Canada Gazette.*

Revus Fungicide does not contain any formulants or contaminants of human health or environmental concerns as identified in the *Canada Gazette*, Part II, Vol. 142, No. 13, SI/2008-67 (2008-06-25), including TSMP Track 1 substances and allergens known to cause anaphylactic-type reactions, or in the PMRA formulants database, Section 2.13.4 of Dir98-04 and Appendix II of Dir99-03.

The use of formulants in registered pest control products is assessed on an ongoing basis through PMRA formulant initiatives and Regulatory Directive DIR2006-02.

7.0 Summary

7.1 Human Health and Safety

The toxicology database submitted for mandipropamid is adequate to define the majority of toxic effects that may result from exposure. In subchronic and chronic studies on laboratory animals, the primary target was the liver along with decreased body weight gain. There was no evidence of carcinogenicity in rats or mice after longer-term dosing. There was no evidence of increased susceptibility of the young in reproduction or developmental toxicity studies. Mandipropamid is not considered to be a neurotoxicant. Only uses for which the exposure is well below levels that cause no effects in animal testing are considered acceptable for registration.

Workers treating potato seed pieces with Revus Fungicide in commercial facilities and on-farm, and those handling and planting treated potato seed pieces, are not expected to be exposed to levels of mandipropamid that will result in risks of concern when Revus Fungicide is used according to label directions. The personal protective equipment on the product label is adequate to protect workers.

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6 NOI2005-01, *List of Pest Control Product Formulants and Contaminants of Health or Environmental* Concern under the New Pest Control Products Act.

7 DIR99-03, The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy.

8 DIR2006-02, Formulants Policy and Implementation Guidance Document.

The nature of the residues in plants is adequately understood. The residue definition for enforcement is mandipropamid in plant products. The proposed seed piece treatment use of mandipropamid on potatoes does not constitute a risk of concern for chronic dietary exposure (food and drinking water) to any segment of the population, including infants, children, adults and seniors. Sufficient crop residue data have been reviewed to recommend an MRL. The PMRA recommends that the following MRL be specified for residues of mandipropamid.

Commodity	Recommended MRL (ppm)
Tuberous and Corm Vegetables (Crop Subgroup 1C)	0.09

7.2 Environmental Risk

The use of Revus Fungicide as a potato seed piece treatment, when used according to label instructions, is not expected to pose risks of concern to terrestrial or aquatic organisms.

7.3 Value

The value information submitted is sufficient to support a claim of control of seed-borne late blight when applied to potato seed pieces prior to disease development.

Revus Fungicide applied as a potato seed treatment may delay infection of the planted crop with the late blight pathogen, potentially reducing the total number of fungicide applications that are necessary to manage this economically important disease.

8.0 Proposed Regulatory Decision

Health Canada's PMRA, under the authority of the *Pest Control Products Act* and Regulations, is proposing full registration for the sale and use of Mandipropamid Technical Fungicide and Revus Fungicide, containing the technical grade active ingredient mandipropamid, as a seed treatment on potato seed pieces to control late blight.

An evaluation of available scientific information found that, under the approved conditions of use, the product has value and does not present an unacceptable risk to human health or the environment.

List of Abbreviations

λ	wavelength
µg	microgram(s)
a.i.	active ingredient
ADI	acceptable daily intake
atm	atmosphere
BBCH	Biologishe Bundesanstalt, Bundessortenamt and Chemical industry
bw	body weight
℃	degrees Celsius
CAF	Composite Assessment Factor
CAS	Chemical Abstracts Service
CDC	U.S. Centres for Disease Control and Prevention
cm^3	centimetre(s) cubed
COEX	co-extrusion
DAP	days after planting
DEEM-FCID	Dietary Exposure Evaluation Model – Food Commodity Intake Database
DIR	Regulatory Directive
EEC	estimated environmental concentration
ERC	evaluation report
FDA	*Food and Drugs Act*
g	gram(s)
ha	hectare(s)
HAFT	highest average field trial
HDPE	high-density polyethylene
HPLC	high performance liquid chromatography
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram(s)
K_{ow}	*n*–octanol-water partition coefficient
L	litre(s)
LAFT	lowest average field trial
LOC	level of concern
LOQ	limit of quantitation
m^3	metre(s) cubed
mg	milligram(s)
mL	millilitre(s)
MOE	margin of exposure
MRL	maximum residue limit
MS	mass spectrometry
MU	monitoring unit
n	number of test subjects
NAFTA	North American Free Trade Agreement
NCHS	National Center for Health Statistics
NHANES	National Health and Nutritional Examination Survey
NIOSH	National Institute for Occupational Safety and Health
NOAEL	no observed adverse effect level
NOI	Notice of Intent
nm	nanometre(s)

