Tiafenacil

DEPARTMENT OF AGRICULTURE

CAS 1220411-29-9; EPA PC CODE 012311 | NEW ACTIVE INGREDIENT REVIEW | JANUARY 2021

PESTICIDE TYPE	HERBICIDE
Chemical Class	Pyrimidinedione
Common Trade Names	Reviton
Major Degradates	24 identified including M-01, M-12, and M-13
Application Rate (lb a.i/A/year)	Max Single: 0.067 Max Annual: 0.223
Registration Status	EPA: Registered unconditionally in September 2020 Minnesota: 2020
Toxicity Profile for Applicators	Signal word: CAUTION Toxicity Categories III (oral and dermal) and IV (inhalation)
Basic Manufacturer	ISK Biosciences
MDA Laboratory Capabilities	In discussion
HUMAN HEALTH	
Non–Cancer	Acute PAD = no value* Chronic PAD = 0.01 mg/kg/day
Cancer	Not likely to be carcinogenic to humans
Acute and chronic population adjusted doses (PADs) are doses that include all relevant uncertainty and safety factors	
ENVIRONMENTAL AQUATIC TOXICITY	
Fish	Acute: >37,800 ppb Chronic: 16 ppb
Invertebrate	Acute: >37,750 ppb Chronic: 605 ppb
Aquatic Plants	Vascular: 5.57 ppb Non-vascular: 4.74 ppb
POLLINATOR TOXICITY	
Honey Bee	Acute Contact: >0.04 mg ai/bee Acute Oral: >0.04 mg ai/bee
Level of Concern (LOC) has been applied to all values. ** There were no adverse effects attributable to a single dose.*	

INTRODUCTION

Tiafenacil (TergeoTM) is a new, nonselective contact herbicide for pre-plant and pre-emergence burndown control of annual grasses and broadleaf weeds. It is registered for use in corn (all types except sweet corn), soybeans, and wheat in Minnesota. It is also labeled for directed post-emergence use in grape vineyards and for burndown applications in fallow and non-crop areas.

Tiafenacil controls plants by inhibiting the protoporphyrin oxidase (PPO) enzyme. This results in the generation of highly reactive singlet oxygen in the presence of light which causes the rapid breakdown of membranes and the destruction of plant cells. It is classified as a Group 14, PPO inhibitor herbicide by the Weed Science Society of America (WSSA). Products containing tiafenacil can be applied by ground boom or with low-pressure handheld spray equipment. Labels specify both maximum single and annual application rates of 0.067 and 0.223 lbs active ingredient/acre (ai/A), respectively, for all the proposed uses.

The Minnesota Department of Agriculture's (MDA) extensive review of the U.S. Environmental Protection Agency (EPA) tiafenacil labels and risk assessments for issues relevant to Minnesota is summarized below.

PROJECTED USE IN MINNESOTA

Tiafenacil can be used in Minnesota to provide preplant or preemergence control of a broad spectrum of problematic broadleaf and grass weeds including marestail, amaranth species (redroot pigweed, Palmer amaranth, waterhemp), ragweed species, kochia, and velvetleaf. Tiafenacil has activity on glyphosate-resistant biotypes of susceptible weed species. It can also reduce herbicide resistance selection pressure by providing an alternative to other non-selective herbicides, including glyphosate, glufosinate, and paraquat.

The following end-use products are proposed for registration in Minnesota:

- **Reviton 30SC Herbicide** (EPA Reg. No. 71512-37-74530) – This product is formulated as a suspension concentrate and contains 30% tiafenacil.

LABEL ENVIRONMENTAL HAZARDS

Water Quality

- **Groundwater** – Tiafenacil has properties and characteristics associated with chemicals detected in groundwater. This chemical may leach into groundwater if used in areas where soils are permeable, particularly where the water table is shallow.
- **Surface water** – Tiafenacil may impact surface water due to runoff in rainwater. This is especially true for poorly draining soils and soils with shallow groundwater. This chemical is classified as having high potential for reaching surface water via runoff for several days after application. A level, well-maintained buffer strip between application areas and surface water features such as ponds, streams, and springs reduces potential loading of this chemical from runoff water and sediment. Runoff of this chemical will be reduced by avoiding application when rainfall is forecast to occur within 48 hours.

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** – Tiafenacil is classified by the EPA as "not likely to be carcinogenic in humans."
- **Drinking Water Guidance** – Tiafenacil and its degradates have potential to reach both surface water and groundwater used as drinking water sources. In addition to the parent compound, 18 major degradates are considered residues of concern in drinking water. The EPA's chronic dietary (food + water) risk estimates were below levels of concern for all populations using an estimated drinking water concentration of 66 µg/L.
- **Occupational and Residential Exposure** – Occupational handler and post-application exposure risk estimates assessed by the EPA were not of concern. Product labels list a restricted entry interval (REI) of 12 hours. Residential handler and post-application exposures are not expected since there are no labeled residential uses.

Non–target Species

- **Aquatic Life Exposure** – The EPA considers tiafenacil and three of its degradates (M-01; M-12; M-13) to be residues of concern for aquatic life. The likelihood of adverse effects to aquatic invertebrates and plants from exposure as a result of the proposed uses of tiafenacil is expected to be low. However, tiafenacil and its degradates exhibit enhanced toxicity in the presence of light and there are possible chronic risks to aquatic invertebrates under certain conditions (i.e., clear, shallow water in direct sunlight).
- **Terrestrial Life Exposure** – Tiafenacil is generally low risk to non-target terrestrial organisms other than plants. Product labels contain recommendations to reduce exposure of non-target plants.
- **Pollinators** – Tiafenacil is practically non-toxic to adult bees on an acute oral and contact basis; however, other beneficial insects (parasitoid wasps) could be affected at levels below label application rates.

ENVIRONMENTAL FATE

Tiafenacil degrades rapidly and is slightly mobile in soil. Its degradates of concern are more persistent than the parent and highly to moderately mobile in soil. Tiafenacil and its degradates can move off the site of application and into surface water via run-off and spray drift. Degradates can potentially leach to groundwater.

Soil

- **Half–life** (20°C) – Aerobic: 0.03 to 0.10 days
  Anaerobic: 3.2 to 8.2 days
- **Mobility** – K_{oc} 1,965 mL/g_{oc}
  Solubility in water (20°C): 110 mg/L
  Tiafenacil and residues of concern were not detected below 30 cm in field dissipation studies.
- **Photolysis** (half–life) – 1,307 days
- **Persistence** – DT_{50}: < 1 day (non-persistent)

Aquatic

- **Half–Life** (20°C) – Aerobic: 3.7 to 8.2 days
  Anaerobic: 2.5 to 4.9 days
- **Photolysis** (half–life) – 18.9 days
- **Hydrolysis** (half–life) – stable at pH 4, 50°C; 24 days at pH 7, 35°C; 1 day at pH 9, 25°C

Air

- **Volatilization** – Not a major route of dissipation. Vapor pressure (20°C) ≤ 1.12×10^{-10} torr; Henry's law constant 6.86×10^{-13} atm m^3 mol^{-1}

Degradates

Tiafenacil degrades rapidly in soil and water to a wide range of major and minor degradates. Twenty-four major degradates have been identified in soil and aquatic systems, three of which are considered degradates of concern to aquatic life (M-01; M-12; M-13). Available data indicate these degradates are more persistent and mobile than the parent compound.

All active ingredient technical information, risk assessment values, fate and transport data, and label hazards have been summarized from final registration documents available at www.regulations.gov Docket ID: EPA-HQ-OPP-2019-0413-0013 and EPA-HQ-OPP-2019-0413-0012.