

# **E X T O X N E T**

## **Extension Toxicology Network**

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University, and University of California at Davis. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

**P**esticide  
**I**nformation  
**P**rofile

**Dicamba**

Publication Date: 9/93

## **TRADE OR OTHER NAMES**

Metambane, Dianat, Banfel, Banvel, Banvel CST, Banvel D, Banvel XG, Mediben.

## **REGULATORY STATUS**

Products containing dicamba must bear the signal word "Warning" ([10](#)).

## **INTRODUCTION**

Dicamba is a benzoic acid herbicide. It can be applied to the leaves or to the soil. Dicamba controls annual and perennial broadleaf weeds in grain crops and grasslands, and it is used to control brush and bracken in pastures. It will kill broadleaf weeds before and after they sprout. Legumes will be killed by dicamba ([3](#), [5](#)). In combination with a phenoxyalkanoic acid or other herbicide, dicamba is used in pastures, range land, and non-crop areas (fence-rows, roadways and wastage) to control weeds ([1](#)).

## **TOXICOLOGICAL EFFECTS**

### **ACUTE TOXICITY**

Dicamba is moderately toxic by ingestion and slightly toxic by inhalation or dermal exposure ([11](#)). Symptoms of poisoning with dicamba include loss of appetite (anorexia), vomiting, muscle weakness, slowed heart rate, shortness of breath, central nervous system effects (victim may become excited or depressed), benzoic acid in the urine, incontinence, cyanosis (bluing of the skin and gums), and exhaustion following repeated muscle spasms ([2](#), [3](#)). In addition to these symptoms, inhalation can cause irritation of the linings of the nasal passages and the lungs, and loss of voice ([11](#)). Most individuals who have survived severe poisoning from dicamba have recovered within 2 to 3 days with no permanent effects ([11](#)).

Dicamba is very irritating and corrosive and can cause severe and permanent damage to the eyes ([11](#), [14](#)). Running water should be flushed through the eyes for at least 15 minutes if any dicamba is splashed into them ([5](#)). The eyelids may swell and the cornea may be cloudy for a week after dicamba is splashed in the eyes ([3](#)).

In some individuals, dicamba is a skin sensitizer ([5](#)). It may cause skin burns ([15](#)). There is no evidence that dicamba is absorbed into the body through the skin ([3](#)).

The amount of a chemical that is lethal to one-half (50%) of experimental animals fed the material is referred to as its acute oral lethal dose fifty, or LD50. The oral LD50 for dicamba in rats is 757 to 1,707 mg/kg, 1190 mg/kg in mice, 2000 mg/kg in rabbits, and 566 to 3,000 mg/kg in guinea pigs ([3](#), [10](#)). The dermal LD50 in

rabbits is greater than 2,000 mg/kg (10). The lethal concentration fifty, or LC50, is that concentration of a chemical in air or water that kills half of the experimental animals exposed to it for a set time period. The inhalation LC50 for dicamba in rats is greater than 200 mg/l (11).

## CHRONIC TOXICITY

Chronic exposure can lead to the development of the same symptoms as described for acute exposure.

Doses of 500 ppm (25 mg/kg) in the diet administered to rats for a 2-year interval produced no observable effects on survival, body weight, food consumption, organ weight, blood chemistry, or tissue structure (3, 13). A 2-year chronic feeding study in rats at dietary doses up to 25 mg/kg/day did not affect survival (2).

The EPA has established a Lifetime Health Advisory (LHA) level of 200 micrograms per liter (ug/l) for dicamba in drinking water. This means that EPA believes that water containing dicamba at or below this level is acceptable for drinking every day over the course of one's lifetime, and does not pose any health concerns. However, consumption of dicamba at high levels well above the LHA level over a long period of time has been shown to cause adverse health effects in animal studies, including changes in the liver and a decrease in body weight (12).

### Reproductive Effects

In a 3-generation study, dicamba did not affect the reproductive capacity of rats (3). When rabbits were given doses of 0, 0.5, 1, 3, 10 or 20 mg/kg/day of technical dicamba from days 6 through 18 of pregnancy, toxic effects on the mothers, slightly reduced fetal body weights, and increased loss of fetuses occurred at the 10 mg/kg dose. EPA has set the NOAEL for this study at 3 mg/kg/day (11, 13).

### Teratogenic Effects

Dicamba is suspected of being a human teratogen. No teratogenic effects have been shown in lab animals such as rabbits and rats (14).

### Mutagenic Effects

Dicamba has not been shown to be a mutagen (8, 13).

### Carcinogenic Effects

Data from laboratory studies are inadequate for EPA to determine if dicamba can increase the risk of cancer in humans (12). Rats fed up to 25 mg dicamba/kg/day for 2 years showed no increased incidence of tumors (13).

### Organ Toxicity

In mice, some enlargement of liver cells has occurred. A similar effect has not been shown in man.