OSHA	Occupational Safety and Health Administration
OVS	OSHA Versatile Sampler
Pa	Pascal(s)
PCPA	*Pest Control Product Act*
PET	polyethylene terephthalate
PHI	preharvest interval
p*K*a	dissociation constant
PMRA	Pest Management Regulatory Agency
PPE	personal protective equipment
ppm	parts per million
PRD	Proposed Registration Decision
RD	registration decision
RQ	risk quotient
SC	soluble concentrate
SD	standard deviation
STMdR	supervised trial median residue
TRR	total radioactive residue
TSMP	Toxic Substances Management Policy
U.S.	United States of America
UV	ultraviolet
WWEIA	What We Eat in America

Appendix I Tables and Figures

Table 1 Residue Analysis

Matrix	Method ID	Analyte	Method Type	LOQ		Reference
Plant	GRM001.01A	SYN 500003	HPLC-MS/MS	0.005 ppm	Potato commodities	2473136 and 2473137

Refer to ERC2009-01and PRD2012-23 for methods previously reviewed.

Table 2 Toxicology Endpoints for Use in Health Risk Assessment for Mandipropamid

Exposure Scenario	Dose (mg/kg bw/day)	Study	Endpoint	CAF[1] or Target MOE[2]
Acute dietary	not required			
Chronic Dietary	NOAEL = 5	12-month capsule dog	- pigmentation in the liver (porphyrin)	100
	ADI = 0.05 mg/kg bw/day			
Short to Intermediate-term Dermal	NOAEL = 1000	28-day dermal rat	- limit dose with no treatment-related effects	100
Short to Intermediate-term Inhalation[4]	NOAEL = 41	90-day dietary rat	- decreased body weight and body weight gain and decreased food efficiency.	100
Long-term Dermal	NOAEL = 1000	28-day dermal rat	- limit dose with no treatment-related effects	300[3]
Long-term Inhalation	NOAEL = 5	1-year dog	- porphyrin staining in the liver and increased liver enzymes	100

[1] CAF (composite assessment factor) refers to a total of uncertainty and PCPA factors for dietary assessment
[2] MOE refers to a target MOE for occupational and residential assessments
[3] Includes an additional uncertainty factor for the extrapolation of a short-term study to a long-term scenario
[4] Since an oral NOAEL was selected, an inhalation absorption factor of 100% (default value) was used in route-to-route extrapolation

Table 3 Dermal Exposure to Mandipropamid During Potato Seed Piece Treatment

Application Scenario	kg a.i. handled per day [1]	Dermal Unit Exposure [2] (µg/kg a.i. handled)	Dermal Exposure [3] (mg/kg bw/day)	Dermal MOE [4]
Treater, Liquid, Open system	18.9	291	0.0687	15 000

[1] Treater kg a.i. handled per day = Application rate (g a.i./100 kg seed) × Conversion Factor (kg/1000 g) × kg Seed Treated per Day
[2] Dermal unit exposure values were derived from PMRA 2313626. Treaters: open mixing, a single layer + chemical-resistant gloves.
[3] Dermal exposure (mg/kg/day) = kg a.i. handled/day × Unit Exposure (µg/kg a.i. handled) × Conversion Factor (mg/1000 µg) ÷ 80 kg bw
[4] Based on a dermal NOAEL of 1000 mg/kg bw/day; target MOE = 100.

Table 4 Inhalation Exposure to Mandipropamid During Potato Seed Piece Treatment

Application Scenario	Activity	kg a.i handled per day [1]	Inhalation Unit Exposure [2] (µg/kg a.i. handled)	Inhalation Exposure [3] (mg/kg bw/day)	Inhalation MOE [4]
Liquid, Open system	Treating and/or cutting and sorting	18.9	18.0	0.00425	9600

[1] Treater kg a.i. handled per day = Application rate (g a.i./100 kg seed) × Conversion Factor (kg/1000 g) × kg Seed Treated per Day
[2] Inhalation unit exposure values were derived from cutter/sorter replicates from the PMRA 2313626.
[3] Inhalation exposure (mg/kg/day) = kg a.i. handled/day × Unit Exposure (µg/kg a.i. handled) × Conversion Factor (mg/1000 µg) ÷ 80 kg bw
[4] Based on an inhalation NOAEL of 41 mg/kg bw/day; target MOE = 100.

