Sulfoxaflor

DEPARTMENT OF AGRICULTURE

CAS 946578-00-3; EPA PC CODE 005210

NEW ACTIVE INGREDIENT REVIEW

MARCH 2013
UPDATED JULY 2019

PESTICIDE TYPE	FUNGICIDE
Chemical Class	Sulfoximine
Common Trade Names	Closer, Transform
Major Degradate	X-11719474 (X-474)
Application Rate (lb a.i./A)	Single: 0.023 - 0.0898 Max Annual: 0.046 - 0.266
Registration Status	EPA: 2013 Minnesota: June 2013
Toxicity Profile for Applicators	Signal word: CAUTION (Closer) or DANGER (Transform) Toxicity III or IV
Basic Manufacturer	Dow AgroSciences
MDA Laboratory Capabilities	In discussion
HUMAN HEALTH	
Non–Cancer	Acute PAD= 0.06 mg/kg/day Chronic PAD= 0.05 mg/kg/day
Cancer	Suggestive evidence of carcinogenic potential
Acute and chronic PADs are doses that include all relevant uncertainty and safety factors	
ENVIRONMENTAL AQUATIC TOXICITY	
Fish	Acute: >181,500 ppb Chronic: 660 ppb
Invertebrate	Acute: >200,000 ppb Chronic: >50,500 ppb
Aquatic Plants	Vascular: 99,000 ppb Non-vascular: 81,200 ppb
POLLINATOR TOXICITY	
Honey Bee	Acute Contact: 0.052 µg/bee Acute Oral: 0.058 µg/bee
Level of Concern (LOC) has been applied to all values.	

INTRODUCTION

Sulfoxaflor is the first member of the sulfoximine class of insecticides. It is considered an agonist of nicotinic acetylcholine receptor (nAChR) and belongs to IRAC (Insecticide Resistance Action Committee) Code 4C. In laboratory experiments, sulfoxaflor was found to be highly efficacious against target insects those displayed resistant to neonictinoids such as imidacloprid. Sulfoxaflor is a systemic insecticide registered by EPA to control piercing/sucking insects such as aphids, stink bugs, plant bugs, and thrips on a variety of row crops. Sulfoxaflor is formulated as a suspension-concentrate (SC) and as water dispersible granules (WDG) containing. Applications can be made with either ground or aerial equipment. Sulfoxaflor can also be applied through chemigation systems (potatoes only).

It was first registered by EPA for emergency use on cotton to control tarnished plant bug, Lygus lineolaris, in select states in June 2012. Its use was extended to other crops (e.g., soybean) in 2013, and it was first registered in Minnesota in June of 2013. In late 2015, all uses were cancelled following a court order concerning potential risks to bees; however, in 2016, sulfoxaflor was approved for uses where exposure of bees could be prevented. In July 2019, sulfoxaflor was registered for select new uses, including use on corn. The Minnesota Department of Agriculture's (MDA) extensive review of the U.S. Environmental Protection Agency (EPA) sulfoxaflor labels and risk assessments for issues relevant to Minnesota is summarized below.

PROJECTED USE IN MINNESOTA

Sulfoxaflor is registered for use on the following major crops in Minnesota: corn, soybeans, potatoes, wheat. According to UMN extension, sulfoxaflor worked well against aphids in soybean and potatoes. It will be of use against piercing/sucking insects such as aphids, leafhoppers, plant bugs, etc. Sulfoxaflor is also registered for use on ornamentals in nurseries.

Two end-use products containing sulfoxaflor are currently registered in Minnesota:

- **Closer® SC** (EPA Reg. No.62719-623) – This product is a suspension concentrate (SC) containing 21.8% sulfoxaflor for foliar application to all approved crops.
- **Transform® WG** (EPA Reg. No.62719-625) – This is a water dispersible granular (WDG) product containing 50% sulfoxaflor for foliar application to all approved crops.

LABEL ENVIRONMENTAL HAZARDS

Water Quality

- Do not apply directly to water, to areas where surface wafer is present. Do not contaminate water when disposing of equipment washwaters.