### Fate in Humans and Animals

Dicamba was excreted rapidly by rats, mainly in the urine, when administered orally or subcutaneously. One to 4% was excreted in the feces (3). Mice, rats, rabbits and dogs excreted 85% of an oral dose as unmetabolized dicamba in the urine within 48 hours of dosing. Eventually, between 90 and 99% of the dose was excreted unmetabolized in the urine. This indicates that dicamba is rapidly absorbed into the bloodstream from the gastrointestinal tract (13). Like most organic acids, dicamba is joined to glycine (8), or glucuronic acid (6) in the liver.

When dicamba was ingested daily in the feed, the concentrations in different organs reached a steady state

within 2 weeks. When daily intake stopped, storage in the organs declined rapidly (3). It is therefore concluded that dicamba does not bioaccumulate in mammalian tissues.

Following an attempted suicide with a mixture of dicamba and 2,4-D, dicamba levels in the blood serum and urine of the victim became undetectable within 2 weeks (3).

## ECOLOGICAL EFFECTS

### Effects on Birds

Dicamba is only slightly toxic to birds. The LD50 for technical dicamba in mallard ducks is 2,009 mg/kg. The 8-day dietary LC50 in mallards and in bobwhite quail is greater than 10,000 ppm (2).

### Effects on Aquatic Organisms

Dicamba is of low toxicity to fish (2, 5). The lethal concentration fifty, or LC50, is that concentration of a chemical in air or water that kills half of the experimental animals exposed to it for a set time period. The 96-hour LC50 for technical dicamba in rainbow trout is 135.4 mg/l, 135.3 mg/l in bluegill sunfish, greater than 100.0 mg/l in grass shrimp, and greater than 180.0 mg/l in fiddler crab and sheepshead minnow (2). The 48-hour LC50 for dicamba in rainbow trout is 35 mg/l, 40 mg/l in bluegill, 465 mg/l in carp (10), and 110.7 mg/l in *Daphnia magna*, a small freshwater crustacean (2).

### Effects on Other Animals (Nontarget species)

When used according to the instructions, dicamba poses little threat to wildlife. Dicamba is not toxic to bees (10).

## ENVIRONMENTAL FATE

### Breakdown of Chemical in Soil and Groundwater

Dicamba does not bind to soil particles ( $K_{oc} = 2$  g/ml) (4) and is highly soluble in water. It is therefore highly mobile in the soil and may contaminate groundwater. Its leaching potential increases with precipitation and the volume applied.

Metabolism by soil microorganisms is the major pathway of loss under most soil conditions. The rate of biodegradation increases with temperature and increasing soil moisture, and tends to be faster when soil is slightly acidic. When soil moisture increases above 50%, the rate of biodegradation declines (2).

Dicamba slowly breaks down in sunlight (2). Volatilization from soil surfaces is probably not significant, but some volatilization may occur from plant surfaces (7). It is stable to water and other chemicals in the soil (8). In humid areas, dicamba will be leached from the soil in 3-12 weeks. The half-life of dicamba in soil has varied from 4 to 555 days with the typical half-life being 1 to 4 weeks. Under conditions suitable to rapid metabolism, the half-life is less than 2 weeks (7). At an application rate of 6.7 kg/HA, no dicamba remained in the soil after one year.

### Breakdown of Chemical in Water

In water, microbial degradation is the main route of dicamba disappearance. Photolysis may also occur. Aquatic hydrolysis, volatilization, adsorption to sediments, and bioconcentration are not expected to be significant (7).

### Breakdown of Chemical in Vegetation

Dicamba is rapidly taken up by the leaves and roots of plants and it is readily translocated to other plant

parts. In some plant species, dicamba accumulates in the tips of mature leaves (2, 3, 8). Desirable broadleaf plants (such as fruit trees, tomatoes, etc.) may be harmed during their growth and development stages (9).

Residues of dicamba on treated plants can disappear through exudation from the roots into the surrounding soil, metabolism within the plant, or by loss from leaf surfaces (2).

## PHYSICAL PROPERTIES AND GUIDELINES

Pure dicamba is an odorless, white crystalline solid. The technical acid is a pale buff crystalline solid. The technical material is stable and resistant to hydrolysis and oxidation under normal conditions (2, 3).

Dicamba is stable under normal temperatures and pressures, but it may pose a slight fire hazard if exposed to heat or flame. It poses a fire and explosion hazard in the presence of strong oxidizers. Thermal decomposition of dicamba will release toxic and corrosive fumes of chlorides and toxic oxides of carbon (11).

Spills or other releases of 1,000 pounds (454 kg) or more of dicamba must be reported to the National Response Center: (800) 424-8802. Dicamba is volatile and presents a drift hazard.

### Occupational Exposure Limits:

No occupational exposure limits have been established for dicamba by OSHA, NIOSH or ACGIH (11).

