

PESTICIDE TYPE	INSECTICIDE
Chemical Class	Pyropene
Common Trade Names	Sefina™, Versys™, Ventigra™
Major Degradate	Multiple
Application Rate (lb a.i./A/year)	Max Annual: 0.015 – 0.270
Registration Status	EPA: Registered unconditionally in September 2018 Minnesota: 2018
Toxicity Profile for Applicators	Signal word: CAUTION Category III or IV (oral, dermal, inhalation, and eye exposure)
Basic Manufacturer	BASF Corporation
MDA Laboratory Capabilities	In discussion
HUMAN HEALTH	
Non-Cancer	Acute PAD= 0.16 mg/kg/day Chronic PAD= 0.08 mg/kg/day
Cancer	Suggestive evidence of carcinogenic potential
<i>Acute and chronic PADs are doses that include all relevant uncertainty and safety factors</i>	
ENVIRONMENTAL AQUATIC TOXICITY*	
Fish	Acute: 8590 ppb Chronic: 300 ppb
Invertebrate	Acute: 4445 ppb Chronic: 0.123 ppb
Aquatic Plants	Vascular (IC ₅₀): 8740 ppb Non-vascular (IC ₅₀): 2040 ppb
POLLINATOR TOXICITY*	
Honey Bee	Acute Contact (LD ₅₀): >80 µg/bee Acute Oral (LD ₅₀): >40 µg/bee
*Value accounts for all chronic toxicity, including carcinogenicity. <i>Level of Concern (LOC) has been applied to all values. Toxicity values refer to the technical grade active ingredient (TGA); however, toxicity of the formulated product was higher in some instances.</i>	

INTRODUCTION

Afidopyropen is a foliar insecticide that functions by disrupting feeding and other behaviors in target insects. It is the first compound belonging to Insecticide Resistance Action Committee (IRAC) Group 9D and offers a new mode of action as a chordotonal organ Transient Receptor Potential Vanilloid-type (TRPV) channel modulator. Therefore, afidopyropen is expected to aid in controlling new and emerging pests, pests with known resistance concerns, and may serve as an alternative to organophosphates and neonicotinoids. Afidopyropen can be used to control aphids, Asian citrus psyllids, whiteflies, and various scale insects. It is registered by the United States Environmental Protection Agency (EPA) for use in soybeans, tubers and corms, *Brassica* head and stem vegetables, cucurbits, fruiting vegetables, leaf petioles, leafy vegetables, pome fruit, stone fruit, tree nuts, vegetables for transplant, and ornamentals. All end-use products containing afidopyropen are formulated as dispersible concentrates, which can be applied aerially, via groundboom, airblast, chemigation, or using handheld equipment.

The single application rates and the maximum annual application rates of afidopyropen vary among application sites. The maximum single application rate ranges from 0.010 to 0.045 lb a.i./A, and a 7-day retreatment interval is required for all listed uses.

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

PROJECTED USE IN MINNESOTA

With the current challenges of aphid resistance to pyrethroids, afidopyropen may provide an important alternative for soybean aphid management in MN. This insecticide could also play a role in management of virus-vectoring aphids in potato, but research on this is lacking. According to the University of Minnesota Extension, efficacy trials with afidopyropen are currently underway.

The following three products are registered for use in Minnesota:

- **Sefina**® (EPA Reg. No. 7969-391) – This product contains 4.89% afidopyropen and is intended for use in cotton, soybean, and tuberous and corm vegetables.
- **Versys**® (EPA Reg. No. 7969-389) – This product contains 9.78% afidopyropen and is intended for use in Brassica head and stem vegetables, cucurbits, fruiting vegetables, leafy vegetables, and tuberous and corm vegetables.
- **Ventigra**® (EPA Reg. No. 7969-393) – This product contains 9.78% afidopyropen and is intended for use in cotton, soybean, and tuberous and corm vegetables.

