NPIC Technical Fact Sheets are designed to provide information that is technical in nature for individuals with a scientific background or familiarity with the regulation of pesticides by the U.S. Environmental Protection Agency (U.S. EPA). This document is intended to be helpful to professionals and to the general public for making decisions about pesticides.

National Pesticide Information Center

Triclopyr

(Technical Fact Sheet)

For less technical information, please refer to the General Fact Sheet.

The Pesticide Label: Labels provide directions for the proper use of a pesticide product. *Be sure to read the entire label before using any product.* Signal words, listed below, are found on the front of each product label and indicate the product's potential hazard.

CAUTION - low toxicity **WARNING - moderate toxicity** **DANGER - high toxicity**

What is triclopyr?

- Triclopyr is a selective systemic herbicide used to control unwanted woody and herbaceous weeds (1).
- Triclopyr is sold predominately as a triclopyr triethylamine salt (TEA) or triclopyr butoxyethyl ester (BEE) (1).

How is triclopyr used?

- Triclopyr was first registered in 1979 for non-crop areas and forests. In descending order of amounts applied (1987 to 1995), triclopyr is currently registered for use on pasture and rangeland, forests, rights-of-way, rice, and lawns. (1). See **Laboratory Testing** box.
- Triclopyr TEA is formulated as soluble and emulsifiable concentrates, liquids, granulars, wettable powders, pellets, or formulation intermediates. Triclopyr BEE is formulated as emulsifiable concentrates, ready-to-use liquids or formulation intermediates (1).

Laboratory Testing: Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed high enough doses to cause toxic effects. These tests help scientists judge how these chemicals might affect humans, domestic animals, and wildlife in cases of overexposure. When pesticide products are used according to the label directions, toxic effects are not likely to occur because the amount of pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

What are some products that contain triclopyr?

- Garlon, Turflon, Pathfinder, Access, Brush-B-Gon, Confront, and Crossbow (3).
- Products that contain triclopyr often contain other herbicide active ingredients such as 2,4-D and clopyralid. All pesticide active ingredients are listed on the front of the product label (2, 3).

What is the mechanism of action for triclopyr?

- Triclopyr is a selective systemic herbicide that mimics the effects of plant hormones (auxins) (2).

What is the acute toxicity of triclopyr?

Oral

- Triclopyr is low in toxicity via the oral route. In rats, the acute oral LD50 of triclopyr TEA and BEE forms is 1847 mg/kg and 830 mg/kg respectively (1). See boxes on **Laboratory Testing**, **LD50/LC50,** and **Toxicity Category**.

Dermal

- Both forms of triclopyr are non-irritating to the skin of rabbits, with an LD50 greater than 2000 mg/kg. However, dermal sensitization occurs from each form applied to the skin of guinea pigs (1).

- The TEA form of triclopyr (44.4% active ingredient) is corrosive to the eyes of rabbits. The BEE form of triclopyr (97.1% active ingredient) causes only minimal eye irritation (1).

Inhalation

- Inhaled triclopyr is low in toxicity to rats (1). The LC50 of triclopyr TEA is greater than 2.6 mg/L and the LC50 is greater than 4.8 mg/L for triclopyr BEE (1).

Signs of Toxicity - Animals

- Triclopyr is slightly irritating to the skin and eyes (1).

- No reports of systemic poisoning resulting from ingestion of triclopyr were found.

Signs of Toxicity - Humans

- Triclopyr has a low rate of absorption and is rapidly eliminated and, therefore, has a very low potential to become acutely toxic through dermal exposure (4).

- No reports of systemic poisoning resulting from ingestion of triclopyr were found.

LD50/LC50: A common measure of acute toxicity is the lethal dose (LD50) or lethal concentration (LC50) that causes death (resulting from a single or limited exposure) in 50 percent of the treated animals. LD50 is generally expressed as the dose in milligrams (mg) of chemical per kilogram (kg) of body weight. LC50 is often expressed as mg of chemical per volume (e.g., liter (l)) of medium (i.e., air or water) the organism is exposed to. Chemicals are considered highly toxic when the LD50/LC50 is small and practically non-toxic when the value is large. However, the LD50/LC50 does not reflect any effects from long-term exposure (i.e., cancer, birth defects, or reproductive toxicity) that may occur at levels below those that cause death.

