



Should Mercury-Containing Fungicide Use Be Continued?

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In the last *The Grass Roots* we discussed the issues surrounding the EBDC's. Their political fate is yet to be determined. (*Note addendum below.) Presently there is a special review underway to determine whether mercury-containing fungicides will continue to be available for snow mold control around the country, including Wisconsin.

I'm sure you will agree that it is increasingly important for us to know considerable detail about the chemicals we're using on the golf course for disease control. We already are acquainted for the most part with their good characteristics, e.g., how we can use them to improve the turf and make them perform better for the golfer. Only the most naive among us would believe that there are not some negatives, or at least perceived ones, as well as their virtues. We need to know about them, both to defend their role or, as the case may be, to decide against using one or more of them because of their negative side.

So I want to share with you some information and my perspective about mercury uses. And I want to present it against the general background of concerns that exist about heavy metal fungicides in general, especially cadmium-containing products.

Most of us believe in safety — to you and me, and to our environment. On the golf course, safety includes potential hazard through application, handling, and disposal. It also involves the potential of incidental exposure following application, such as when a golfer treks over treated turf, or licks a ball that has followed a similar route.

Conceivably, it could also occur via food channels. How, you say, can that be when we don't eat products of the golf course, except may be the score card upon occasion? We have to become theoretical and "long range" on this question, but there are those who pose the question about cumulative soil residuals from heavy use of products over a long period of time. What

would happen if the course were converted to a farming or residential area, and ultimately to someone's garden? What might be the consequences? I'm not about to debate the likelihood of this occurring at this point, by the way, but it has happened. (It sure would be bucking the present trend, though, wouldn't it!)

If you are more than 60 years old, you can remember the times when cadmium- and mercury-containing fungicides were all that we had for protecting our courses from dollar spot, brown patch and snow mold. These products came under intense fire during the 60's. The cadmium and chromium products were banned in Wisconsin (though not in most other states), most uses of mercury were banned nationally, while the phenyl and inorganic mercury formulations were retained for very limited uses.

Cadmium as an example. There were several real and alleged raps against cadmium. During the 69's it was found that industrial workers exposed to cadmium were eight times more likely to develop cancer; a Japanese disease called "Itai-itai byo", or "ouch ouch" disease, which produced rheumatism-like symptoms, was linked to cadmium exposure. Cadmium is cumulative in the body, and linked to hypertension, liver, testicular and renal damage. And there is a teratogenic linkage.

It also became evident during that time that cadmium can be taken up and concentrated by plants growing in soils containing high levels of cadmium.

So cadmium came onto the "hit list", though I believe it is proper to say that cadmium is generally not regarded as a problem except to those who smoke (there's an estimated 0.1 to 0.2 ug inhaled with each cigarette) or are subject to it occupationally.

And that is certainly not to say that all the use of cadmium in golf course maintenance work for 50 years ever caused **any** of this. I doubt it, and I've

never heard of any linkage.

But there are at least two additional tests that should be considered: 1) Are there safer alternatives available? and 2) What is going to be the perception with its continued use among both golfers and the general public? In other words, on a risk-benefit use, can it be defended?

I didn't think it could. Cadmium's primary role was for dollar spot control. While it was good, a number of our present day, very effective organic fungicides had appeared on the scene by that time. Also, there were an increasing number of cadmium-resistant cases of dollar spot appearing. I elected a long time ago not to dig in my heels on this one.

So now to mercuries in the 1990's — what's the connection? Both are heavy metals, both are cumulative in the soils where applied, and both — in certain circumstances — are clearly recognized as hazardous to human health.

But there are some differences.

For the general population, exposure to methylmercury formulations, particularly via fish, is by far the most dangerous form of exposure. Following the disastrous fish episode in Japan, it was learned that various mercury forms can be bioconverted microbially to the highly toxic methylmercury formulation in the bottom sediment of water (lakes and streams). Some people poisonings by careless handling of methylmercury-treated seeds also took place about the same time, and it was clear that these formulations were going to be lost to agriculture and other industries.

But there are other, much less toxic formulations of mercury. That isn't to say that exposure to phenyl and inorganic mercuries we still have around can't be hazardous. They can be absorbed by skin or inhaled. But they have much less toxic effects, and the body eliminates them over time. The literature says 30 to 60 days. So they are

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a problem for a careless applicator, perhaps, but proper handling and application techniques should eliminate that hazard.