Table 5 Dermal Exposure to Mandipropamid During Planting of Treated Potato Seed Pieces, Closed Cab

Worker Activity Category	kg a.i. handled per day [1]	Unit Exposure [2] (µg/kg a.i. handled)	Dermal Exposure [3] (mg/kg bw/day)	MOE [4]
Back of planter workers	7.85	2853	0.280	3570
Planter drivers and mostly loaders		367	0.0360	27800

[1] Planter kg a.i. handled per day = Application rate (g a.i./100 kg seed) × Conversion Factor (kg/1000 g) × kg Seed Planted per Day
[2] Unit Exposure values from PMRA 2557310
[3] Exposure (mg/kg/day) = kg a.i. handled/day × Unit Exposure (µg/kg a.i. handled) × Conversion Factor (mg/1000 µg) ÷ 80 kg bw
[4] Based on a dermal NOAEL of 1000 mg/kg bw/day; target MOE = 100.

Table 6 Inhalation Exposure to Mandipropamid During Planting of Treated Potato Seed Pieces, Closed Cab

Worker Activity Category	kg a.i. handled per day [1]	Unit Exposure [2] (µg/kg a.i. handled)	Inhalation Exposure [3] (mg/kg bw/day)	MOE [4]
Back of planter workers	7.85	62.39	0.00614	6700
Planter drivers and mostly loaders		18.45	0.00181	22600

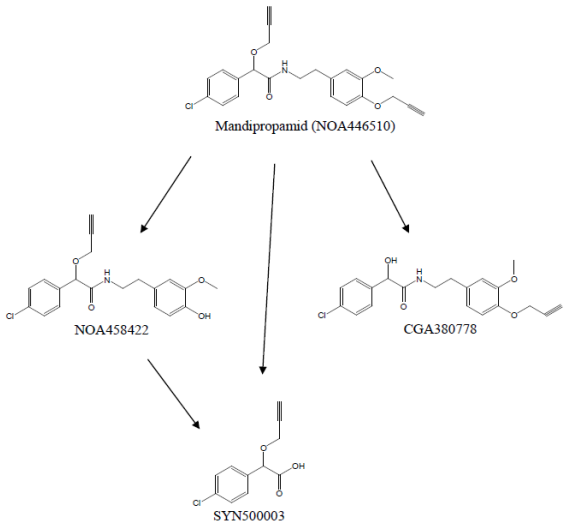
[1] Planter kg a.i. handled per day = Application rate (g a.i./100 kg seed) × Conversion Factor (kg/1000 g) × kg Seed Planted per Day
[2] Unit Exposure values from PMRA 2557310
[3] Exposure (mg/kg/day) = kg a.i. handled/day × Unit Exposure (µg/kg a.i. handled) × Conversion Factor (mg/1000 µg) ÷ 80 kg bw
[4] Based on an inhalation NOAEL of 41 mg/kg bw/day; target MOE = 100.

Table 7 Integrated Food Residue Chemistry Summary

NATURE OF THE RESIDUE IN POTATOES FOLLOWING SEED PIECE TREATMENT	PMRA 2473237
Radiolabel Position	[^{14}C-CHLOROPHENYL] and [^{14}C-METHOXYPHENYLl]-MANDIPROPAMID
Test Site	The treated seed pieces were planted outdoors 5 days after treatment in raised planting boxes.
Treatment	Seed piece treatment
Total Rate	6.068-6.275 mg a.i./seed piece equivalent to ~10 g a.i./100 kg seed pieces
Formulation	Suspension concentrate (SC) formulation
Preharvest interval	Samples of mature whole potato tubers (BBCH 49) were harvested 183 days after planting (DAP).

