

Just how toxic are golf course chemicals?

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

For the past fifteen years, I have been going around the country speaking at regional or monthly meetings of the Golf Course Superintendents on the subject of tank mixing pesticides with the emphasis on compatibility and avoiding phytotoxicity.

A relationship between human toxicity and phytotoxicity exists 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. Human 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.

Superintendents 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. Epidermal toxicity with insolubles (wetable powders and flowables) is non-existent to a very high degree.

You can see how doubtful the claim was that a golfer died from dermal exposure to Daconil 2787, an insoluble, sprayed on the grass. No way could Daconil have diffused into his body.

It could be argued that Daconil vaporized and he breathed in a sufficient amount of it to poison him. But this mode of toxicity is doubtful with Daconil. In the same way a grass plant breathes through stomates and receives nutrition through the stomates and the roots, humans breathe through our lungs and receive nutrition through our mouths, and, then via the alimentary canal, by digestion into the blood stream.

We measure toxicity primarily by the minimum lethal dosage (MLD) neces-

TOXICITY OF PESTICIDES			
Expressed as Minimal Lethal Dosage necessary to kill 50 percent of the test animals by ingestion expressed in milligrams per kilogram body weight MLD ₅₀ mg/kg.			
INSECTICIDES		FUNGICIDES	
DASANIT	4	ACTIDIONE	2
NEMACUR	15	PMAS	40
OFTANOL	32	CADDY	88
MOCAP	62	BAYLETON	363
DURSBAN	135	CADMINATE	660
DIAZINON	300	THIRAM	780
PROXOL	450	BANNER	1517
SEVIN	500	KOBAN	2000
METHOXYLCHLOR	6000	RUBIGAN	2500
HERBICIDES		CHIPCO 26019	3500
PARAQUAT	150	DYRENE	5000
2,4DP	300	ALLIETTE	5800
2,4-D	375	FORE	7500
DSMA	600	FUNGO	7500
MSMA	700	BANOL	7860
BETASAN	770	DACONIL 2787	10,000
MCPP	930	TERSAN 1991	10,000
DICAMBA	1040	PCNB	15,000
PENDIMETHALIN	1250	3336	15,000
DACTHAL	3000		
BALAN	10,000		

sary 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 percent of the animals ingesting it. The MLD₅₀ of aspirin is 1750—that's about six 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 MLD₅₀ of 10,000 mg. That is six times safer than aspirin. That golfer would have had to ingest 100 grams or over three ounces of Daconil to have killed him. That's unlikely.

In my speech on how to avoid phytotoxicity, I generalize by saying insolubles cannot burn, but solubles can. 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. Keep in mind the MLD₅₀ 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, an insecticide used by farmers. The MLD₅₀ of Disyston is about three mg. per kg. A cat or dog doesn't weigh

much more than three or five kg., so a lethal dose is not much more than 20 mg., the equivalent of a couple pinches of salt.

Disyston is a thiophosphate insecticide not much different than the thiophosphate insecticides you use, except yours are safer. Oftanol is 10 times safer with an MLD₅₀ of 32; Dursban is about 50 times safer with MLD₅₀ of 135; and Diazinon 5 is 100 times safer with MLD₅₀ of 300.

Nevertheless, these are low MLD₅₀'s and the concentrates are potentially dangerous. They act on insects and humans in the same way, 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 an organic solvent, with an emulsifiable agent added. These, in turn, are to be mixed with large volumes of water sprayed on the golf course. It is further recommended 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. They, too, should 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

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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 must 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. Despite a startlingly high

toxicity, you have used it successfully for decades without any fear that it is 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 MLD₅₀ of two mg. per kg.! But Upjohn, the manufacturer, did an excellent job of formulating the product to market it in a form that was non-poisonous.

A product must bear a skull and crossbones label if the formulated material has an MLD₅₀. By diluting Actidione with inerts so that you received

a two percent mixture, the formulated product then had an MLD₅₀ of 100.

Upjohn asked the consumer to dilute the product with water at the rate of one oz. per three gallons of water. The diluted spray then had an MLD₅₀ of 37,500.

This example emphasizes the importance of exercising great care and caution working 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.

I've included a table of the MLD₅₀'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 LD refers to the pure active ingredient, so that if you want the MLD₅₀ of the formulated product, you divide by the percentage of active. For example, Caddy is 20 percent cadmium chloride solution. Since cadmium chloride has an MLD₅₀ of 88, dividing by 0.2, the MLD₅₀ of Caddy becomes 440.

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 manufacturers' recommendations on personal protective equipment required. It is better to be overly safe than sorry. **LM**

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