

PESTICIDE TYPE	Herbicide
Chemical Class	Benzoic Acid
Common Trade Names	XtendiMax [®] with VaporGrip [®] Technology, Engenia [®] , FeXapan [™] plus VaporGrip [®] Technology
Application Rate (lb a.e./A)	Single: 0.5 Max Annual: 2.0 (combined total for dicamba)
Registration Status	EPA: DGA salt- Nov 2016 BAPMA salt- Dec 2016 Minnesota: Registered
Toxicity Profile for Applicators	Signal word: Caution Toxicity III or IV (oral, dermal, inhalation), II (eye & dermal irritant)
Basic Manufacturer	Bayer, BASF, DowDupont
MDA Laboratory Capabilities	Method developed for parent chemical
HUMAN HEALTH	
Non-Cancer	Acute PAD= 0.29 mg/kg/day Chronic PAD= 0.04 mg/kg/day
Cancer	Not likely to be carcinogenic to humans
<i>Acute and chronic PADs are doses that include all relevant uncertainty and safety factors</i>	
ENVIRONMENTAL AQUATIC TOXICITY	
Fish	Acute: 14,000 ppb Chronic: N/A
Invertebrate	Acute: 50,000 ppb* Chronic: No data
Aquatic Plants	Vascular: > 3250 ppb Non-vascular: 61 ppb
POLLINATOR TOXICITY	
Honey Bee	Acute Contact (LD ₅₀): 36.3 µg a.i./bee** Acute Oral (LD ₅₀): N/A
<p><i>Level of Concern (LOC) has been applied to all values.</i></p> <p>*Value may be lower for certain dicamba salts.</p> <p>** Value generated from technical end product.</p> <p><i>*Toxicity values of the formulated product were higher than Technical Grade Active Ingredient (TGAi).</i></p>	

INTRODUCTION

Dicamba is a systemic and plant growth regulator Group 4 herbicide that is used for post-emergence selective control of broadleaf weeds in a variety of food and feed crops and in residential areas. Dicamba mimics auxin plant hormone, and kills weeds by causing abnormal cell growth. Dicamba is currently registered in a variety of forms like diglycolamine (DGA), N, N-Bis-(3-aminopropyl) methylamine (BAPMA), sodium salt. In 2016, the EPA approved a new use of certain forms of dicamba as a post-emergence application for weed control in genetically-engineered (GE) soybeans. Dicamba was previously registered for only preplant and pre-harvest applications to soybeans. The new use allows over-the-top applications of dicamba on GE soybeans to control broadleaf weeds such as pigweeds (*Amaranthus* spp.), ragweeds (*Ambrosia* spp.), horseweed (*Conyza* spp.), and *Kochia* spp. The active ingredient, dicamba, is a highly volatile chemical that can damage non-target plant species through spray drift and/or volatilization. In an effort to prevent dicamba-related damage to non-target plant species, the Minnesota Commissioner of Agriculture has set forth additional restrictions for dicamba use on GE soybeans in MN. In 2018, additional restrictions included an application cutoff date of June 20 and an application cutoff temperature over 85°F. In 2019, the only additional restriction is the application cutoff date of June 20. There is no temperature restriction in 2019. The Minnesota Department of Agriculture’s (MDA) review of the new dicamba products and the risk assessments for issues relevant to Minnesota are summarized below.

PROJECTED USE IN MINNESOTA

The new dicamba products are “Restricted Use Pesticides” and are considered to be less volatile than the old products. The University of Minnesota extension expects that farmers will adopt this technology to control glyphosate resistant weeds in soybeans. Three new dicamba products are available as:

- **XtendiMax[™] with VaporGrip[™] Technology** (EPA Reg. No. [524-617](#))- is a new product from Bayer comprising dicamba DGA salt (42.8%) with VaporGrip Technology for use on GE soybeans.
- **Engenia[™]** (EPA Reg. No. 7969-345)- is a new product from BASF containing dicamba BAPMA salt (60.8%) for use on GE soybeans.
- **Dupont FeXapan[™] plus VaporGrip[™] Technology** (EPA Reg. No. [352-913](#))- is a new product from DowDuPont containing DGA salt (42.8%) with VaporGrip Technology for use on GE soybeans.

LABEL ENVIRONMENTAL HAZARDS

New product labels for post-emergence applications on GE soybeans carries the following restrictions or advisories:

Water Quality

- Dicamba has properties and characteristics to leach through soil into groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Spray drift, runoff, or volatilization may adversely affect aquatic invertebrates and non-target plants.

Other Restrictions

- The product label requires applicators to follow mandatory spray drift management and buffer distance for the protection of sensitive species, sensitive areas, and endangered species.
- Aerial application is prohibited.

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** – Dicamba is known to leach into groundwater under certain conditions, specifically where the water table is shallow. However, drinking water exposure estimates are considered to be protective of general U.S. population and sub-groups.
- **Occupational Exposure** – The occupational handler risk estimates are not of concern for dicamba on GE soybeans for most scenarios. However, inhalation risk estimates are of concern for BAPMA salt in absence of respiratory protection PPE. The label requires 24 hr restricted entry interval.

Non-target Species

- **Aquatic Life Exposure** – Based on the available ecotoxicity information, dicamba is practically non-toxic to moderately toxic on an acute basis to freshwater fish and freshwater invertebrates.
- **Others** – Dicamba is practically non-toxic to moderately toxic to mammals and birds.

ENVIRONMENTAL FATE

Soil

- **Half-life** – Aerobic: 18 days
- **Mobility** – Koc = 13.4 mL/g (very mobile)
Solubility in water = 6,100 mg/L
- **Persistence** – Dicamba is not expected to be persistent in soils at the labelled rates.

Water

- **Half-Life** – Aerobic: 72.9 days
Anaerobic: 423 days
- **Half-life via hydrolysis** – Stable
- **Photolysis in water** (half-life) – 105 days

Air

- **Volatilization** – Vapor pressure = 3.41×10^{-5} Torr; Henry's law constant 1.6×10^{-9} atm m³ mole⁻¹
New dicamba products are not expected to volatilize significantly.

Degradates

3,6-dichlorosalicylic acid (DCSA) is the major degradate of dicamba. Because DCSA is primarily formed in plants, the EPA does not expect DCSA to reach groundwater at levels that would be of concern. DCSA is more toxic than the parent compound to certain species of birds and mammals; therefore, there could be potential adverse effects on certain species of birds and mammals. Measures were taken to alleviate these risks. Other minor degradates of dicamba include 3,6-dichlorogentisic acid (DCGA) and 5-OH-dicamba.