Toxicity Category (*Signal Word*)

	High Toxicity (*Danger*)	Moderate Toxicity (*Warning*)	Low Toxicity (*Caution*)	Very Low Toxicity (*Caution*)
Oral LD50	Less than 50 mg/kg	50 - 500 mg/kg	500 - 5000 mg/kg	Greater than 5000 mg/kg
Dermal LD50	Less than 200 mg/kg	200 - 2000 mg/kg	2000 - 5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50 - 4hr	Less than 0.05 mg/l	0.05 - 0.5 mg/l	0.5 - 2 mg/l	Greater than 2 mg/l
Eye Effects	Corrosive	Irritation persisting for 7 days	Irritation reversible within 7 days	Minimal effects, gone within 24 hrs
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation

U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Labeling
http://www.epa.gov/oppfead1/labeling/lrm/chap-07.htm

Is triclopyr a carcinogen?

Animals

- There is no evidence that triclopyr causes unscheduled DNA synthesis or acts as a mutagen (1).

- In feeding studies with mice and rats, no compound-related tumors are observed in male animals. However, there is a significant increase in the presence of mammary gland adenocarcinomas in female mice and rats fed triclopyr at 36 mg/kg/day for 2 years (1).

Humans

- The Carcinogenicity Peer Review Committee (CPRC) at the U.S. EPA classified triclopyr as a group D carcinogen, that is, not classifiable as to human carcinogenicity (1). See box on **Cancer**.

Cancer: The U.S. EPA has strict guidelines that require testing of pesticides for their potential to cause cancer. These studies involve feeding laboratory animals large *daily* doses of the pesticide over most of the lifetime of the animal. Based on these tests, and any other available information, EPA gives the pesticide a rating for its potential to cause cancer in humans. For example, if a pesticide does not cause cancer in animal tests, then the EPA considers it unlikely the pesticide will cause cancer in humans. Testing for cancer is not done on human subjects.

Does triclopyr cause reproductive or teratogenic effects?

Animals

- Developmental effects from oral exposure to triclopyr during pregnancy occur at 100 mg/kg/day in rabbits and 300 mg/kg/day in rats for the BEE and TEA forms of triclopyr, respectively. Rabbits produce a decreased number of live fetuses and have an increased incidence of fetal death. The fetuses exhibit a lack of ossification in their digital bones and an increase in the percentage of fetuses with 13 ribs. Rats demonstrate a decrease in mean fetal body weight and increased incidences of fetal and liter skeletal anomalies (1, 5).

- The developmental Lowest Observable Effects Level (LOEL) for the BEE form is 100 mg/kg and the No Observable Effect Level is 30 mg/kg. (1). The TEA developmental LOEL is 300 mg/kg and the NOEL is 30 mg/kg.

- In a two-generation study where rats were fed triclopyr at a rate of 200 and 250 mg/kg/day, the animals exhibited significant decreases in parental body weight and weight gain, mean litter size and number, and the number of live pups and pup weight (1, 5). Parental toxicity was observed at 25 mg/kg/day with no effects observed in the offspring (1).

Humans

- No data was found on the effects of triclopyr on human reproduction or development.

Could chronic exposure to triclopyr cause health effects?

Animals

- Triclopyr administered in the diet of both male and female rats for 13 weeks at 20 mg/kg results in degeneration of the proximal tubules within the kidney (1).

- There are no significant changes in the body weight, food consumption or blood chemistry of beagle dogs fed up to 2.5 mg/kg/day of triclopyr over 183 days or in those dogs fed up to 5.0 mg/kg day over 1 year (1).

- Triclopyr causes a decrease in body weight, food consumption, blood chemistry, and liver histpathology in beagle dogs fed 20 mg/kg body weight over 228 days. There are also significant increases in male liver and female kidney weights (1).

