
NPTN fact sheets are designed to answer questions that are commonly asked by the general public about pesticides that are regulated by the U.S. Environmental Protection Agency (US EPA). This document is intended to be educational in nature and helpful to consumers for making decisions about pesticide use.

National Pesticide Telecommunications Network

Fipronil

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.* A signal word on each product label indicates the product's toxicity after a single dose.

CAUTION- low toxicity

WARNING- moderate toxicity

DANGER- high toxicity

What is fipronil?

Fipronil is a phenylpyrazole insecticide which was introduced to the United States for use in animal health, indoor pest control, and commercial turf in 1996.

How does fipronil work?

Fipronil disrupts normal nerve function. Fipronil acts by blocking the GABA-gated chloride channels of neurons in the central nervous system (1,2). The GABA-receptor system is responsible for inhibition of normal neural activity (i.e. prevents excessive stimulation of the nerves). When the system's regular functions are blocked by fipronil, the result is neural excitation and the death of the insect. Fipronil kills insects by contact and ingestion. The principal path of activity is dependent on the insect target (2). It appears to be effective against adult and larval stages (3).

What types of products contain fipronil?

- granular turf products
- pet care flea and tick sprays
- pet care flea and tick topical solutions
- roach and ant baits

What are some products that contain fipronil?

- Chipco Choice™
- Frontline®
- Frontline® Topspot™
- Combat®
- Maxforce®

How toxic is fipronil?

Animals

- The *technical* product (96.5% fipronil) has a high order of toxicity with respect to ingestion and inhalation in the rat, but appears to be less toxic via skin absorption. Fipronil is more toxic via skin absorption in the rabbit than in the rat (4).
- Fipronil may cause mild irritation to the eyes and slight skin irritation. It does not sensitize the skin (4).
- Signs of toxicity in rats include reduced feed consumption, anuria (no urination), increased excitability, and seizures (4). See **Laboratory Testing** box.
- Affected organs may include the liver, thyroid, and kidney (4).
- The *technical* form of fipronil carries the signal word "Warning." All *formulated* or *end-use* fipronil products in the United States have the signal word "Caution." See **The Pesticide Label** box (above). Formulated products contain diluted amounts of fipronil.

Humans

- Human toxicity data are not available.

Laboratory Testing: Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term and long-term health effects. Laboratory animals are purposely fed high enough doses to cause toxic effects. From these tests, scientists judge how these chemicals might affect humans in cases of accidental overexposure. Toxic effects are not expected in humans or pets since the amount of a pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

How will fipronil flea and tick products affect my pet?

- Fipronil pet products carry the signal word "Caution." These *formulated* products are not absorbed through the skin, but may cause some skin irritation at the application site. They have low toxicity if ingested (5,6).

Effects of fipronil on human health and the environment depend on how much fipronil is present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

Does fipronil break down and leave the body?

Animals

- The major route of fipronil excretion in rats is via feces. Excretion in the feces ranges from 45-75% of the administered dose, while excretion in urine ranges from 5-25% (4).

Humans

- Human metabolism data are not available.

Is fipronil likely to cause cancer?

Animals

- Fipronil showed no evidence of causing cancer in mice that were fed large daily amounts in long-term studies. However, there was an increase in thyroid tumors in both sexes of rats in the same type of studies (4). See **Cancer** box.

Humans

- Human cancer data are not available.

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 for up to 2 years. These animals are compared with a group of animals that did not receive the chemical. Animal studies help show whether a chemical is a potential human carcinogen. If a pesticide does not cause cancer in animal tests, then the EPA considers it unlikely the pesticide will cause cancer in humans.

Does fipronil cause reproductive problems or birth defects?

Animals

- Reproduction studies in rats over several generations show that reproductive toxicity occurs at the higher doses tested. Clinical signs include decreased litter size, decreased body weights in litters, decreased fertility, and death of the fetus (4).
- Fipronil may cause a delay in development at high doses, but there is no evidence of causing birth defects (2,7).

Humans

- Human data on reproductive and developmental toxicity are not available.

What happens to fipronil in the environment?

Soil: In lab studies, fipronil has a half-life of 122-128 days in oxygenated sandy loam soil (4). In field studies, dissipation half-life on soil surfaces ranged from 0.7 to 1.7 months. Half-life of fipronil applied by soil incorporation ranged from 3 to 7.3 months. Residues remain mainly in the upper 12 inches of soil. Fipronil has low soil mobility. It binds to the soil and has little potential for groundwater contamination (2,4).

Anaerobic metabolism: Fipronil degrades slowly in water and sediment that lack oxygen with a half-life ranging from 116-130 days (4).

Hydrolysis: Fipronil is stable to breakdown by water at mildly acid (lower pH) to neutral pH. It degrades with a half-life of 28 days in basic (higher pH) solutions (4).

Half-life is the time required for half of a 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

Remember that the amount of chemical remaining after a half-life will always depend on the amount of the chemical originally applied.

Photodegradation: In studies where fipronil was exposed to light, fipronil had a half-life of 3.6 hours in water and 34 days in loamy soil (4).

What effect does fipronil have on wildlife?

- Fipronil is highly toxic to fish and aquatic invertebrates. Its tendency to bind to sediments and its low water solubility may reduce the potential hazard to aquatic wildlife (2,4).
- Fipronil is toxic to bees and should not be applied to vegetation when bees are foraging (2).
- Fipronil has been found to be highly toxic to upland game birds, but is practically non-toxic to waterfowl and other bird species (2,4). One of the metabolites of fipronil has a higher toxicity to birds than the parent compound itself (4).

- Fipronil is non-toxic to earthworms, soil microorganisms and aquatic plants (2,4). Fipronil is moderately toxic to small mammals if ingested (4).

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Selected References:

1. Cole, Loretta M., Russell A. Nicholson, and John E. Casida. 1993. Action of phenylpyrazole insecticides at the GABA-gated chloride channel. *Pest. Biochem. Physiol.* 46:47-54.
2. Hamon, Nicholas, Richard Shaw, and Henry Yang. 1996. Worldwide development of fipronil insecticide. *Proc.- Beltwide Cotton Conf.* 2:759-765.
3. Colliot, F., K.A. Kukowski, P.W. Hawkins, and D.A. Robers. 1992. Fipronil: a new soil and foliar broad spectrum insecticide. *Brighton Crop Prot. Conf.- Pests Dis.* 1:29-34.
4. United States Environmental Protection Agency. 1996. Fipronil Pesticide Fact Sheet. EPA-737-F-96-005. U.S. Environmental Protection Agency. Washington, D.C.
5. Birckel, P., P. Cochet, P. Benard, and A. Weil. 1996. Cutaneous distribution of ¹⁴C-fipronil in the dog and in the cat following a spot-on administration. Presented at the Third World Congress of Veterinary Dermatology, Edinburgh, Scotland, UK. 11-14 Sept. 1996.
6. Rhone Merieux. 1996. Frontline Top Spot. Technical literature. Rhone Merieux. Athens, GA.
7. United States Environmental Protection Agency. 1997. Tolerance petition for residues of fipronil in or on corn and animal RAC's: HED risk assessment. U.S. Environmental Protection Agency. Washington D.C.