What about mercury accumulation in the environment, and possible bioconversion to methylmercury?

You should know that those questions were scrutinized in detail when present uses were retained back in 1972. Largely under the direction of the Mallinckrodt Chemical Company, which at that time was the distributor of Calo-Clor and Calo-Gran, and which had the responsibility for collecting the data and defending it, some seven golf courses with a long history (up to 45 years) were examined in detail to find out: 1) where the mercury that had been applied previously now was; 2) whether mercury levels were different above, at or below the streams and lakes adjacent to the courses; and 3) whether any biomethylation of mercury had occurred, either in the turf sites or in the adjacent waters. (More than seven courses were involved in certain parts of this study.)

Examination of the water, sediment and fish from the streams of the nearby golf greens did not show evidence that the mercurials had been transported by any means. The mercurials were found to be strongly bound in the organic thatch and the upper six inch soil profile where they remained in concentrations ranging from 0.01% to 0.04% where use had been most extensive. No methylmercury could be found at the detectable level, either in the turf environment or in adjacent waters.

So, as long as mercury was not introduced directly into the water, there appeared to be no threat in the aquatic environment. I am not aware of any additional information that has come along to contradict that conclusion. And with the concerns today about possible groundwater contamination, these data should serve to dissuade that question.

But the mercuries do accumulate. They are basic elements, they don't leach or move, so that's no surprise. Suppose a garden were somehow to be placed over an old green at some time in the future. Would that constitute a problem? Well, unlike cadmium, mercury is not taken up and accumulated in plants. From my perspective, I don't see that as a likely problem.

Potential exposure to the golfer is another concern. One consideration is when a chemical is applied. The appli-

cation is made after the busy season, and the chemical certainly has an opportunity to dry (or settle in, if applied as a granular) on the turf before the small amount of play remaining would take place.

But cautions remain. One thing that emerged from the Mallinckrodt studies was that clippings from early spring mowings contained mercury. This came as no surprise to anyone, but someone could argue that there remains a limited amount of golfer exposure, which the EPA could conceivably judge to be too great a hazard. I don't know the amount of that exposure. My perspective is that the amount an individual golfer would be exposed to would be measured in levels well below any biological concern, and the mercury form, remember, is not of the biocumulative form. When spring topdressing occur, the remaining chemical is no longer on the surface.

However, one should think about the mercury in the first clippings. Not that anyone would, I hope, but they certainly should not be disposed of in the lake or stream. And when applications are made, care should continue to be made to honor the 25 foot barrier from green to water.

Other precautions during application, as prescribed on the label, should be followed. These include safety clothes and the way chemicals are stored and applied. The fact that inorganic mercuries have an LD₅₀ of 55 mg/kg, that it can be absorbed through the skin and also inhaled are points not to ignore.

One more test remains: Are there biologically and environmentally safer alternatives available today?

For the past twenty years following the initial mercury concern, we have looked at virtually every experimental and registered turf chemical that has come along for snow mold activity. Many of you have been instrumental in helping us to do this. A number of chemicals have quite a bit of activity against the various snow mold fungi. And many of you have put together combinations of, say PCNB, chloroneb, and maybe some Daconil, thiram, or other chemicals that do the job for you. Certainly the pressure is not as great on some courses as for others, and I believe we can expect control on certain courses 90% of the time without mercuries.

We've not had that consistent a success on other courses, however, especially where snow mold seasons are

longer, or where summer fungicide applications have not been as great. For that reason, I'm not willing to concede that we have alternatives for the inorganic mercuries on our greens and tees as a sweeping statement.

We have learned that excessively high rates, for instance, repeated maximum rate applications, do not do any better than lower rates where the mercuries are incorporated with PCNB or chloroneb, depending on site. In fact, combinations including only one or two ounces of mercury are virtually always as effective as higher rates of inorganic mercury, either alone or in combinations. So we've learned how to reduce the amount used.

Of course, if society decides that a lower level of control is acceptable, then we do have alternatives. Our judgment has been based upon the present demand, which is a green coming out of the winter in sound condition without holes that prevent its early spring-time enjoyment.

It will be interesting to see how mercuries are judged by the new generation. I've given you my thoughts. How do you feel about it?

***Update on EBDC's.** On the date of this preparation, December 4, 1989, the EPA announced its proposed cancellation of registration. Maneb and mancozeb uses on homeowner turf and other crops would be eliminated. The news release was not clear to me about mancozeb future on other turfs.

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