

# Pesticide Toxicity Profile: Triazine Pesticides<sup>1</sup>

Frederick M. Fishel<sup>2</sup>

*This document provides a general overview of human toxicity, provides a listing of laboratory animal and wildlife toxicities and a cross reference of chemical, common and trade names of triazine pesticides registered for use in Florida.*

## General

As a chemical family, the triazines are a group of pesticides with a wide range of uses. Most are used in selective weed control programs; others, such as prometon, have nonselective properties which make them suitable for use on industrial sites. A unique member of this family is cyromazine, which is an insect growth regulator. It is used in livestock, vegetable, and ornamental applications by interfering with insect molting and pupation. As herbicides, the triazines may be used alone or in combination with other herbicide active ingredients to increase the weed control spectrum. They are inhibitors of electron transport in photosynthesis. Tolerant plants are capable of metabolizing the active ingredient, whereas susceptible plants do not. Triazines are some of the oldest herbicides, with research initiated on their weed control properties during the early 1950s. As a family, their chemical structures are heterocyclic, composed of carbon and nitrogen in their rings. Most, except for metribuzin, are symmetrical with their altering carbon and nitrogen atoms. Herbicide members of this family include atrazine, hexazinone, metribuzin,

prometon, prometryn, and simazine. Atrazine is widely used in corn, and was estimated to have been the most often-used pesticide in the U.S. during the late 1990s. Other atrazine uses include selective weed control in turfgrass, sugarcane, sweet corn, and sorghum. Some of its uses are classified as restricted because of ground and surface water concerns. Hexazinone is used primarily in alfalfa, pastures, pine plantations, rights-of-way, and other industrial sites. Because of its different chemical properties, metribuzin has different use patterns from the other triazine herbicides. It is used in soybean and some vegetables for selective control of broadleaf weeds. Prometryn is labeled for use in Florida on cotton, celery, and several other specialty vegetables. Simazine has the most crops and sites labeled for use of the triazines and simazine is commonly used in citrus weed control programs in Florida. Some specific uses of simazine, such as on grapes and certain berries, are classified as restricted. Product formulations of the triazine pesticides vary widely.

## Toxicity

Systemic toxicity is unlikely unless large amounts have been ingested. Some of the triazines are moderately irritating to the eyes, skin, and respiratory tract. Atrazine is considered slightly to moderately toxic to humans. The EPA has established a Lifetime Health Advisory Level for atrazine in drinking water of 3 micrograms per liter. Water containing

1. This document is PI-121, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date April 2006. Reviewed September 2018. Visit the EDIS website at <http://edis.ifas.ufl.edu>.

2. Frederick M. Fishel, professor, Agronomy Department, and director, Pesticide Information Office; UF/IFAS Extension, Gainesville, FL 32611.

The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication do not signify our approval to the exclusion of other products of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer's label.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For more information on obtaining other UF/IFAS Extension publications, contact your county's UF/IFAS Extension office.

U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A & M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Nick T. Place, dean for UF/IFAS Extension.

atrazine at or below this level is acceptable for drinking every day over the course of one's lifetime, and does not pose any health risk. Long-term consumption of high levels of atrazine has caused adverse health effects in animals, including tremors, changes in organ weights, and damage to the liver and heart. Hexazinone is not considered to be acutely toxic, but can cause serious and irreversibly eye damage. Because of this ability, the signal word it bears on its label is "DANGER."

During the 1980s, metribuzin was restricted in its use classification by the EPA because of questions regarding groundwater contamination and chronic toxicity. Later, manufacturers of metribuzin resolved this once they submitted the necessary data to disprove these concerns. It is now classified as a general use pesticide. Prometon products bear the signal word "WARNING" because of substantial but temporary eye injury potential. Any serious toxic effects caused by prometon, prometryn, or simazine are not likely.

As a family of pesticides, the triazines are one of the least toxic to wildlife. Only prometon is considered as moderately toxic to fish. No adverse effects to bees are known.

Mammalian toxicities for the triazine pesticides are shown in Table 1. Table 2 lists the toxicities to wildlife by the common name of the pesticide. Table 3 provides a cross listing of many of the trade names that these products are registered and sold by in Florida.

## Additional Information

Crop Protection Handbook. 2005. vol. 91. Willoughby, Ohio: Meister Publishing Co. <http://store.meistermedia.com/>

Nesheim, O.N., F.M. Fishel and M.A. Mossler. 2005. *Toxicity of Pesticides*. PI-13. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <http://edis.ifas.ufl.edu/pi008>

Reigart, J.R. and J.R. Roberts. 1999. Recognition and management of pesticide poisonings, 5<sup>th</sup> edition. United States Environmental Protection Agency Publication EPA-735-R-98-003.

Seyler, L.A., et.al. 1994. Extension toxicology network (EXTOXNET). Cornell University and Michigan State University. <http://extoxnet.orst.edu/index.html>. Visited July 2005.

Tomlin, C. (Ed.). 1994. A World Compendium. The Pesticide Manual. Incorporating the agrochemicals handbook. (10<sup>th</sup> ed.). Bungay, Suffolk, U.K.: Crop Protection Publications.

Table 1. Triazine pesticide mammalian toxicities (mg/kg of body weight).

Common name	Rat oral LD <sub>50</sub>	Rabbit dermal LD <sub>50</sub>
Atrazine	1,780	750
Cyromazine	3,387	---
Hexazinone	1,690	5,278
Metribuzin	2,000	>20,000
Prometon	2,980	>2,000
Prometryn	5,235	>2,020
Simazine	>5,000	>3,100

Table 2. Triazine pesticide wildlife toxicity ranges.

Common name	Bird acute oral LD <sub>50</sub> (mg/kg)*	Fish (ppm)**	Bee <sup>†</sup>
Atrazine	ST	ST	PNT
Cyromazine	ST	ST	PNT
Hexazinone	PNT	PNT	PNT
Metribuzin	ST-MT	ST	PNT
Prometon	ST	ST	PNT
Prometryn	PNT	MT	PNT
Simazine	PNT	PNT	PNT

\*Bird LD<sub>50</sub>: Practically nontoxic (PNT) = >2,000; slightly toxic (ST) = 501 – 2,000; moderately toxic (MT) = 51 – 500; highly toxic (HT) = 10 – 50; very highly toxic (VHT) = <10.

\*\*Fish LC<sub>50</sub>: PNT = >100; ST = 10 – 100; MT = 1 – 10; HT = 0.1 – 1; VHT = <0.1.

<sup>†</sup>Bee: HT = highly toxic (kills upon contact as well as residues); MT = moderately toxic (kills if applied over bees); PNT = relatively nontoxic (relatively few precautions necessary).

Table 3. Cross reference list of common, trade and chemical names of triazine pesticides.

Common name	Trade names*	Chemical name
Atrazine	Aatrex®, Atrazine®	6-chloro-N-ethyl-N-(1-methylethyl)-1,3,5-triazine-2,4-diamine
Cyromazine	Armor®, Citation®, Flyzine®, Larvadex® Solitude®, Trigard®	N-cyclopropyl-1,3,5-triazine-2,4,6-triamine
Hexazinone	Velpar®	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione
Metribuzin	Sencor®	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one
Prometon	Pramitol®	6-methoxy-N,N-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
Prometryn	Caparol®, Cotton Pro®, Prometryn®, Suprend®, Vegetable Pro®	N,N-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
Simazine	Princep®, Sim-trol®, Simazine®	6-chloro-N,N-diethyl-1,3,5-triazine-2,4-diamine

\*Does not include manufacturers prepackaged mixtures.