

PESTICIDE FACTS AND MYTHS¹

by J.R. Vaccaro

Pesticides are one of the most wrongfully maligned groups of chemicals encountered in the health professional arena. Pesticides protect our homes from wood destroying insects, keep our lawns attractive and protect our crops from destructive pests. In most cases, these materials are applied responsibly and in accordance with labeled directions. It is interesting to view 1986 poison control center data. Drugs accounted for nearly 40% of all calls concerning poisonings or alleged poisonings. Pesticide calls accounted for less than 6%, behind cleaning substances 13%, plants 10.5% and cosmetics 10%.

Pesticides like any other substances are metabolized by the human body and excreted depending on the chemical structure of the pesticides. Essentially, three things can happen when a pesticide or, for that matter, any substance is absorbed into the blood stream via inhalation, ingestion or dermally. The first thing is, the material can be absorbed and excreted without change or very minor change. The bodies favorite route of excretion of such materials is the urine. The more fat soluble compounds without specific functional groups are more apt to be metabolized through the feces. 2,4-D is excreted in its acid form in the urine where DDT is largely excreted, via feces.

The second mechanism is metabolism to a completely different compound or to more than one compound. Most organophosphates are metabolized in the liver and excreted in the urine. The body attempts to convert organophosphates to more water soluble compounds so they can be excreted in the urine.

The third fate is accumulation. Those lipid soluble materials that have very long half-lives, i.e. months, tend to accumulate in fat deposits. Some materials, such as arsenic, tend to accumulate in skin and hair and are excreted in lost skin and sweat. It is important to realize that small amounts of pesticides are metabolized in mammals without incident.

The dose response mechanism is operative in all living systems. An individual who drinks one martini every hour for four hours may have some slight central nervous system type effects. The individual who drinks four martinis every hour for four hours will have more pronounced effects. This is a classic case of dose response. It is possible in many cases to determine what level of exposure could be sustained by an individual without adverse effects. Paracelsus, a 16th century physician, stated that the dose determines the difference between a remedy and a poison.

One laboratory experiment that is commonly run on test substances using lab animals is the acute oral LD50. In this test, the dose it takes to kill ½ of the test population of animals is determined. This is an ingestion test, i.e. the test substance is placed into the stomach. This gives the observer some idea of how acutely toxic the material is. If you compare the LD50's of pesticides with common materials, you will find that pesticide acute toxicity is not higher than many common substances. Diazinon and chlorpyrifos have acute oral LD50's in rats of 97 and 192 mg/kg respectively. Indocin, a common antiinflammatory drug used for arthritis, has an LD50 of 12 mg/kg.

Many have a mental block when thinking about pesticides in that they consider them some of the most toxic materials known to man. Often drugs have greater acute toxicity. Dr. Bruce Ames, nationally known toxicologist and founder of the well-known Ames Test for mutagenicity, claims "We are eating more than 10,000 times more of nature's pesticides than of man-made pesticides." Plants develop defense mechanisms to protect from insect infestations. Dr. Ames has been somewhat of a voice crying in the wilderness. Few scientists have had the courage to stand scientifically and be counted.

The National Testing Program (NTP) studies for carcinogenicity has been responsible for, in my opinion, needlessly concerning the public about cancer causing substances. The NTP approach is

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to dose lab animals, usually rats, at very high doses of substances; levels that may be hundreds or thousands times higher than would be expected under normal exposure conditions. The results of those doses are then extrapolated back to lower dose levels using a straight line extrapolation. Such extrapolations lead to predictions of cancer, for example, even at very low, insignificant levels. The problem with such an approach is that few, if any, substances cause cancer at all doses. For most materials there appears to be a threshold above which cancer may be induced. Therefore, the dose response curve is bowed somewhat like a hockey stick. Inhalation testing of formaldehyde at 14.5 ppm in rats induced cancer in 103 of 232 animals tested. When the air concentration was reduced to 5.6 ppm only 2 of 235 animals should have developed cancer. The problems with using maximum tolerated doses (MTD) is that at high doses, organs are damaged that would not be damaged at lower doses, thus creating the need for repair (replication). Such replication induces "mistakes" leading to neoplasia.

Each pesticide that is registered for use must go through a battery of toxicological testing including acute, subchronic and chronic testing. Reproduction and teratology studies would be included in the subchronic category and carcinogenicity is evaluated in lifetime studies in rodents.

