

# Just How Toxic Are The Chemicals We Are Using On Our Courses

By Paul Sartoretto, Ph.D.  
W.A. Cleary Chemical Corporation

For the past fifty years I have been going around the country speaking at a regional or monthly meetings of the Golf Course Superintendents on the subject of tank mixing pesticides with the emphasis on compatibility and avoiding phytotoxicity. There is a relationship between human toxicity and phytotoxicity as you will see, primarily because of the close similarity of the toughness of the epidermis of the grass blade and our outer skin. The skin of the grass blade has its stomates through which air and water pass in and out. Whereas our skin has pores through which water diffuses.

In my talk I make a general broad statement that all the insoluble pesticides can be tank mixed and sprayed and you will not incur phytotoxicity. The reason is obvious. Even though the insolubles have to be ground down to micron size in order to get

them to disperse in water, the micron particles are too large to diffuse through the stomates. They have to be thousands of times smaller, actually molecular in size and in solution to diffuse into the cells of the grass blade.

The same principle applies to our outer skin. The insolubles cannot be absorbed through our pores because the particles are too large, and only the solubles that are molecular in size can diffuse through the skin.

You can take a certain amount of comfort in knowing that you work with a large number of insolubles and that they cannot penetrate our tough outer layer of skin, and can conclude that epidermal toxicity with insolubles (wetable powders and flowables) is non-existent to a very high degree.

From what you have learned thus far you can see how doubtful the claim was that a golfer died as the result of dermal exposure to Daconil 2787 which is an insoluble and was sprayed on the grass. No way could Daconil have diffused into his body. It could be argued that Daconil vaporized and that he breathed in a sufficient amount of it to poison him. I will now show you how doubtful this mode of toxicity is with respect to Daconil.

Whereas the grass plant breathes through

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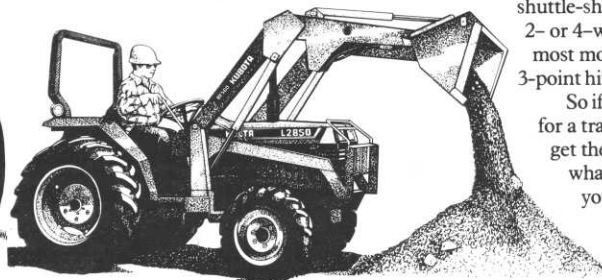
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stomates and receives nutrition not only through the stomates but also through the roots, we humans breathe through our lungs and receive nutrition through our mouth, and then via the alimentary canal, by digestion into the blood stream. We measure toxicity primarily by the minimum lethal dosage necessary to kill an animal by ingestion. Let us use aspirin as a bench mark to compare with our pesticides. It takes 1750 milligrams of aspirin for every kilogram of body weight to kill 50% of the animals ingesting it. The MLD50 of aspirin is 1750—that's about 6 aspirin tablets. An adult weighing 50 kg. (110 lbs.) by extrapolation would die from 50 times the dosage or 300 aspirin tablets. In actuality, 10 times the dosage or 60 aspirin is fatal - 17.5 grams about 2/3 of an ounce. Reference is Merck Index.

But Daconil 2787 has an LD50 of 10,000 mg. That is six times safer than aspirin. That golfer would have had to ingest 100 grams or over 3 ounces of Daconil to have killed them. That's unlikely.

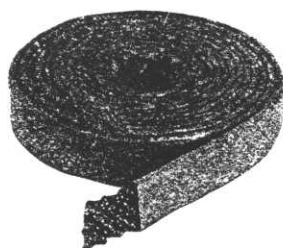
In my speech on how to avoid phytotoxicity, I generalize by saying insolubles cannot burn, but solubles can and you must exercise caution in their use. We have been comparing an insoluble Daconil with a soluble aspirin. Aspirin is a safe soluble, but there are a number of solubles that you use that are

not as safe as aspirin but keep in mind the LD50 of aspirin as a bench mark.

You may have read recently about a fanatic that has been killing a lot of household pets in North Carolina by lacing pet food with the pesticide DISYSTON, and insecticide you don't use, but farmers do. The LD50 of DISYSTON is about 3 mg. per kg. A cat or dog doesn't weigh much more than 3 or 5 kg., so a lethal dose is not much more than 30mg. which is the equivalent of a couple pinches of salt. DISYSTON is a thiophosphate insecticide not much different than the thiophosphate insecticides that you are using, except yours are safer. Oktanol is 10 times safer with an LD50 of 32; Dursban is about 50 times safer with LD50135; and Diazinon is 100 times safer with LD50300. Nevertheless, these are low LD50's and the concentrates are potentially dangerous. They act on the insects and humans in the same way by poisoning the nervous system.

Ironically, Granular Diazinon which is the safest of the three has been suspect for use on golf courses in some areas because of unfortunate misuse. They are usually formulated as emulsifiable concentrates dissolved in a organic solvent with an emulsifiable agent added. These in turn are to be mixed with large

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volumes of water, sprayed on the golf course with a further recommendation that they be watered in to get to the grubs. The same emulsifiable concentrate can be mixed with a granular carrier such as corn cobs or vermiculite so that they can be applied with a spreader with further recommendation that they later be washed into the soil with large volumes of water. If the corn cob is laced with Diazinon it becomes a tempting poisonous morsel for a bird. Birds weigh less than a kilogram, so all they have to ingest is about the amount of Diazinon that is equivalent to the amount of a baby aspirin.

