PI-89

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# Pesticide Toxicity Profile: Arsenical Herbicides[1]

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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 the arsenical herbicides registered for use in Florida.

## General

The arsenical herbicides are a group of older herbicides, having been in use since the 1950s. There are currently three arsenical herbicide active ingredients registered for use in Florida: cacodylic acid, disodium methanearsonate, and monosodium methanearsonate (DSMA and MSMA, respectively). Many arsenic compounds have been discontinued in the United States because of regulatory reasons. They are applied as postemergence or directed sprays acting primarily as contact materials with limited translocation. Their mode of action is to inhibit plant growth by uncoupling phosphorylation. Their initial plant injury symptoms are chlorosis caused by a loss of chlorophyll. Their phytotoxic activities are inactivated upon soil contact. They have been historically useful for grass control in turfgrass sites, cotton, citrus, rights-of-way and other industrial and non-crop sites. Commercial products are readily available and numerous. They are formulated as liquids.

## Toxicity

The arsenical active ingredients remaining on the market in the U.S. are the organic methylated compounds which are considered to present less toxic hazard than other forms (arsines or arsenites). Acute poisoning symptoms and signs usually appear within one hour, if ingested. Cacodylic acid is absorbed into the bloodstream more readily through inhalation than through ingestion or dermal exposure. With severe cases, garlicky odor of the breath and feces are noticeable. There may also be a salty, metallic taste in the mouth, along with abdominal discomfort. The central nervous system is also commonly affected with acute exposures, beginning with dizziness, headache, drowsiness and confusion. Symptoms may progress with weakened muscles, spasms, coma and convulsions. Death usually occurs one to three days following onset of symptoms and is often the result of circulatory failure, but renal injury may also contribute. Chronic exposures are more difficult to determine; but, neurological symptoms are usually

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more common than gastrointestinal effects which are more closely associated with acute poisoning. A sign of exposure is the formation of white bands across the nails. Mammalian toxicities for the arsenical herbicides 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://www.meisterpro.com/mpn.

Extension toxicology network (EXTOXNET). Cornell University and Michigan State University. http://extoxnet.orst.edu/index.html. Visited November 2005.

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Ware, G.W. 2000. The pesticide book. 5th edition. Thomson Publications.

**Table 1.** Arsenical herbicide mammalian toxicities (mg/kg of body weight).

| Common name | Rat oral $LD_{50}$ | Rabbit dermal $LD_{50}$ |
|---|---|---|
| Cacodylic acid (sodium salt) | 2,756 | --- |
| DSMA | 600 | 236 - 325 |
| MSMA | 1,700 | >2,500 |

**Table 2.** Arsenical herbicide wildlife toxicity ranges.

| Common name | Bird acute oral $LD_{50}$ (mg/kg)* | Fish (ppm)** | Bee† |
|---|---|---|---|
| Cacodylic acid (sodium salt) | PNT | ST – PNT | PNT |
| DSMA | ST | PNT | PNT |
| MSMA | PNT | PNT | PNT |

*Bird $LD_{50}$: 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 $LC_{50}$: 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 arsenical herbicides.

| Common name | Trade names* | Chemical name |
|---|---|---|
| Cacodylic acid (sodium salt) | Liquid Edger®, others | Hydroxydimethylarsine oxide |
| DSMA | DSMA, Methar®, others | Disodium methanearsonate |
| MSMA | Ansar®, Bueno®, MSMA, others | Monosodium methanearsonate |

* Does not include manufacturers' prepackaged mixtures.