

PESTICIDE TYPE	<b>Nematicide</b>
CHEMICAL CLASS	Phenyl oxadiazole
COMMON TRADE NAMES	Acceleron® N-364
MAJOR DEGRADATE	3-thienyl, iminoamide, benzamidine, thiophene acid
APPLICATION RATE (lbs a.i./A/year)	Max Annual: 0.089 lbs (corn); 0.28 lbs (soybeans)
REGISTRATION STATUS	EPA: Registered unconditionally in 2017 Minnesota: May 2017
TOXICITY PROFILE FOR APPLICATORS	Signal word: Caution IV (inhalation, oral, dermal) Mild eye irritant
BASIC MANUFACTURER	Monsanto
MDA LABORATORY CAPABILITIES	In discussion

## HUMAN HEALTH

NON-CANCER	Acute PAD= 0.25 mg/kg/day Chronic PAD= 0.05 mg/kg/day
CANCER	likely to be carcinogenic to humans

Acute and chronic PADs are doses that include all relevant uncertainty and safety factors

## ENVIRONMENTAL AQUATIC TOXICITY

FISH	Acute: 0.0185 ppb Chronic: 9.4 ppb
INVERTEBRATE	Acute: 0.417 ppb Chronic: 5.9 ppb
AQUATIC PLANTS	Vascular (IC <sub>50</sub> ): 0.954 ppb Non-vascular (IC <sub>50</sub> ): 0.125 ppb

## POLLINATOR TOXICITY

HONEY BEE	Acute Contact (LD <sub>50</sub> ): >0.40 µg/bee Acute Oral (LD <sub>50</sub> ): >0.16 µg/bee
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Level of Concern (LOC) has been applied to all values.

## Introduction

Tioxazafen is a systemic nematicide approved for use as a seed treatment on field corn and soybeans. This new active ingredient represents a new mode of action that disrupts ribosomal activity of nematodes. It can be a valuable tool for Integrated Pest Management (IPM) and nematode resistance management. Tioxazafen is not a restricted use pesticides. Use of tioxazafen is approved for use in fully-automated commercial seed treatment equipment facilities using closed transfer and application equipment only. Use of this product for on-farm seed treatment application is prohibited. Minnesota Department of Agriculture (MDA) extensive review of the EPA tioxazafen product labels and risk assessments for issues relevant to Minnesota is summarized below.

## Projected Use in Minnesota

The USEPA approved tioxazafen active ingredient under the trade name, Acceleron® N-364 as seed treatment and it will be available as a suspension soluble concentrate. The approved maximum annual application rate of tioxazafen as seed treatment for field corn and soybeans is 0.089 lbs a.i./acre and 0.28 lbs a.i./acre, respectively. According to the University of Minnesota extension, tioxazafen was not evaluated on corn and soybeans in Minnesota specific conditions.

- **Acceleron® N-364 (EPA Reg. No. 524-624)** - The product carries 45.9% of tioxazafen and is approved as seed treatment on corn and soybeans for nematode control.

## Label Environmental Hazards

### Water Quality:

- Tioxazafen product label carries statements that the product is toxic to birds, mammals, fish and aquatic invertebrates.
- Do not contaminate water when disposing of equipment washwater or rinsate.

### Other:

- Do not plant treated seeds by broadcast application to the soil surface.
- Treated seed exposure may be hazardous to wildlife.
- The seed treatment applicators and other workers handling tioxazafen-treated seeds equipment require proper protective personal equipment (PPE).
- Treated seed must be incorporated into soil at a depth of 1 inch for corn and soybeans.

## Toxicology and Exposure

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EPA's screening models generate high-end, conservative exposure estimates for active ingredients and toxicologically significant degradates. Model inputs include annual usage at maximum use rates, maximum treated acres, maximum food residues, peak runoff and drift scenarios, etc. Some proposed products, application rates and use scenarios are not relevant to Minnesota. EPA's estimates, therefore, may not reflect future use and impacts in Minnesota.

### Human Health

- **Carcinogenic Effects**- Tioxazafen is classified as "likely to be carcinogenic to humans".
- **Drinking Water Guidance**- Model estimates suggest that there is potential for acute and chronic exposure through drinking water from tioxazafen and its major degradates, benzamidine, 3-thienyl, and iminoamide. However, EPA concludes that conservative exposure estimates are below levels of concern for the general population and all population subgroups.
- **Occupational Exposure**- During loading/applying and secondary handler activities in commercial settings, there is potential for occupational short- and intermediate-term dermal and inhalation exposure. Product label language is intended to mitigate these risks. The potential for post application exposures following the planting of tioxazafen-treated seeds is unlikely.

### Environment- Non-target Species

- **Stressor of concern**- No risk concerns were identified for pollinators, reptiles, terrestrial amphibians, terrestrial invertebrates, terrestrial plants, and for freshwater fish, invertebrates, and aquatic plants from tioxazafen and its degradates. However, potential risks were identified to birds and mammals from eating the treated seed. The language on product label is intended to mitigate these effects.
- **Aquatic & Terrestrial Life Exposure**- Tioxazafen is highly toxic to very highly toxic to freshwater fish on an acute basis and can bioaccumulate in fish. Tioxazafen is moderately to non-toxic to birds on acute oral basis. No aquatic exposure concerns are expected from crops because treated seed will be buried more than 2 cm deep in soil.

## Environmental Fate

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Tioxazafen is a relatively nonvolatile, moderately mobile in soil, and persistent and may move to ground water slowly via leaching. Tioxazafen may move to surface water bodies via spray drift and runoff of dissolved or sorbed residues.

### Soil

- **Half-life** - Aerobic: 48 to 303 days.  
Anaerobic: 28 to 500 days.
- **Mobility**- K<sub>oc</sub> is 2,996 to 10,318 mL/g.
- **Photolysis**- 990 days.
- **Persistence**- DT<sub>50</sub> value 26.9 to 220 days.

### Aquatic

- **Half-Life**- Aerobic: 4.4 to 5.9 days.  
Anaerobic: 4.4 to 6.0 days.
- **Half-life via hydrolysis**- 985 to 2289 days.
- **Photolysis in water**- 0.19 days.

### Air

- **Volatilization**- nonvolatile, Vapor pressure =  $5.82 \times 10^{-7}$  torr; Henry's Law Constant  $5.82 \times 10^{-7}$  atm m<sup>3</sup> mole<sup>-1</sup>. Tioxazafen is not likely to volatilize from soil or water.

### Degradates

Tioxazafen breaks down into four major degradates, 3-thienyl (MON 102130), iminoamide, benzamidine, and thiophene acid. Based on the data, the major degradate MON 102130 (3-Thienyl 102100) may be equally to slightly more toxic to aquatic species than the parent compound. Toxicity data are not available for other degradates.