Unlike the insolubles, the solubles can be absorbed through the skin. As a rule one need not worry about the diluted spray, but has to exercise caution in handling the concentrates. Wear protective clothing and a respirator when preparing the diluted mixture in the spray tank.

Let's consider a prominent soluble fungicide which has been around for many years and has a startling high toxicity. Yet you have used it successfully for a couple of decades without any fear that it could have been hazardous. This product is Actidione TGF - an antibiotic! Antibiotics are safe; haven't we all taken antibiotics prescribed by doctors? Well, this one has a LD50 of 2 mg. per kg.! But, Upjon, the manufacturer, did an excellent job of

formulating the product so that you received it in a form that was non-poisonous. A product must bear a skull and crossbones label if the formulated material has an LD 50-50. By diluting Actidione with inerts so that you received a 2% mixture the formulated product then had an LD50 100. You, in turn, were asked to dilute the product with water at the rate of 1 oz. per 3 gallons of water. The diluted spray then had a LD50 37,500.

This example emphasizes the importance of exercising great care and caution with the formulated concentrate and at the same time demonstrates the minimal danger of handling the diluted spray. Actidione was taken off the market because EPA challenged the risk factor and Nor-Am made the business decision to drop the product.

Following is a table providing you with LD50's of all the pesticides available to the Golf Course Superintendent. This data was taken from W.T. Thomson's Agricultural Chemicals 1985-86 Revision. Bear in mind that the LD50 refers to the pure active ingredient so that if you want the LD50 of the formulated product you divide by the percentage of active. For example, Caddy is 20% Cadmium Chloride solution. Since Cadmium Chloride has an LD50 88, dividing by 0.2 the LD50 of Caddy becomes 440.



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Nothing in my talk should be interpreted as a suggestion that you can ignore safety in using pesticides. Read and follow the label instructions carefully! Read the Material Safety Data Sheet carefully! Follow the manufacturer's recommendations on personal protective equipment required. It is better to be overly safe than sorry.

**Toxicity of Pesticides**

Expressed as Minimal Lethal Dosage necessary to kill 50% of the test animals by ingestion expressed in milligrams per kilogram body weight **MLD50** mg/kg.

**INSECTICIDES**

DASANIT .....	4
NEMACUR .....	15
OFTANOL .....	32
MOCAP .....	62
DURSBAN .....	135
DIAZINON .....	300
PROXOL .....	450
SEVIN .....	500
METHOXYCHLOR .....	6000

**HERBICIDES**

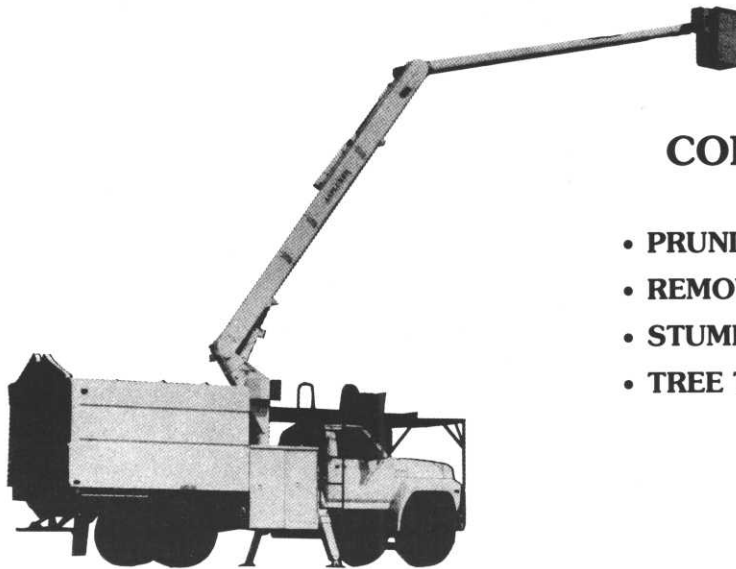
PARAQUAT .....	150
2,4DP .....	300
2,4D .....	375
DSMA .....	600

MSMA .....	700
BETASAN .....	770
MCPP .....	930
DICAMBA .....	1040
PENDIMETHALIN .....	1250
DACTHAL .....	3000
BALAN .....	10,000

**FUNGICIDES**

ACTIDIONE .....	2
PMAS .....	40
CADDY .....	88
BAYLETON .....	363
CADMINATE .....	660
THIRAM .....	780
BANNER .....	1517
KOBAN .....	2000
RUGIGAN .....	2500
CHIPCO 26019 .....	3500
DYRENE .....	5000
ALLIETTE .....	5800
FORE .....	7500
FUNGO .....	7500
BANOL .....	7860
DACONIL 2787 .....	10,000
TERSAN 1991 .....	10,000
PCNB .....	15,000
3336 .....	15,000

*Credit: A Patch of Green, Michigan Border Cities GCSA, May/June 1987*



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