Currently, these are a few myths concerning pesticides and other man made substances that are being propagated. One myth is that anything natural is beneficial and that if it's man-made the material is suspect. Naturally occurring materials, like man-made materials, have inherent toxicity. Numerous nutrients essential for good health such as selenium and Vitamin A can be toxic at high doses. These same materials at lower doses are beneficial. Aflatoxin found in grains such as rice and even in peanuts, is a potent liver carcinogen in animals, yet peanuts and its products haven't been removed from the market. One must be reminded that arsenic and mercury are naturally occurring materials.

Another myth surrounds the motives of environmental organizations. Although many environmentalists have the best interest of their planet in mind, when they push for cleaner waters

and air, many have ulterior motives. Several well-known environmental organizations are sympathetic to "new age" philosophies which basically sees man as an intruder into the environment. Many environmentalists are completely opposed to the use of pesticides in the environment not because of scientific reasons. The public has been lulled into a mind set that environmental groups have the protection of the environment only in mind when they conduct their "business."

Another myth is the belief that the media reports from a neutral standpoint. The media, largely a liberal force in America, is basically anticorporation. Television shows such as 20/20 and 60 Minutes seldom depict industry as responsible, but primarily as self-serving.

The cancer epidemic myth is one that media, environmental groups and other apocalyptic groups have fostered. A close look at cancer in America indicates that age adjusted cancers have leveled off and in some instances are falling. If one looks at lung cancer, they will see a sharp increase in cancer due to an increase in woman smokers over the past 25 years. Life expectancy in the United States is now about 74.5 years. In 1900 it was 45.3 years. This increase in longevity along with a continued attenuation of the natural immune system has more people dying of cancer today than 85 years ago. Deaths per 100,000 people due to cancer indicate 28 deaths in the 25-44 year old range, 300 deaths in the 45-64 range and 1000 in the 65 and older range.

Each person must realize that the human system is programmed to die. As we extend life in the years to come, more deaths will result from cancer. Cancer is largely a result of an immune system which simply fails at some finite time. The cancer deaths in no way can be linked to an increase in pesticide use. Most experts believe diet and tobacco are responsible for 65% of all cancer deaths. Sexual behavior and viral infections are believed to account for another 20%; sunshine and alcohol another 6%. It is apparent that lifestyle choices is very important in cancer prevention. The reduction of dietary fat and the inclusion of nutrients such as selenium, fruits and certain vegetables are believed to be important in reducing the cancer potential.

Of interest is a study conducted by H.H. Wang

M.D.⁽¹⁾ on the mortality of pesticide applicators. Wang categorized deaths in an early study from 1967-1975 where 311 deaths were investigated. In 1988, an update (extension) of that study⁽²⁾ was made looking at 1,082 deaths up to December 31, 1984. In the initial study the overall standard mortality ratio (SMR) for pest control operators (PCO's) was 84. The SMR is a dimensionless number that indicates whether a certain response is occurring below or above the average. The SMR of a normal population is 100; therefore, anything below 100 means that we are seeing less than a predicted number of effects. The overall SMR of PCO's was 84. This means that PCO's appear to be dying, from the causes studied, at a rate lower than the normal population. There was, however, SMR's that exceeded 100 for 3 types of cancers. Lung cancer had an SMR of 115, skin cancer, 173 and bladder cancer SMR of 277. Despite the high bladder cancer SMR of 277, it was not considered statistically significant since 1.3 bladder cancers were expected and 3.5 were observed. These numbers were too small to have statistical significance. An extension of the Wang study indicated an overall SMR of 97 (slightly below the average of 100) with a lung cancer incidence

above the norm at 135. Interestingly, enough termite workers had a lung cancer SMR of 97; those individuals conducting PCO applications indoors had a SMR of 158. These data do not fit the theory that older termiticides such as chlordane were causing higher incidences of cancer among applicators.

The old testament prophet Hosea admonished that "My people are destroyed for lack of knowledge". Much of the confusion concerning pesticides is derived from misinformation transmitted by the media which in turn has created a mild hysteria in many segments of the American population. Although education is not a panacea, it is an important step in bringing reality to the pesticide issue.

Literature Cited

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Abstract

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Arborists and landscape managers frequently encounter injuries to trees caused by incorrectly or inappropriately applied herbicides. It is important that arborists and managers of landscape properties learn to recognize herbicide injury symptoms, mimicking symptoms, and steps that can be taken to alleviate the injury. This article summarizes more than 16 years of on-site observations of herbicide injuries to trees with laboratory documentation of the amounts of soil and tissue residues that will result in damage from a wide variety of herbicides.