Other Restrictions

- This product is highly toxic to bees and other pollinating insects exposed to direct treatment or to residues in/on blooming crops or weeds. Protect pollinating insects by following label directions intended to minimize drift and reduce pesticide risk to these organisms.

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 "Suggestive Evidence of Carcinogenic Potential." EPA has determined the chronic population adjusted dose (PAD) is protective of all long-term effects, including potential carcinogenicity.
- **Drinking Water Guidance** – Model estimates suggest that degradates will be found in groundwater to a greater degree than the parent sulfoxaflor. This is due to sulfoxaflor rapidly degrading in soil. Residues in groundwater will primarily be made up of the degradate X11719474 (X-474) and to a lesser extent X11519540 (X-540). High-end, screening exposure estimates for drinking water suggest that applications of sulfoxaflor degradates may result in surface water and groundwater detections; however, EPA concludes that conservative exposure estimates are below levels of concern for the general population and all population subgroups.
- **Occupational Exposure** – Protective eyewear was added for use of Transform due to Category II acute ocular toxicity.

Non–target Species

- **Stressor of Concern** – The parent sulfoxaflor is the only stressor of concern for aquatic and terrestrial organisms.
- **Aquatic & Terrestrial Life Exposure** – High end screening exposure estimates for risks to fish and invertebrates did not generate concern for aquatic life. Estimates suggest that surface water concentrations will not exceed 10% of the available aquatic life toxicity benchmark. Bioaccumulation is not expected in aquatic life.
- **Pollinators** – Sulfoxaflor is highly toxic to honeybees on acute exposure basis. Label statements are designed to mitigate these effects.

ENVIRONMENTAL FATE

The fate of sulfoxaflor in the environment is highly dependent on whether it is in a soil system, groundwater system, or surface water system. Environmental fate characteristics are listed for parent and all relevant degradates where appropriate.

Soil

- **Half–life** – Aerobic: Sulfoxaflor = <1 day;
  X-474 = >1,000 days; X-540 = 2,808 days

  Anaerobic: Sulfoxaflor = 113-120 days;
  X474 = 1,090-5,270 days
- **Mobility** – Parent/ degradates are very high to highly mobile
  K_{foc} (mL/g_{oc}) = 11-72 (Sulfoxaflor);
  7-68 (X-474); 1-25 (X-540)
- **Soil Photolysis and Hydrolysis** – Sulfoxaflor is stable.
- **Persistence** – Sulfoxaflor is expected to be non-persistent in soils and exhibits low affinity to soil or sediment particles. In the aerobic soil system, sulfoxaflor degrades into metabolites. Degradates are considered to be highly persistent in soil.

Aquatic

- In both aerobic and anaerobic aquatic conditions sulfoxaflor degrades slowly to X-474 (Half-life- Aerobic - 37-88 days, Anaerobic-103-382 days). Degradate X-474 is expected to be more persistent than its parent in both aerobic and anaerobic aquatic systems.
- Sulfoxaflor is not expected to partition into the sediment.
- **Surface water** – Sulfoxaflor is expected to be the principle residue in surface water. Contamination of surface water is expected to be mainly related to drift and very little due to run-off. This is because sulfoxaflor drift that reaches aquatic systems is expected to persist. Surface water is also expected to be contaminated by X-474 and X-540.
- **Groundwater** – Sulfoxaflor is expected to be absent from groundwater. Degradates X-474 and, to a lesser extent, X540 are expected to be found in groundwater.
- **Hydrolysis in water**: Parent and degradates are characterized as stable.

Air

- **Volatilization** – Not a major route of dissipation. Vapor pressure (25°C) = 1.9×10^{-8} torr; Henry's law constant 1.2×10^{-11} atm m3 $mole^{-1}$

Degradates

Sulfoxaflor has three important degradates; one major degradate, X-474, and two minor degradates, X-540 and X11579457 (X-457). Available evidence indicates that X-474 and X-457 is much less toxic to humans and the environment than the parent. X-540 appears to be more toxic than sulfoxaflor, but is not expected to be found at high concentrations. are persistent in the environment, but not considered to be residues of concern in water.

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-2010-0889.