Matrices	[^{14}C-Chlorophenyl]		[^{14}C-Methoxyphenyl]	
	TRRs (ppm)		TRRs (ppm)	
Potato tubers	0.054		0.024	
Metabolites Identified	**Major Metabolites (>10% of the TRRs)**		**Minor Metabolites (<10% of the TRRs)**	
Radiolabel Position	**[^{14}C-Chlorophenyl]**	**[^{14}C-Methoxyphenyl]**	**[^{14}C-Chlorophenyl]**	**[^{14}C-Methoxyphenyl]**
Potato tubers	SYN 500003	Mandipropamid	Mandipropamid	CGA 380778 NOA 458442

Proposed Metabolic Scheme in Potatoes Following Seed Piece Treatment



CROP FIELD TRIALS & RESIDUE DECLINE ON POTATOES	PMRA 2473162 and 2473163

Field trials were conducted in 2012 in Canada and the United States. Trials were conducted in NAFTA Growing Regions 1(7 trials), 2 (1 trial), 3 (1 trial), 5 (5 trials), 7 (2 trials), 9 (1 trial), 10 (1trial), 11 (6 trials) and 14 (2 trials) for a total of 26 trials, of which 24 trials were considered independent. Revus Fungicide was applied once as a seed piece treatment at 10 g a.i./100 kg seed pieces followed by 3 foliar broadcast sprays at a rate of 130-150 g a.i./ha/application for a seasonal application rate of 600-707 g a.i./ha/season. The foliar applications were made at 7-day intervals with the last application occurring approximately 14 days before harvest. Residue decline data show that residues of mandipropamid generally decreased in potatoes with increasing preharvest intervals (PHIs).

Commodity	Application Rate (g a.i./ha)	PHI (days)	n	LAFT *	HAFT *	Median *	Mean *	SD *
Mandipropamid								
Potato	600-707	12-15	24	<0.01	0.056	0.014	0.018	0.012
SYN 500003 as parent equivalents								
Potato	600-707	12-15	24	<0.009	0.065	0.035	0.030	0.013

* Values based on per-trial averages. LAFT = Lowest Average Field Trial, HAFT = Highest Average Field Trial, SD = Standard Deviation. For computation of the LAFT, HAFT, median, mean and standard deviation, values < LOQ are assumed to be at the LOQ.
n = number of field trials.

PROCESSED FOOD AND FEED - CROP	PMRA 2473162	
Test Site	Two trials in NAFTA Growing Regions 5 and 11	
Treatment	1 seed piece treatment and 3 broadcast foliar applications	
Rate	50 g a.i./100 kg seed pieces followed by 3 foliar applications of 630-663 g a.i./application for a total of 3058-3081 g a.i./ha/season.	
End-use product/formulation	Revus Fungicide	
Preharvest interval	14 days	
Processed Commodity	**Average Processing Factor**	
	Mandipropamid	SYN 500003
Wet peel	2.0	<0.7
Flakes/granules	<0.07	1.7
Chips	<0.07	1.4
Fries	<0.08	0.7

Table 8 Food Residue Chemistry Overview of Metabolism Studies and Risk Assessment

PLANT STUDIES	
RESIDUE DEFINITION FOR ENFORCEMENT **Primary crops (grapes, lettuce, potatoes [foliar, seed piece], tomatoes)** **Rotational crops (wheat, spinach, radish)**	Mandipropamid
RESIDUE DEFINITION FOR RISK ASSESSMENT **Primary crops (grapes, lettuce, potatoes [foliar, seed piece], tomatoes)** **Rotational crops (wheat, spinach, radish)**	Mandipropamid, for all except root and tuber vegetables, which includes SYN 500003
METABOLIC PROFILE IN DIVERSE CROPS	Similar in grapes, lettuce, potatoes, tomatoes.

DIETARY RISK FROM FOOD AND WATER			
	POPULATION	**ESTIMATED RISK % of ACCEPTABLE DAILY INTAKE (ADI)**	
		Food Alone	**Food and Water**
Refined chronic non-cancer dietary exposure analysis **ADI = 0.05 mg/kg bw/day** **Estimated chronic drinking water concentration = 5.9 µg/L**	**General Population**	3.1	3.3
	All Infants	2.3	3.2
	Children 1-2 years old	5.9	6.3
	Children 3-5 years old	4.9	5.2
	Children 6-12 years old	2.9	3.1
	Youth 13-19 years old	1.9	2.1
	Adults 20-49 years old	3.0	3.2
	Adults 50-99 years old	3.3	3.5

Appendix II Supplemental Maximum Residue Limit Information—International Situation and Trade Implications

The MRLs proposed for mandipropamid in Canada are the same as corresponding tolerances to be promulgated in the United States.

