

PESTICIDE TYPE	FUNGICIDE
Chemical Class	Pyrimidinyl(thio)benzoate
Common Trade Names	Vexis
Major Degradates	M-1, M-2, M-5, M-8, M-18, Imino-M-18
Application Rate (lb a.i./A)	Max Single: 0.06 Max Annual: 0.09
Registration Status	EPA: 2018 Minnesota: September 2019
Toxicity Profile for Applicators	Signal word: CAUTION Toxicity III or IV
Basic Manufacturer	PBI-Gordon Corporation
MDA Laboratory Capabilities	In discussion
HUMAN HEALTH	
Non-Cancer	Acute RfD = 3 mg/kg Chronic RfD = 0.1 mg/kg/day
Cancer	Not likely to be carcinogenic to humans
<i>Acute and chronic reference doses (RfD) are doses that include all relevant uncertainty and safety factors</i>	
ENVIRONMENTAL AQUATIC TOXICITY	
Fish	Acute: >50,000 ppb Chronic: 11,000 ppb
Invertebrate	Acute: >61,000 ppb Chronic: 41,000 ppb
Aquatic Plants	Vascular: 2.3 ppb Non-vascular: 19 ppb
POLLINATOR TOXICITY	
Honey Bee	Acute Contact: >10 µg/bee Acute Oral: >40 µg/bee
<i>Level of Concern (LOC) has been applied to all values.</i>	

INTRODUCTION

Pyrimisulfan is a new selective, systemic herbicide for pre- and post-emergence weed control in turf. It belongs to HRAC (Herbicide Resistance Action Committee) Group 2 and is classified as an acetolactate synthase (ALS) inhibitor. Herbicides in this group control weeds by blocking key enzymes responsible for biosynthesis of three essential amino acids required for normal plant growth and development. The U.S. Environmental Protection Agency (EPA) has registered pyrimisulfan for use on warm- and cool-season turf in a variety of sites. Application sites include residential sites, ornamental turf sites (parks, cemeteries, athletic fields, etc.), institutional sites (hospitals, schools, golf courses, etc.), and non-crop-land sites (rights-of-way, railroads, airports, etc.). Pyrimisulfan is also registered for use in commercial sod production. It is proposed for pre-emergence and post-emergence control of certain broadleaf, sedge, and kyllinga species.

The Minnesota Department of Agriculture's (MDA) extensive review of the EPA pyrimisulfan labels and risk assessments for issues relevant to Minnesota is summarized below.

PROJECTED USE IN MINNESOTA

Pyrimisulfan is registered for use on turf in Minnesota to control select broadleaf weeds (e.g., common chickweed, dollarweed, ground ivy), sedges (e.g., yellow and purple nutsedge) and kyllinga (e.g., green kyllinga). Pyrimisulfan is available in a granular formulation that can be applied using a rotary or drop spreader. Single application rates range from 0.02725 to 0.06 lb a.i./A with a 30-day retreatment interval. The label yearly maximum rate is 0.09 lb a.i./A.

According to University of Minnesota Extension, pyrimisulfan has not been studied in trials in Minnesota. However, pyrimisulfan-containing granular products may be of interest for turf use because there are few granular post-emergence herbicide options for some of the weeds pyrimisulfan controls.

One end-use product containing pyrimisulfan is currently registered in Minnesota:

- **Vexis Granular Herbicide** (EPA Reg. No.2217-1024) – Alternative brand name: EH-1566 ORP Granule. This product contains 0.025% pyrimisulfan.

LABEL ENVIRONMENTAL HAZARDS

Water Quality

- **Groundwater Advisory:** This chemical has properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination.
- **Surface Water Advisory:** This product has a potential for reaching surface water via runoff after application. Runoff of this product will be reduced by avoiding applications when heavy rainfall or irrigation is expected to occur within 48 hours.

Other Restrictions

- Do not collect grass clippings from treated turfgrass for use as mulch around plants or in compost for 3 weeks after treatment.

