

# Benzovindiflupyr

CAS 1072957-71-1; EPA PC CODE 122305

New Active Ingredient Review  
October 2015

PESTICIDE TYPE	<b>FUNGICIDE</b>
CHEMICAL CLASS FRAC Code	SDHI inhibitor 7
COMMON TRADE NAMES	Eight end use products (Aprovia, Mural, etc.)
MAJOR DEGRADATE	None
APPLICATION RATE (lbs a.i./A)	Single: 0.046-0.089 Max Annual: 0.272
REGISTRATION STATUS	EPA: Conditionally registered in August 2015 Minnesota: Sept. 2015
TOXICITY PROFILE FOR APPLICATORS	Signal word: Caution IV (oral, dermal, and inhalation)
BASIC MANUFACTURER	Syngenta Crop Protection
MDA LABORATORY CAPABILITIES	In discussion

## HUMAN HEALTH

NON-CANCER Acute PAD = 0.10 mg/kg/day  
Chronic PAD = 0.082 mg/kg/day

CANCER Suggestive evidence of cancer

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

## ENVIRONMENTAL AQUATIC TOXICITY

FISH Acute: >1.75 ppb  
Chronic: >0.95 ppb

INVERTEBRATE Acute: 42.5 ppb  
Chronic: >5.6 ppb

AQUATIC PLANTS Vascular: >880 ppb  
Non-vascular: 240 ppb

## POLLINATOR TOXICITY

HONEY BEE Acute Contact: >40 µg a.i./bee  
Acute Oral: >43.6 µg a.i./bee

*Level of Concern (LOC) has been applied to all values.*

*Values above indicate toxicity (EC<sub>50</sub>/LD<sub>50</sub>) from the technical grade active ingredient (TGA).*

## Introduction

Benzovindiflupyr also known as solatenol belongs to the dehydrogenase inhibitor (SDHI) pyrazole-carboxamide class of fungicides [Fungicide Resistance Action Committee (FRAC) group 7]. Benzovindiflupyr acts by inhibiting the succinate dehydrogenase mechanism of the citric acid cycle, which is a functional part of the tricarboxylic cycle and is linked to the mitochondrial electron transport chain. The EPA has conditionally registered benzovindiflupyr for controlling broad range of fungal diseases (blight, mildew, rust, scab, leafspot etc.) on corn, soybean, ornamentals, turf etc. Benzovindiflupyr will be marketed as eight end-use products such as Trivapro A, Aprovia, Mural, etc. The end-use products also include mixtures with other fungicide active ingredients like azoxystrobin, difenoconazole, propiconazole, etc. Benzovindiflupyr can be applied through foliar sprays (ground, aerial, and chemigation), soil applications (in-furrow and banded) and soil drench applications. Application rates range from 0.046 to 0.089 lb a.i./A at 7 and 21 days intervals. The approved maximum seasonal application rate is 0.272 lbs. a.i./A.

## Projected Use in Minnesota

In Minnesota, benzovindiflupyr is approved for use on corn, soybean, ornamentals, turf etc. According to the University of Minnesota extension benzovindiflupyr was not evaluated in Minnesota specific conditions; however, the new active ingredient has the potential to help Minnesota farmers in controlling broad range of diseases and managing fungicide resistance.

Benzovindiflupyr is marketed as Emulsifiable concentrate (EC) or Water dispersible granule (WDG) end-use products and can be used in block, alternating spray, or tank-mix programs with other crop protection products. Some of the common end use products include:

- **Trivapro A™ (EPA Reg. No. 100-1471)** – Trivapro A is a foliar spray EC product containing 10.27% benzovindiflupyr. The EPA has approved the product for controlling fungal diseases on multiple crops.
- **Mural™ (EPA Reg. No. 100-1479)** – Mural is a WG formulation product containing 15.0 % benzovindiflupyr and 30.0 % azoxystrobin approved for controlling multiple fungal diseases on turf and ornamentals. The product labels carry groundwater and surface water advisory statements for benzovindiflupyr and azoxystrobin.

## Label Environmental Hazards

### Water Quality:

- Benzovindiflupyr based product labels carry statements that the product is toxic to fish, aquatic invertebrates, and mammals. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas.
- The product labels carry a surface water advisory that the product may impact surface water quality due to runoff of rain water especially in poorly draining soils and soils with shallow groundwater.
- A 15 foot vegetative buffers around ponds, streams, and springs and sound erosion control practices are advised for reducing potential loading of benzovindiflupyr to aquatic environments.

### Other:

- The benzovindiflupyr based product labels carry caution statements for moderate eye irritation and an advisory to use protective eyewear, chemical resistant gloves, footwear, socks, and headgear.



## 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**- Classified as "Suggestive evidence of carcinogenic potential." Based on data, quantification of cancer potential was not required.
- **Drinking Water Guidance**- Exposure model estimates by the EPA for drinking water suggest that drinking water exposure estimates are below the levels of concern. Even though, benzovindiflupyr has low solubility and mobility, model estimates suggest that small quantities of benzovindiflupyr may reach groundwater through leaching because of its highly persistent properties in soil and water. Benzovindiflupyr may move from the treated field to surface water through run-off, erosion, and spray drift.
- **Occupational Exposure**- Occupational risks did not exceed EPA's levels of concern.

### Environment- Non-target Species

- **Stressor of concern** – Because of highly persistent properties in soil and water, benzovindiflupyr may move from the treated field to surface water through run-off, erosion, and drift.
- **Aquatic Life Exposure** – Estimates of proposed uses of benzovindiflupyr indicated potential risks to fresh water fish and aquatic invertebrates. The label language is intended to mitigate these risks. Peak environmental concentration estimates did not exceed the levels of concern for aquatic plants, terrestrial plants, birds or mammals. The EPA has required the registrant to submit controlled water monitoring study on environmental fate of benzovindiflupyr in aquatic environment by Sept. 2018.
- **Pollinators** – Benzovindiflupyr is classified as practically nontoxic to adult honey bees for acute contact exposure. The EPA has required the registrant to submit acute oral toxicity to larval honey bees and chronic oral toxicity studies to adult honey bees by Sept. 2018.

## Environmental Fate

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The fate of benzovindiflupyr in the environment is highly persistent in soil and aquatic environments. Environmental fate characteristics are listed for parent only because of small level of degradate formation (<10%).

### Soil

- **Half-life**- Aerobic: = Up to > 2,000 days.  
Anaerobic: Up to 1,339 days.
- **Adsorption**- Benzovindiflupyr is classified as slightly mobile to immobile.  $K_{oc}=3829-5221$  (mL/g); water solubility=0.98 mg/L.

### Water

- **Surface water**- Because of low solubility in water and high persistence in soil benzovindiflupyr can move to surface water through run-off, erosion, and spray drift. Benzovindiflupyr dissipation is slow in water with half-life up to 2920 days and photolysis half-life 11.2 days in natural water. The EPA has required the registrant to submit field studies to address concerns on runoff, sediment transport, and delivery of total benzovindiflupyr in water by Sept. 2018.
- **Groundwater** Benzovindiflupyr potential to reach and persist in groundwater following application is low.
- **Half-life via hydrolysis**: Stable.
- **Sediment**: Expected to persist in the sediment.

### Air

- **Volatilization**- Not a major route of dissipation. Vapor pressure =  $2.4 \times 10^{-11}$  Torr; Henry's Law Constant =  $9.75 \times 10^{-9}$  atm m<sup>3</sup> mole<sup>-1</sup>.

### Degradates

Because of high persistence of benzovindiflupyr, degradates are not expected to be prevalent in the environment.