### Physical Properties

<b>CAS #:</b>	1918-00-9														
<b>Specific gravity:</b>	1.57 at 25 degrees C (11)														
<b>Solubility in water:</b>	Highly soluble; 500,000 ug/ml (4)														
<b>Solubility in other solvents:</b>	<table><thead><tr><th>Solvent</th><th>Solubility at 25 degrees C</th></tr></thead><tbody><tr><td>Acetone</td><td>810 g/L (5)</td></tr><tr><td>Dichloromethane</td><td>260 g/L (5)</td></tr><tr><td>Dioxane</td><td>1.18 kg/L (5)</td></tr><tr><td>Ethanol</td><td>922 g/L (5)</td></tr><tr><td>Toluene</td><td>130 g/L (5)</td></tr><tr><td>Xylene</td><td>8 g/L (5)</td></tr></tbody></table>	Solvent	Solubility at 25 degrees C	Acetone	810 g/L (5)	Dichloromethane	260 g/L (5)	Dioxane	1.18 kg/L (5)	Ethanol	922 g/L (5)	Toluene	130 g/L (5)	Xylene	8 g/L (5)
Solvent	Solubility at 25 degrees C														
Acetone	810 g/L (5)														
Dichloromethane	260 g/L (5)														
Dioxane	1.18 kg/L (5)														
Ethanol	922 g/L (5)														
Toluene	130 g/L (5)														
Xylene	8 g/L (5)														
<b>Dicamba is an acid that forms water soluble salts:</b>	Sodium salts - 360 g.a.e./L; Potassium salts - 480 g.a.e./L; Dimethylammonium - 720 g.a.e./L.														
<b>Melting point:</b>	114-116 degrees C (237-241 degrees F) (10).														
<b>Flash point:</b>	390 degrees F (199 degrees C) (11)														
<b>Decomposition temperature:</b>	decomposes at approx. 392 degrees F (200 degrees C) (11)														
<b>Vapor pressure:</b>	$3.75 \times 10^{-3}$ mm Hg at 100 degrees C (5); Zero (4)														
<b>Oil:</b>	water partition coefficient:														
<b>Koc:</b>	2 g/ml (4)														
<b>Odor threshold:</b>	250.8 ppm (6)														
<b>Chemical class/use:</b>	phenoxy herbicide; benzoic acid derivative; carboxylic acid														

## BASIC MANUFACTURER

Sandoz Crop Protection Corp.  
1300 E. Touhy Ave.  
Des Plaines, IL 60018

## Review by Basic Manufacturer

Comments solicited: October, 1992

Comments received:

## REFERENCES

1. Meister, R.T. (ed.) 1987. Farm Chemicals Handbook. Willoughby, OH: Meister Publishing Co.
2. WSSA Herbicide Handbook Committee. 1989. Herbicide Handbook of the Weed Science Society of America, 6th Ed. WSSA, Champaign, IL.
3. Hayes, W.J. and E.R. Laws (ed.). 1990. Handbook of Pesticide Toxicology, Vol. 3, Classes of Pesticides. Academic Press, Inc., NY.
4. U. S. Department of Agriculture, Soil Conservation Service. 1990 (Nov.). SCS/ARS/CES Pesticide Properties Database: Version 2.0 (Summary). USDA - Soil Conservation Service, Syracuse, NY.
5. Worthing, C.R. (ed.). 1987. The pesticide manual: A world compendium. 8th Ed. British Crop Protection Council. Croydon, England.
6. Hayes, Wayland, Jr. 1982. Pesticides Studies in Man. Baltimore, MD: Williams & Wilkins.
7. Howard, P.H. (ed.). 1989. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol. III: Pesticides. Lewis Publishers, Chelsea, MI.
8. Hartley, D. and H. Kidd, (eds.) 1983. The agrochemicals handbook. Nottingham, England: Royal Society of Chemistry.
9. Crop Protection Chemicals Reference. 1986. 2nd Ed. New York: Chemical and Pharmaceutical Pub. Corp.
10. Meister, R.T. (ed.). 1992. Farm Chemicals Handbook '92. Meister Publishing Company, Willoughby, OH.
11. Occupational Health Services, Inc. 1991 (Feb. 21). MSDS for Dicamba. OHS Inc., Secaucus, NJ.
12. U.S. Environmental Protection Agency. 1989 (Jan.). Health Advisory Summary: Dicamba. US EPA, Washington, DC.
13. \_\_\_\_\_. 1988 (Aug.). Dicamba: Health Advisory. Office of Drinking Water, US EPA, Washington, DC.
14. Hallenbeck, W.H. & K.M. Cunningham-Burns. 1985. Pesticides and Human Health. New York: Springer-Verlag.
15. Department of Transportation. 1984. Emergency Response Guidebook: Guidebook for hazardous materials incidents. Washington, DC: U.S. DOT.
16. TOXNET. 1985. National library of medicine's toxicology data network. Hazardous Substances Databank. Public Health Service. National Institute of Health. U.S. Department of Health and Human Services. Bethesda, MD: NLM.
17. Gosselin, R.E. 1984. Clinical Toxicology of Commercial Products. 5th Ed. Baltimore, MD: Williams & Wilkins.