Swordfish for Dinner And Healthy Turf, Too

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What is the relationship between swordfish and turf? As one looks back at the 1972 season with all of the rain in the Midwestern and Eastern parts of the country and many courses closed because of flooding, you may conclude that I'm proposing fish propogation as a side line for golf course operations. That's not my purpose. Still another correlation might be in urging the use of fish for fertilizer as the American Indians and early settlers did. Again, not really. Well then, you conclude, I'm going to discuss improved turf management techniques so that you will not only have a great golf course, but more time to go fishing! Not a bad idea. But actually, my attempt is to enlighten you as to what has been happening in pesticide legislation and how we can still have swordfish for dinner and healthy turf too.

The recent legislation restricting the use of mercury, The Environmental Protection Agency PR Notice 72-5, dated 3/22/72, entitled "Certain Products Containing Mercury; The Cancellation Thereof," caused great concern to people in agriculture and especially individuals in the areas of turfgrass management. The use of mercury has not been banned, but restricted by the Federal Government. State and local governments have however banned mercury use in many instances. Mercury in pesticides occurs in the inorganic or salt form, and in the organic form as the alkyl and aryl groups.

INORGANIC OR SALT FORM

This group includes the metal itself and the compounds of chloride, sulfide and the oxides. The familiar use of this form of mercury used on golf courses is mercurous and mercuric chloride for the control of *Rhizoctonia solani* (brown patch), *Sclerotina homeocarpa* (dollar spot), *Fusarium nivale* (pink snow mold) and *Typhula itoana* (gray snow mold).

Symptoms of poisoning from this form of mercury are tremors of the extremities, inflammation of the gums and a personality change. An example of the personality change led to the common tale that the Mad Hatter in "Alice in Wonderland" was a victim of mercury poisoning. Mercury nitrate is used in the process of making felt hats.

ORGANIC—ARYL GROUP

The second group is the aryl group. This is a large group, and the most familiar compounds in this group are the phenylmercuric acetate and nitrate materials. Observations have shown that this group is no more dangerous or toxic than the inorganic form and may be even safer. Upon entering the body, the phenyl-mercurials are distributed and removed or excreted similarly to the inorganics. Mercury containing compounds have the unusual characteristic of being absorbed through the skin; therefore, added caution and protection should be used when handling these materials. However, it is just as important to guard against inhaling the dust or fumes of these chemicals. Both the inorganics and phenyl-mercurials are fairly rapidly excreted. Although both of these types have the tendency to accumulate in the kidneys, only under rare conditions do they cause permanent damage.

ORGANIC—ALKYL GROUP

The most detrimental group of mercury-containing compounds is the alkyl group. This is the group that has caused the greatest concern in today's mercury controversy. Unlike the other mercury compounds, the alkyl compounds are known to cause permanent, irreversible damage to several parts of the brain, resulting in paralysis, blindness, and even death. The major outbreaks of poisoning in Iraq, Guatemala, Sweden, Japan and the United States that have been brought to our attention were due to alkyl mercurials that had been used for seed treatment or that evolved through the ecological food chain, such as the mercury poisoning incidents from fish consumption in Japan.

The present concern about mercury and the most serious part of the relation that it has with the environment is the fact that inorganic and possibly phenyl-mercurials can be converted in nature to the highly toxic methyl mercury. This conversion can be referred to as biosynthesis; it was first noted in Japan, then in Sweden and later in Canada and the United States. Consequently, the health implications of the biosynthesis of methyl mercury are evident. Many forms of inorganic mercury when present in polluted water are transformed to methyl mercury. This methyl mercury is taken up by algae, which in turn are taken up by zoo plankton. The zoo plankton are eaten by small fish. These smaller fish are eaten by larger fish, and so on until we get to swordfish.

Therefore, one can see how it may be

Superintendent Lou Haines, Denver Country Club believes in ecology on the golf course. "It's our environment too!"

possible for the mercury containing compounds used on turfgrass to affect the environment. However, with the soil being the greatest filter known to man, the majority of materials applied are adsorbed by the soil particles and become a part of the microflora in the thatch layer. Studies show that mercury containing compounds applied to turf have little if any leaching ability and remain stable in the thatch, mat and upper few inches of the soil. Nevertheless, given the basic chemical properties of mercury and its pattern of activity in the environment, it cannot be said that any use is not a potential contaminant to water and the food chain. Soil particles carrying mercury fixed to it may erode from treated agricultural areas and, once these soil-mercury particles reach an aquatic environment, it then is possible for them to become converted to the highly toxic alkyl mercury form by microorganisms in the bottom sediment.