Humans

- No human data was found on teratogenic or reproductive effects of triclopyr.

What is the fate of triclopyr in the body?

Animals

- The elimination half-life of triclopyr in rats is 3.6 hours (1). See box on **Half-life**.

- In beagle dogs, triclopyr has an elimination half-life of 7.2 hours (6).

- The elimination half-life of triclopyr in the rhesus monkey is 6.3 hours (6).

- In rats, greater than 90% of triclopyr ingested is recovered unchanged in the urine or feces within 24 to 72 hours. Some of the remaining triclopyr is found in fatty tissue and the ovaries of females when the experiments were concluded. Some of the triclopyr is metabolized into 3,5,6-trichloro-2-pyridinol (TCP) which is also a metabolite of chlorpyrifos (1,7). Researchers noted similar findings in the beagle dog (6).

Half-life: the time required for half of the compound to degrade.

1 half-life = 50% remaining
2 half-lives = 25% remaining
3 half-lives = 12% remaining
4 half-lives = 6% remaining
5 half-lives = 3% remaining

The amount of chemical remaining after a half-life will always depend on the amount of the chemical present initially.

Humans

- Greater than 80% of the triclopyr ingested by six human volunteers appeared unchanged in the urine within 48 hours. From these data the half-life of triclopyr was determined to be 5.1 hours in humans (4). See box on **Half-life**.

- Triclopyr was applied at a rate of 3.7 mg/kg body weight to the forearm of human volunteers for 8 to 12 hours and approximately 1.7% of the dose was absorbed. Less than 0.5% of triclopyr ingested by the volunteers was detected as TCP in the urine (4).

What is the environmental fate of triclopyr?

Soil

- In soil, triclopyr has a half-life ranging from 1.1 to 90 days depending on soil type (1,8). Several resources have reported a 46 day half-life for triclopyr (2, 8, 9). The half-life of the major metabolite, TCP, is 30 to 90 days (2).

- In soil, both forms of triclopyr degrade into several intermediates before ultimately degrading into carbon dioxide (CO_2) (1).

Water

- Triclopyr in water is predominantly degraded by exposure to sunlight, with half-lives ranging from 1 to 10 days depending on water conditions, such as turbidity. Triclopyr is stable in water without sunlight (1, 10).

Air

- The vapor pressure of triclopyr is 0.2 mPa at 25° C (2).

Plants

- Triclopyr's half-life in plants ranges from 3 to 10 days. The main metabolite is 3,5,6-trichloro-2-methoxypyridine (2).

Does triclopyr affect wildlife?

Birds

- Both forms of triclopyr are slightly to practically non-toxic to birds such as quail (for BEE, LD50 = 735 to 849 mg/kg), mallard ducks (for TEA, LD50 = 2055 mg/kg), and zebra finch (for BEE, LD50 = 1,627 to 2,277 mg/kg) (1,11).

Fish and Aquatic Life

- Triclopyr TEA is practically non-toxic (LC50 > 100 ppm) to bluegill sunfish (*L. macrochirus*), rainbow trout (*O. mykiss*), and fathead minnow (*P. promelas*) in acute studies. Triclopyr BEE is moderately to highly toxic (LC50 0.1 to ≤ 10 ppm) to these same species under similar conditions (1).

- The major metabolite, TCP, is moderately toxic to fish (LC50 >1 to ≤12) including several species of salmon and the previously mentioned fish species (1).

- The elimination half-life in crayfish (*P. Clarki*) is 7 to 17 days. There is no evidence for bioaccumulation in this aquatic invertebrate (12).

- Triclopyr TEA is practically non-toxic to *Daphnia magna* (waterflea) with an LC50 of 1,496 mg/L, while triclopyr BEE is slightly to moderately toxic with an LC50 of 1.7 to 12 mg/L (1).

- Levels of triclopyr TEA that elicit reproductive impairment in the waterflea under laboratory conditions are not expected in freshwater systems with current labeled rates (TEA concentrations greater than 80.7 mg/L) (1).