Once established, the American tolerances for mandipropamid will be listed in the Electronic Code of Federal Regulations, 40 CFR Part 180, by pesticide.

Currently, there are Codex MRLs[9] listed for mandipropamid in or on any commodity on the Codex Alimentarius Pesticide Residues in Food website.

Table 1 compares the MRLs proposed for mandipropamid in Canada with corresponding American tolerances and Codex MRLs.[10] American tolerances are listed in the Electronic Code of Federal Regulations, 40 CFR Part 180, by pesticide. A listing of established Codex MRLs is available on the Codex Alimentarius Pesticide Residues in Food website, by pesticide or commodity.

Table 1 Comparison of Canadian MRLs, American Tolerances and Codex MRLs (where different)

Food Commodity	Canadian MRL (ppm)	American Tolerance (ppm)	Codex MRL (ppm)
Tuberous and corm vegetables, CSG1C	0.09	0.09	0.01*

*Based on foliar use

MRLs may vary from one country to another for a number of reasons, including differences in pesticide use patterns and the locations of the field crop trials used to generate residue chemistry data. For animal commodities, differences in MRLs can be due to different livestock feed items and practices.

9 The Codex Alimentarius Commission is an international organization under the auspices of the United Nations that develops international food standards, including MRLs.

10 The Codex Alimentarius Commission is an international organization under the auspices of the United Nations that develops international food standards, including MRLs.

References

A. List of Studies/Information Submitted by Registrant

1.0 Human and Animal Health

PMRA Document Number	Reference
2313626	2013, ADMIRE 240F –Determination of Dermal and Inhalation Exposure of Workers during On-Farm Seed Piece Treatment of Potatoes (imidacloprid), DACO 5.3, 5.4
2557310	2015, Observational Study to Determine Dermal and Inhalation Post-Application Exposure of Workers to Difenoconazole during Handling and Planting of Treated Potato Seed Pieces, DACO 5.6
2473154	2014, 14C-Mandipropamid-Metabolism in Potatoes Following Seed Piece Treatment, DACO: 6.2, 6.3, 6.4, 7.5, 7.6, 7.8,IIIA 8.2
2473136	2006, GRM001.01A: Method for the Determination of Residues of SYN500003 in Potato Tubers and Processed Potato Commodities. Final determination by LC-MS/MS, DACO: 7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.2.5, IIIA 5.3.1
2473137	2006, Validation of Analytical Method GRM001.01A for the Determination of Residues of SYN500003 in Potato Tubers and Processed Potato Commodities by LC-MS/MS, DACO: 7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.2.5, IIIA 5.3.1
2473162	2014, Mandipropamid (A12946B) - Magnitude of the Residues in or on Potato. USA 2012, DACO: 3.5.10, 7.4.1, 7.4.2, 7.4.6, IIIA 5.3.2, IIIA 8.3.1
2473163	2014, Mandipropamid SC (A12946B) - Residue Levels on Potatoes From Trials Conducted in Canada During 2012, DACO: 3.5.10, 7.4.1, 7.4.2, 7.4.6, IIIA 5.3.2, IIIA 8.3.1

2.0 Value

PMRA Document Number	Reference
2473144	2012, Develop A12946 for Use as a Seed Treatment in Potato, DACO: 10.2.3.4,IIIA 6.1.3
2473145	2012, Develop A12946 for Use as a Seed Treatment in Potato, DACO: 10.2.3.4,IIIA 6.1.3
2473146	2013, Develop A12946 for Use as a Seed Treatment in Potato, DACO: 10.2.3.4,IIIA 6.1.3
2501280	2015, REVUS Fungicide: Response to Clarification Questions Regarding Value (Sub. No. 2014-5276), DACO: 10.6

B. Additional Information Considered

i) Published Information

1.0 Value

PMRA Document Number	Reference
2516286	Cohen, Y., E. Rubin, T. Hadad, D. Cotlieb, H. Sierotzki, and U. Gisi. 2007. Sensitivity of *Phytophthora infestans* to Mandipropamid and the Effect of Enforced Selection Pressure in the Field. Plant Pathology 56: 836-842.