

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

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

## General

Organophosphates are some of the most widely used pesticides in the world. They are used in agriculture, homes, gardens, and veterinary practices, replacing the same uses as the organochlorines, many of which have been banned for years. In general, they are not persistent in the environment as they break down quickly. Because of their relatively fast rate of degradation, they have been a suitable replacement for the more persistent organochlorines.

## Toxicity

Some of the early organophosphates were developed as nerve poisons for human warfare. The organophosphates recommended for non-residential uses are relatively toxic to vertebrate organisms. Their primary mode of action on insects and other animals is by phosphorylation of the acetylcholinesterase enzyme. This enzyme is necessary for controlling nerve impulse transmission between nerve fibers. A loss of this enzyme function results in an accumulation of acetylcholine, which causes unregulated nervous impulses. Higher levels of acetylcholine result in

sensory and behavioral disturbances, incoordination, and depressed motor function. Symptoms of acute poisoning develop during or after exposure, within minutes to hours, depending on method of contact. Inhalation exposure results in the fastest appearance of symptoms, followed by the gastrointestinal route, and then the dermal (skin) route. Some of the early symptoms include headache, nausea, dizziness, sweating, and salivation. Symptoms such as muscle twitching, weakening, vomiting, abdominal cramps, and diarrhea all indicate a worsening condition. Recovery from organophosphate exposure depends upon generation of new enzyme. Mammalian toxicities for organophosphate pesticides are shown in Table 1. Table 2 lists the toxicities to wildlife by the common name of the organophosphate. Table 3 provides a cross-listing of many of the trade names that these products are registered and sold by in Florida.

## Additional Information

Nesheim, O.N., F.M. Fishel, and M. Mossler. 2002. *Toxicity of Pesticides*. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/pi008>

Reigart, J.R. and J.R. Roberts. 2013. "Recognition and Management of Pesticide Poisonings." (6<sup>th</sup> ed.) *United States Environmental Protection Agency Publication EPA-735K-13001*.

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

Common name	Rat oral LD <sub>50</sub>	Rabbit dermal LD <sub>50</sub>
Acephate	1,030–1,447	>10,250
Chlorpyrifos	96–270	2,000
Diazinon	1,250	2,020
Dimethoate	235	400
Disulfoton	2–12	3.6–15.9
Ethoprop	61.5	2.4
Malathion	5,500	>2,000
Methamidophos	13 (female only)	122
Methidathion	25–44	200
Naled	191	360
Oxydemeton-methyl	50	1,350
Phorate	2–4	20–30 (guinea pig)
Phosmet	147–316	>4,640
Profenofos	358	472

Table 2. Organophosphate wildlife toxicity ranges.

Common name	Bird acute oral LD <sub>50</sub> (mg/kg)*	Fish LC <sub>50</sub> (ppm)**	Bee†
Acephate	MT	PNT	HT
Chlorpyrifos	HT	HT	HT
Diazinon	HT	HT	HT
Dimethoate	HT	MT	HT
Disulfoton (Di-Syston S)	HT	MT	HT
Ethoprop	HT	HT	—
Malathion	MT	HT	HT
Methamidophos	HT	ST	T
Methidathion	Not available	VHT	HT
Naled	MT	HT	HT
Oxydemeton-methyl	MT to PNT	ST	T
Phorate	VHT	ST	MT
Phosmet	ST	HT	HT
Profenofos	Not available	VHT	Not available

\*Bird LD<sub>50</sub>: PNT = >2,000; ST = 501–2,000; MT = 51–500; HT = 10–50; VHT = <10.

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

†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 organophosphates.

Common name	Trade names*	Chemical name
Acephate	Acephate <sup>®</sup> , Orthene <sup>®</sup> ,	O,S-dimethyl acetylphosphoroamidothioate
Chlorpyrifos	Chlorpyrifos <sup>®</sup> , Govern <sup>®</sup> , Lorsban <sup>®</sup> , Nufos <sup>®</sup> , Warhawk <sup>®</sup> , Whirlwind <sup>®</sup>	O,O-diethyl O-(3,5,6-trichloro-2-pyridinyl) phosphorothioate
Diazinon	Diazinon <sup>®</sup>	O,O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate
Dimethoate	Dimethoate <sup>®</sup> , Cygon <sup>®</sup>	O,O-dimethyl S-methylcarbamoylmethyl phosphorodithioate
Disulfoton	Di-Syston <sup>®</sup>	O,O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate
Ethoprop	Mocap <sup>®</sup>	O-ethyl S,S-dipropyl phosphorodithioate
Malathion	Fyfanon <sup>®</sup> , Malathion <sup>®</sup>	Diethyl (dimethoxythiophosphorylthio)succinate
Methamidophos	Monitor <sup>®</sup>	O,S-Dimethyl phosphoramidothioate
Methidathion	Supracide <sup>®</sup>	S-2,3-dihydro-5-methoxy-2-oxo-1,3,4-thiadiazol-3-ylmethyl O,O-dimethyl phosphorodithioate
Naled	Dibrom <sup>®</sup>	1,2-dibromo-2,2-dichloroethyl dimethyl phosphate
Oxydemeton-methyl	MSR <sup>®</sup>	S-[2-(Ethylsulfanyl)ethyl]O,O-dimethyl phosphorothioate
Phorate	Phorate <sup>®</sup> , Thimet <sup>®</sup>	O,O-Diethyl S-[(ethylthio)methyl] phosphorodithioate
Phosmet	Imidan <sup>®</sup>	S-[(1,3-dihydro-1,3-dioxo-2H-isoindol-2-yl)methyl] O,O-dimethyl phosphorothioate
Profenofos	Curacron <sup>®</sup>	O-4-bromo-2-chlorophenyl O-ethyl S-propyl phosphorothioate

\*Does not include manufacturers' prepackaged mixtures.