- Triclopyr TEA is practically non-toxic to slightly toxic to several aquatic invertebrates acutely exposed (e.g., oyster *(C. virginica*) LC50 = 58 mg/L, shrimp (*P. pugio* and *P. duorarum*), LC50 = 326 to 895 mg/L, and crab *(U. pugilator*), LC50 >1000 mg/L) (1).

Terrestrial Invertebrates

- Triclopyr is practically non-toxic to honey bees (*A. mellifera*) in acute contact exposure (LD50 > 100 µg/bee) (1).

Date reviewed: September, 2002

For more information contact: NPIC
Oregon State University, 333 Weniger Hall, Corvallis, Oregon 97331-6502.
Phone: 1-800-858-7378 Fax: 1-541-737-0761 Email: npic@ace.orst.edu
NPIC at http://npic.orst.edu/ EXTOXNET at http://ace.orst.edu/info/extoxnet/

References

1. *Reregistration Eligibility Decision Document: Triclopyr;* EPA-738-R-98-011; U.S. Environmental Protection Agency, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, Oct 1998; 3-58.
2. *A World Compendium: The Pesticide Manual*, 12th ed.; Tomlin, C. D. S., Ed.; British Crop Protection Council: Farnham, UK, 2000; pp 933-934.
3. *Pest-Bank Pesticide Product Data* [CD-ROM]; Purdue Research Foundation: West Lafayette, IN, 2001.
4. Carmichael, N. G.; Nolan, R. J.; Perkins, J. M.; Davies, R.; Warrington, S. J. Oral and Dermal Pharmacokinetics of Triclopyr in Human Volunteers. *Hum. Toxicol.* **1989**, *8* (6), 431-7.
5. Hanley, T. R. Jr., Thompson D. J.; Palmer, A. K.; Beliles, R. P.; Schwetz, B. A. Teratology and Reproduction Studies with Triclopyr in the Rat and Rabbit. *Fundam. Appl. Toxicol.*. **1984**, *4* (5 Oct), 872-82.
6. Timchalk, C.; Nolan, R. J. Pharmacokinetics of triclopyr (3,5,6-trichloro-2-pyridinyloxyacetic acid) in the Beagle Dog and Rhesus Monkey: Perspective on the Reduced Capacity of Dogs to Excrete this Organic Acid Relative to the Rat, Monkey, and Human. *Toxicol. Appl. Pharmacol*. **1997**, 144(2), 268-278.
7. Timchalk, C.; Dryzga, M. D.; Kastl, P. E. Pharmacokinetics and metabolism of triclopyr (3,5,6-trichloro-2-pyridinyloxyacetic acid) in Fischer 344 rats. *Toxicology.* **1990**, *62*(1), 71-87.
8. *Pesticide Properties in the Environment*; Hornsby, A. G., Wauchope, R. D., Herner, A. E., Eds.; Springer-Verlag: New York, 1996; p. 200.
9. *Pesticide Profiles: Toxicity, Environmental Impact, and Fate*; Kamrin, M. A., Eds.; Lewis Publishing: New York, 1997; pp. 524-527.
10. Petty, D. G.; Skogerboe, J. G.; Getsinger, K. D.; Foster, D. R.; Houtman, B. A.; Fairchild, J. F.; Anderson, L. W. The aquatic fate of triclopyr in whole-pond treatments. *Pest Manage. Sci.* **2001**, *57* (9), 764-775.
11. Holmes, S. B.; Thompson, D. G.; Wainio-Keizer, K. L.; Capell, S. S.; Staznik, B. Effects of Lethal and Sublethal Concentrations of the Herbicide, Triclopyr Butoxyethyl Ester, in the Diet of Zebra Finches. *J. Wildl. Dis.* **1994**, *30* (3), 319-27.
12. Barron, M. G.; Hansen, S. C.; Ball, T. Pharmacokinetics and Metabolism of Triclopyr in the Crayfish (Procambarus clarki). *Drug Metab. Dispos.* **1991**, *19* (1), 163-7.