Although mercury was first described in the fourth century B.C. by Aristotle, and much of the chemistry of the medieval era and later was based on the use of mercury or quicksilver, it wasn't until recently that people considered it a threat to life. This is an interesting sidelight, because hundreds of years before the metal itself was identified, the parent ore, cinnabar, was used by prehistoric man for religious rites, for war paint and related magic reasons. Cinnabar was valued for its brilliant red color and was used in decorative work by the ancient Egyptians; it is also believed that the Sphinx was painted with this pigment at one time. Consequently, we can see that mercury has been used for a considerable period of time, but only recently has become a major area of interest, as DDT was several years ago.

Coming back to the present, the use of mercury containing compounds has been one of the major weapons in a superintendent's management program for the control of turf disease. With the restrictions and limitations imposed by state and local governments, this caused some inconvenience to superintendents who have been using mercury compounds throughout the year for disease control, especially in the late fall and early winter for a preventive snow mold program.

Should the mercury limitations have been imposed several years ago, the impact on turf management would have been more severe than what it is today. Why? Because alternate materials are available instead of mercury. These newer chemicals have proven to be

satisfactory when used for specific disease control, such as *Rhizoctonia solani, Fusarium nivale* or *Typhula itoana.* Many of the new chemicals do not have the broad spectrum characteristics that are associated with the mercury compounds. Therefore, it is required that two different materials be used for snow mold protection; one fungicide for *Fusarium nivale* (pink snow mold) and another for *Typhula itoana* (gray snow mold). Fungicides being more specific and lacking broad spectrum characteristics require the superintendent to recognize a specific disease and know what chemical is needed for control.

Prior to having specific fungicides for specific pathogens, it was possible to spray one chemical and control many organisms, the pathogenic as well as the non-pathogenic. However, now with the advent of the systemic fungicides and the broad spectrum range of control they claim, the possibility does exist that these chemicals will be used much as the old broad spectrum mercury materials.

The newer systemics do not contain mercury and other heavy metals. Unfortunately, they have not been around very long; this makes it quite difficult to evaluate their effect on the environment. Several years ago when enzymes were substituted for phosphates in detergents, everyone was happy until it was found that the substituted enzymes often caused more harm than the original phosphates. It is possible that the chemicals we have substituted for mercury will cause more harm than if we continue to use the heavy metals. With the registration required to market a pesticide, this is not very probable or likely to happen.

Dr. Jesse Steinfeld, Surgeon General of the United States Public Health Service, put it appropriately when he said, "The problem of the health effects of toxic metals is a legitimate area for concern. It is not, however, a legitimate cause for hysteria."

The loss of mercury was anticipated by suppliers of pesticides for the agricultural and turf industries. It was through the efforts of these people that alternate materials were developed for use today. From the practical point of view, it is very possible that the use of mercury may become more restricted in the future, but other chemicals that have proven satisfactory are available.

When one reviews the history of mercury as first described by Aristotle, then during periods of Medieval medicine to its use today as a fungistat, one can see that its uses have been many and varied. With understanding people in the legislative areas of government, mercury applications can continue on a limited or restricted basis. However, should the mercury-containing pesticides be completely removed, it will be necessary to apply the available alternate chemicals now on the market.

What is new about ecology, environment and pollution? Just because protection of our environment has suddenly been discovered by a lot of excited citizens doesn't make it new. Golf course superintendents, horticulturists and many others in agriculture have been active, practicing ecologists for a long time, going about their work and protecting and improving the environment without headlines or hysteria. On a golf course, protection and improvement of the environment is just plain good turf management. Each day, superintendents must combine the elements that make up the environment to efficiently provide the superior playing conditions needed for the game of golf.

The current crop of militant environmentalists are missing the mark when they accuse people in agriculture of being environmental polluters. Fertilization, irrigation and appropriate use of pesticides are all part of the solution to pollution, not part of the problem. Golf course superintendents and golfers alike have an important and positive story to tell when they say, "It's our environment, too."