TOXICOLOGY AND EXPOSURE

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** – Classified as “Not likely to be carcinogenic to humans.”
- **Drinking Water Guidance** – Pyrimisulfan has the potential to reach ground and surface water sources of drinking water; however, EPA acute and chronic dietary exposure estimates were below the level of concern for all populations. The EPA dietary risk assessment for pyrimisulfan is based on drinking water exposure (no food uses) and includes residues of the parent, its major degradates (M-1, M-2, M-5, M-8, M-15, M-18, Imino-M-18), and one minor degradate (M-12). Estimated Drinking Water Concentrations (EDWCs) of 31.7 and 24.1 µg/L in groundwater (parent + degradates) were used in acute and chronic dietary risk assessments, respectively.
- **Occupational Exposure** – All exposure scenarios assessed by the EPA resulted in risk estimates not of concern. The restricted entry interval (REI) is 12 hours for all label uses.

Non-target Species

- **Aquatic & Terrestrial Life Exposure** – Pyrimisulfan is practically non-toxic to fish, aquatic invertebrates, and non-vascular aquatic plants on an acute basis, and predicted exposures did not exceed EPA's levels of concern. Exposure estimates for federally-listed vascular plants exceeded the level of concern for one scenario (California turf application in January).

- **Terrestrial Life Exposure** – Pyrimisulfan is practically non-toxic to birds and slightly toxic to mammals on an acute basis. In the EPA risk assessment, there was an exceedance of the avian level of concern; however, it is considered unlikely that a bird will consume enough granules to reach toxic levels. Pyrimisulfan is highly toxic to some plants and labels warn of potential damage from applying composted grass clippings to sensitive plants.
- **Pollinators** – Pyrimisulfan is practically non-toxic to honeybees on acute exposure basis.

ENVIRONMENTAL FATE

Pyrimisulfan is slightly to moderately persistent in the environment and is highly mobile to mobile in soil. It is expected to dissipate primarily through leaching and aerobic degradation in terrestrial and aquatic environments. Degradates are more persistent than the parents and are also highly mobile to mobile in soil. Due to the granular formulation, drift is not expected, and watering in after application is expected to reduce the runoff risk.

Soil

- **Half-life** (20°C) – Aerobic: 17.6 to 159 days
Anaerobic: Stable
- **Mobility** – K_{oc} values range from 2 to 49 L/kg_{oc}
Solubility in water (pH 7, 25°C) is 2,676 mg/L
- **Photolysis** – Stable
- **Persistence** – DT₅₀ values range from 4 to 51 days

Aquatic

- **Half-life** (20°C) – Aerobic: 16.8 to 25.8 days
- **Anaerobic:** Stable
- **Photolysis** (half-life 25°C) – 214 days
- **Hydrolysis** – Stable at pH 4, 7, and 9 (50°C)

Air

- **Volatilization** – Not a major route of dissipation. Vapor pressure (25°C) = 1.58×10^{-10} torr; Henry's law constant 9.8×10^{-13} to 1.0×10^{-14} atm m³ mole⁻¹ (varies with pH)

Degradates

Pyrimisulfan has seven major environmental degradates: M-1, M-2, M-5, M-8, M-15, M-18, and Imino-M-18. All degradates show minimal structural changes except M-18 and Imino-M-18 (pyrimidine ring is broken). Degradates, like the parent, are highly mobile to mobile in the soil [K_{oc} = 7-17 (M-1); 12-31 (M-15); 2-26 (imino-M-18) mL/goc], and the persistence of “pyrimisulfan-like” degradates is extended beyond the relatively shorter persistence of the pyrimisulfan alone. All seven major degradates and one minor degradate (M-12) were considered residues of concern in aquatic exposure assessments. Structural analysis suggests none of the degradates are more toxic than the parent, and aquatic toxicity studies were either non-definitive or found M-1 and M-15 to be an order of magnitude less toxic than the parent.