LABEL ENVIRONMENTAL HAZARDS

Water Quality

- **Groundwater Advisory:** Afidopyropen and a degradate of concern may leach into groundwater if used in areas where soils are permeable, particularly where the water table is shallow.
- **Surface Water Advisory:** This product may impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having a medium-high potential for reaching both surface water and aquatic sediment via runoff for several weeks to months after application.
- **Vegetative Buffer Zone:** Only apply to fields where a minimum 10-foot vegetative filter strip exists between the field and down gradient aquatic habitat.
- A 10 ft buffer zone from aquatic habitats is required for ground application.
- A 150 ft buffer zone from aquatic habitats is required for aerial application.

Other Restrictions

- DO NOT make more than 2 sequential applications before rotating to a product of a different mode of action group.

TOXICOLOGY AND EXPOSURE

The 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. The EPA's estimates, therefore, may not reflect future use and impacts in Minnesota.

Human Health

- **Carcinogenic Effects**—Afidopyropen is classified as having “suggestive evidence of carcinogenic potential.”
- **Drinking Water Guidance** – The residues of concern in drinking water are afidopyropen and all structurally similar monomeric degradates, as well as CPCA. According to the EPA Environmental Fate and Effects Division (EFED), the following Estimated Surface Water Environmental Drinking Water Concentration (EDWCs) for afidopyropen and its total toxic residues should be used in human health dietary risk assessments: 7.1 ppb (1-day mean) and 3.9 ppb (annual mean). The EPA's dietary (food + water) risk assessments found that drinking water exposure estimates were below levels of concern for the parent compound and residues of concern for the U.S. population or any population subgroups.
- **Occupational Exposure** – The EPA identified no occupational handler or post-application exposure risk estimates of concern. A restricted-entry interval (REI) of 12 hours has been set for all afidopyropen-containing products.

- **Residential Exposure** – There is potential for post-application dermal exposure; however, none of the EPA's risk estimates were of concern.

Non-target Species

Toxicity data suggests formulated products containing afidopyropen are more toxic than the TGAI.

- **Aquatic & Terrestrial Life Exposure**— Afidopyropen is slightly toxic to freshwater fish and moderately toxic to invertebrates; however, formulated products are highly to very highly toxic. It is moderately toxic to birds, practically non-toxic to mammals and honey bees, and is not expected to harm terrestrial plants.

ENVIRONMENTAL FATE

Afidopyropen is moderately-to-slightly mobile in soil and may move to surface waters and groundwater via spray drift, leaching, and runoff of dissolved or sorbed residues.

Afidopyropen is moderately persistent in the environment, with the primary routes of dissipation being aqueous photolysis, soil metabolism, and aquatic metabolism.

Soil

- **Half-life** (20°C) – Aerobic: 1 to 30 days
Anaerobic: 15 to 59 days
- **Mobility** – K_d is 4.77 to 21.8 L/kg; K_{oc} is 548 to 2690 L/kg_{oc}
Solubility in water is 25.1 mg/L
- **Photolysis** – Stable
- **Persistence** – DT_{50} value 1.5 to 7.9 days

Aquatic

- **Half-Life** – Aerobic: 76 to 102 days
Anaerobic: 32 to 45 days
- **Half-life via hydrolysis** – Stable at pH 4 and 7;
 DT_{50} = 134 days (pH9)
- **Photolysis in water** (half-life) – 6 to 19.3 days

Air

- **Volatilization** – non-volatile, vapor pressure (25°C) < 7.49×10^{-8} Torr; Henry's law constant < 2.31×10^{-9} atm m³ mol⁻¹

Degradates

Eight major degradates of afidopyropen have been identified: M440I001, M440I002, M440I003, M440I024, M440I046, M440I047, M440I057, and nicotinic acid. With the exception of nicotinic acid, all major degradates retain a core structure similar to the parent compound. An additional 11 structurally similar minor degradates are included in total toxic residue (TTR) assessments: M440I005, M440I006, M440I014, M440I015, M440I016, M440I021, M440I048, M440I049, M440I050, M440I052, and M440I053; however, limited toxicity data is available for the degradates.

Cyclopropane carboxylic acid (CPCA) is another metabolite considered to be a residue of concern in drinking water; however, risk assessments of the afidopyropen and its structurally similar degradates are thought to be protective of exposures to CPCA.

Degradates are expected to be similar or less mobile than the parent compound.