What's an LD_{50}?

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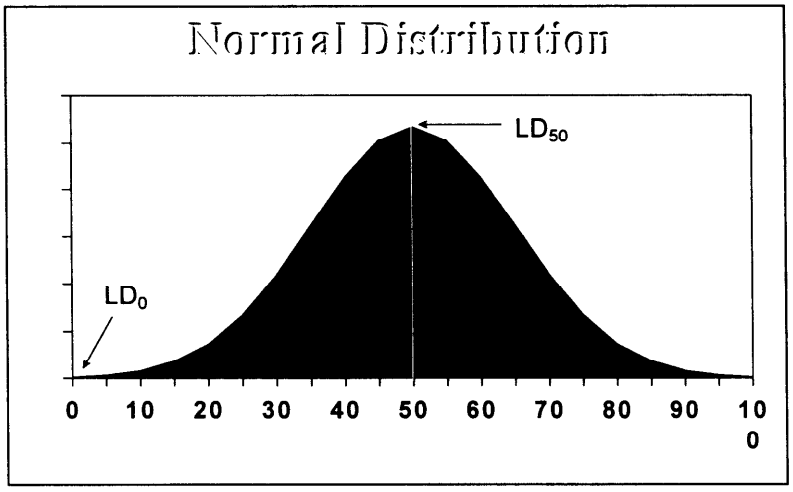
Pesticides are commonly used pest management tools on Wisconsin cranberry marshes. For the most part pesticides are reliable and economic tools when used according to the label instructions. However, since pesticides are designed to kill pests they do pose health risks to humans. This article will describe methods of comparing the toxicity of various products and offer suggestions to limit exposure to pesticides.

Not all pesticides are equally toxic or dangerous to mammals. In order to compare the relative toxicity of various products the concept of LD50 was developed. In a typical population of test animals or humans there is a range of susceptibility to toxic agents. That is to say, a given acute dose of a pesticide may not kill all members of a population. On the other hand, some particularly susceptible individuals may be injured or killed when given a very small dose of a toxicant (Fig. 1). When deciding whether to expose yourself to various toxicants, it is helpful to know where in the normal distribution you fall. Of course, there is no way to know that except through exposing yourself to a lethal dose!



An LD50 then is the amount of toxin that will kill 50% of the exposed population. It is usually expressed as the mg of toxin per kg of body weight. By expressing the ratio this way the data can be extrapolated from mammals such as rats and rabbits to humans. The trick is to transfer an LD50 of say 100 mg/kg to the amount that would kill 50% of 180 pound men who were exposed to that level. Table 1 is an attempt to express the values for an LD50 to a recognizable form for growers. By examining this table you can gauge the relative toxicity of common cranberry pesticides.

However, I think the number that is really of most value and interest to applicators is the LD50 That is the amount of toxicant that will kill none of the population. That figure appears at the far left tail of the normal distribution. Again this is largely a theoretical number. You can make sure that you don't approach this number by handling pesticides carefully and in compliance with the label instructions. The most important part of the pesticide label for applicators is the section that deals with wearing personal protective equipment. You must always wear gloves when working with pesticides and you must wear the personal protective equipment listed on the product label.

Table 1. LD50 information for common cranberry pesticides. The far right column lists the amount of chemical formulation required to kill 50% of people who would ingest that amount of formulation. The LD0 is much lower.

Product	LD50 (mg/kg)	g ai/180 lbs	% active	g of formulation	amount of formulation
2,4-D 20G	300	24.6	0.2	123	0.27 lbs
Orthene	900	73.8	0.75	98.4	0.22 lbs
Guthion 50W	13	1.066	0.5	2.132	2.132 grams
Sevin XLR	307	25.174	0.04	629.35	1.3 liters
Bravo 720	10000	820	0.54	1518.519	2.1 liters
Lorsban	380	31.16	0.04	779	1.6 liters
Diazinon 50W	66	5.412	0.5	10.824	10.8 grams
Casoron 4G	3160	259.12	0.04	6478	14.27 lbs
Roundup	3000	246	0.41	600	1.25 liters
Devrinol 10G	5000	410	0.1	4100	9 lbs
Poast EC	3000	246	0.18	1366.667	7.6 liters
Mancozeb 80WP	11200	918.4	0.8	1148	2.53 lbs

You should also realize that the LD50 concept is based on acute oral exposures to pesticides. Data for dermal exposure are also available and are expressed as a dermal LD50. It is unusual for pesticides to be ingested orally unless through a purposeful act (suicide). The most common avenue for pesticides into the body is through dermal exposure through the hands and groin area. Dusts may also be breathed into the lungs or liquids or dusts may enter the body through the eyes.

LD50 does not take into account chronic exposure over a period of months or years. Further, it does not consider the indirect effects of pesticides as they may be carcinogenic (cancer inducing), mutagenic (induce mutations in the genetic material) or they may be teratogenic (inducing developmental changes, particularly in fetal development). While these issues are not immediately fatal, they almost always reduce the length or quality of life.

Pesticides are not necessarily the most toxic substances you may encounter during the course of a day. Many common substances are toxic if we are exposed at elevated levels. A listing of the LD50 for common materials and pesticides is given in Table 2. Notice that caffeine and nicotine are more toxic than Malathion or Poast. Even table salt has about the same toxicity as Casoron (but I don't know how you could eat a half pound of salt at one sitting). In small quantities materials such as Tylenol, Aspirin and Ibuprofen offer relief from pain. In large quantities at one time they may be fatal. The truth of the statement "The dose makes the poison" is evident here.

Used prudently synthetic chemicals can enhance the quality of life. Misused or used carelessly they may be very dangerous. Applicators should use caution when mixing, loading or applying pesticides to minimize exposure through the use of appropriate personal protective equipment, as specified on the product label and through minimizing the opportunity for exposure to either concentrate or dilute solutions.

Table 2. LD50 values for common materials and pesticides

Material	**LD_{50}, g ai to kill 150 lb person**
Parathion	<1 gram
Guthion	<1 gram
Thiodan	3
Mesurol	9
Lorsban	9
Gasoline	11
Paraquat (Gramoxone)	11
Nicotine	16
Caffeine	16
Diazinon	20
Tylenol	23
Sevin	34
2,4-D	34
Ridomil	46
Valium	48
Aspirin	51
Enide	65
Funginex	68
Ibuprofen	72
Malathion	94
Poast	182
Dacthal	205
Table Salt (NaCl)	226
Casoron	290
Roundup	334
Chloropropham	341
Princep	341
Sinbar	341
Captan	614
Ronilan	682
Alcohol	699
Benlate (Benomyl)	>700