Pesticide Risk: Fact and Fiction

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Opposition to the use of pesticides, including turfgrass pesticides, has increased greatly during the past decade. This increased opposition is due to many factors, not the least of which is our increased health consciousness as a society. As life expectancy has increased, people have become more concerned with maintaining their health and quality of life. Along with this desire for healthfulness has come marketing propaganda which indicates that anything labelled 'natural' or 'organic' is a safe, desirable, and healthy material. Conversely, consumers are cautioned that 'chemicals' are artificial, unnatural, and should be avoided. Since pesticides are most often 'chemicals' rather than 'natural', society in general has come to fear their use. Turfgrass managers must be able to understand the facts concerning turfgrass pesticides and be able to convey these facts to the layman.

In reality, everything we come in contact with is made up of 'chemicals.' The public needs to be made aware that *the toxicity of any material is dependent upon its chemical structure, not whether it is natural or man-made*, common product or pesticide.

Many common foods and beverages contain agents known to contain cancer causing agents (carcinogens), usually determined by tests with laboratory animals. Municipal tap water contains the carcinogen chloroform at about 93 ppb (ppb = parts per billion; 1/1,000,000,000) as a result of chlorination. Coffee contains methylglyoxal (4,000 ppb) and hydrogen peroxide (4,000 ppb). Beer contains formaldehyde (700 ppb), alcohol (50 million ppb), and nitrosamines. Parsley, dill, and nutmeg contain the carcinogens apiole and myrsitiein. Even 'healthy' foods are not completely risk free. Milk contains variable amounts of fat, implicated in breast and colon cancer. Fruit juices contain small amounts of carcinogenic mold toxins. Honey contains variable amounts of grayanotoxin (LD 50 = 1 ppb in rats). Many additional examples could be cited (1). Nonetheless, the public happily consumes many of these products every day, unaware or unconcerned of their potential hazard. People are willing to consume these products without question but are often afraid to allow even the least toxic pesticide to be applied to their property. Why? Because these common products are perceived as safe and acceptable and pesticides are perceived as unsafe and unacceptable.

Public overestimation of the risk associated with pesticides has been demonstrated in a previous public opinion poll (9). Thirty sources of risk were tabulated, along with their actual annual contribution to the number of deaths in the United States. Three

different groups of individuals were then asked to rank the sources according to their own *perceptions* of how risky the sources were. All groups of individuals perceived pesticides to pose a much greater health hazard than they actually do.

Pesticides actually ranked 28th of the 30 sources of risk, contributing less to the number of annual deaths than vaccinations, scholastic football, and lawn mowers, for example. However, the individuals ranked pesticides ninth in their perceived risk, higher than deaths caused by motor vehicles, surgery, or electrical power. The public clearly overestimates the potential danger of pesticides.

It is human nature to fear what we do not understand. Widespread use of electricity was opposed by many people when first introduced. Eventually through education the public came to accept that benefits of electricity such as convenience, labor saving devices, and improved safety via night lighting outweighed the relatively remote chance of electrocution. Although we cannot state that turfgrass pesticides carry zero risk (few things do), it should be emphasized that they do not contribute meaningfully to the average persons' health risk (1).

To understand the risks associated with pesticide exposure, one must first understand the concept of toxicity. Toxicity is the extent to which a substance is poisonous to humans and other animals. The risk associated with exposure to anything potentially toxic depends on 1) toxicity of the material, and 2) amount of exposure to the material. Thus, hazard (risk) equals pesticide toxicity times exposure. In order to decrease the risk associated with a pesticide, one may either reduce the toxicity of the material or the amount of exposure to the material.

One could reduce risk by choosing whichever material provided acceptable control while exhibiting the least toxicity in tests of acute and chronic toxicity. One could also choose a less concentrated formulation of a given pesticide. Turfgrass pesticides are applied in extremely dilute solutions (typically in 80 to 200 gallons of water per acre), thus, their toxicity is further reduced so that they pose little risk of acute toxicity to the public. Because of the relatively nontoxic nature of most turf pesticides, their diluted application, and the fact that they are applied few times per year, the health risk associated with application of turf pesticides in minimal.

Four areas of public concern associated with pesticide use include their potential for: acute toxicity, chronic toxicity, allergic reactions (pesticide sensitivity), and environmental pollution.

Acute toxicity is defined as poisoning and/or death resulting from a single dose of a pesticide. The term LD50 is used to characterize acute toxicity. LD50 (Lethal Dose 50) is the amount of undiluted pesticide active ingredient that will result in the death of 50 percent of the test population (usually mice, rats or some other lab animal). LD50s are expressed in milligrams of pesticide per kilogram of test animal weight (mg/kg), which is equivalent to parts

per million (ppm). The higher the LD50 of a material, the less likely the material is to cause acute toxicity. The majority of turfgrass pesticides have LD50s high enough to classify them as relatively nontoxic.

Acute toxicity from turf pesticides is an extremely rare phenomenon that might result, for example, from accidental ingestion of a pesticide concentrate. Pesticides are applied to turf in very dilute solutions and therefore acute toxicity to a person who comes into contact with a treated turf area is virtually an impossibility.

Chronic long-term effects are probably what concern the public the most. Chronic health risks are problems that develop over a relatively long period of time following one large exposure or a series of small exposures which accumulate. The following types of chronic risks are routinely evaluated before a product is registered for use: mutagenicity (genetic mutation), teratogenicity (defects in developing fetuses), fetotoxicity (direct toxic injury or death to fetuses), neurotoxicity (irreversible nerve damage). Pesticides which test positive for these types of potential chronic problems are not released to the market until they can be shown to be safe for use.

People are concerned that over a long period of time, minute exposure to turf pesticides might in fact increase their chance of cancer. There is no scientific information to date to indicate that exposure to turf pesticides will increase a persons' risk of cancer. It has been estimated, however, that more than 99 percent of all carcinogens that we ingest are the result of products other than man-made pesticides. Natural plant toxins, byproducts of cooking food (nitrosamines for example), mold toxins, tobacco smoke, radon gas and alcohol are only a portion of the numerous known health risks which the average person is exposed to daily (1). Thus, even if we completely banned all turfgrass pesticide use, the public's risk of health hazard would not decrease meaningfully since most people have little or no direct exposure to applied turf pesticides.

Pesticide sensitivity is the development of some type of allergic reaction in response to exposure to a pesticide application. Shortness of breath, a rash, and sweating are a few of the symptoms which might occur. Countless people are plagued by allergic reactions to everything from dust to grass, and there are certainly people who are sensitive to pesticides as well. Unfortunately, these isolated instances of allergic reactions have often been singled out by anti-pesticide activists and portrayed as what everyone can expect if they contact a pesticide treated turf area. When someone dies from a bee sting, we realize that it was an unfortunate accident, but we do not feel particularly at risk of death from bees. Severe reaction to a turf pesticide is very rare and should not be misconstrued as typical.

A final area of concern is potential damage to our environment from pesticides. Primarily, there is a fear that the materials used for turf management may leach into groundwater and pollute drinking supplies. Research in this area has been lacking but is on the increase because of accelerated interest in how turf pesticides react

in the environment. While certain agricultural pesticides (Aldicarb for example) have been detected in ground- water, commonly used turf pesticides have not been shown to pose a groundwater hazard (2,4,5,7,8).

It can argued that rather than threatening the environment and groundwater, turfgrass areas actually protect groundwater. Turfgrass cover reduced soil erosion and prevents soil and chemical runoff into water sources (unlike areas without vegetation). Also, turfgrass thatch has a high capacity for binding many pesticides (2,5,6) and has been shown to increase the degredation of some pesticides (2). Several studies have shown that commonly applied insecticides do not penetrate more than 2 to 3 centimeters into the soil profile (2,4,5). Indeed, one of the factors hampering soil inhabiting insect control is the inability of turf insecticides to penetrate below the first few centimeters of the soil profile. Potential for groundwater pollution from turf pesticides is further minimized by the resistance of most turf pesticides to leaching, as well as degredation caused by photodecomposition and microbial breakdown.

In spite of any arguments that could be put forth, there remain those who would say, "Any detectable amount of pesticide is too much." This assumes that the smallest detectable amount of material actually poses a health risk. We would obviously prefer to detect zero parts per billion (ppb) of every possible toxin, however, we need to ask if very small amounts of turf pesticide cause cancer and/or health risks over the long run. There is no evidence that turf pesticides pose chronic risks to the public.

Also, it is important to keep in mind the quantities we are discussing. Quantities of pesticides that have been detected in groundwater have been found in concentrations in the low parts per billion. One ppb is equivalent to 1 second in 32 years. This is an incredibly small amount of material. Remember, risk equals toxicity times exposure. Even if a potent carcinogen were detected at 1 ppb, our exposure would normally be sufficiently low as to result in minimal risk. Today's analytical equipment makes detection of concentrations as low as one part per trillion possible. Soon we may be able to detect one part per quadrillion. Just because something is measureable does not mean that it is meaningful.

In conclusion, the purpose of this article is not to portray pesticides as harmless materials whose use requires little caution, but rather to emphasize that the current anti-pesticide furor is based on emotional reaction and is not supported by scientific fact. Turfgrass pesticides are not highly toxic. When used *responsibly* according to the label they have been shown to be devoid of environmental and health hazard (similar to many "potentially toxic" household chemicals). It should be noted that rather than causing health and environmental risks, turfgrass areas can actually provide numerous environmental benefits. Some of these benefits include erosion control, noise and dust abatement, and absorption of toxic emissions and atmospheric pollution.

The greatest risk from pesticides lies not with the general public, but with those handling concentrates and spray solutions without proper safety precautions. It is somewhat ironic that those individuals having virtually no exposure to pesticides are often the most concerned about pesticide safety while persons' using these materials on an almost daily basis all too often the most cavalier about safety.

Eliminating the use of pesticides would not lower the public's health risk because virtually all of the hazards we are exposed to result from non-pesticide risks. Research concerning the environment fate of additional pesticides needs to be initiated so we can choose to use the safest materials available.

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