

Understanding Pesticide Safety and Toxicity

What is a pesticide?

It may seem overly simplistic to define what a pesticide is, however people are often confused on what is classified as a pesticide. A pesticide is a management tool that focuses on a pest. In an agricultural setting, a pest is any organism that causes unwanted damage or difficulties to crops or livestock. Categories of common pests include: other plants, insects, fungi, bacteria, nematodes, viruses and vertebrates (deer, birds, etc). A pesticide is a product that either directly kills the target pest or repels the pest from the area where they are causing the problem.

Pesticides can be naturally derived or synthetically created. Certified organic producers can use organically acceptable, naturally derived pesticides that are used to manage many different types of pests. Conventional producers have access to a greater variety of pesticides including naturally and a wide variety of synthetically derived products to manage many pests.

All pesticides, by their nature, are toxic at some level. They are designed to kill or cause avoidance by one or more “modes of action”. A mode of action is the way a pesticide acts in order to achieve pest control. This includes how and when the pest comes in contact with the pesticide and the bio-chemical mechanism the pesticide uses to kill the pest.

All pesticides that are used in Canada are registered through the Pesticide Management Regulatory Agency (PMRA), a division of Health Canada. The PMRA requires that all companies, who want to have their pesticides registered in Canada, submit toxicological data on their product. Extensive research is done on every pesticide. Toxicological effects on humans, the environment and non-target sensitive organisms are examples of some of the tests performed. These studies measure acute toxicity (immediate exposure issues) and more long-term effects, like risks for cancers, birth defects and many others.

Acute toxicity and LD50

All pesticides vary in their toxicity. Some products breakdown to inert forms very rapidly, while others stay in the environment for long periods of time. For example, the deregistered product DDT, has a half life of 2-15 years and can still be detected in some ecosystems 20 years after the last application. Some products are less toxic to humans because they work on processes in other organisms that humans don't have. Glyphosate, a common herbicide, stops the formation of specific amino acids in plants by altering the shikimate pathway. Humans don't have this pathway and thus toxicity is relatively low.

Determining the relative acute toxicity of pesticides is critical for determining how much caution should be observed when handling a particular pesticide. This is done by using the *Lethal Dose 50* (LD50). The LD50 is a number in mg/kg of body weight that will kill 50% of a tested population. The LD50 is a number usually determined from testing lab animals like mice, rats and

rabbits. This testing gives us a general idea of human toxicity. The lower the LD50 number the more acutely toxic it is.

Let's compare the oral LD50 for rats of the **active ingredients*** of two common pesticides and some common everyday human use products:

Azinophos-methyl (common insecticide that is currently being deregistered in Canada) – LD50 = 7

Glyphosate (a common broad spectrum herbicide) – LD50 = 4320

Nicotine (addictive chemical in cigarettes) – LD50 human = 30 – 60

Caffeine (chemical found in drinks like coffee) – LD50 oral rat = 192

Table salt – LD50 human = 3300

Active ingredient means the concentrated form. Caffeine, for example, is in very low levels in a cup of coffee but when consumed in its concentrated form it is quite toxic.

This means that a rat would have to orally ingest 7 mg of the active ingredient azinophos-methyl per kg of body weight in order to have a 50% chance of death. A similar rat would have to ingest 4320 mg of glyphosate per kg of body weight to have the same chance of death.

1000 mg = 1 gram = a single Smartie™

(If you broke a Smartie into 1000 equal sized pieces, each piece would roughly be one milligram.)

This information is critical when a manufacturer determines the safety precautions required for a certain product. A product with a low LD50 must be handled with extreme caution and with the proper safety equipment. All safety precautions on a product label are based on the toxicology data collected including LD50.

Pesticide Exposure

Pesticide applicators have the greatest risk for pesticide exposure. They handle the concentrated pesticide during transport and mixing. They also apply the product and are exposed to pesticides suspended in the air, on the tractor and sprayer and on the ground.

From a toxicological perspective there are several ways a pesticide can enter the human body and cause problems. Ingestion (via mouth), inhalation (breathing), absorption (dermal - through the skin; ocular – through the eye; other mucous tissues – ie. nose).

The most common exposure route is through the skin; hands, arms and face. Areas of the human body like the groin, armpits and small of the back have lots of sweat glands and are often warm, making them excellent points of entry for pesticides. For applicators, it is very easy to have product splashed on them during mixing and spraying. This is why most product labels require chemical resistant gloves and spray bibs when mixing. Some toxic products have respirator and protective spray suit requirements. **It is extremely important to follow all label instructions, especially regarding handling and safety precautions.**

Pesticide safety can be overlooked because acute toxicity symptoms are not easily identified. Applicators may claim they have never had pesticide toxicity symptoms, however the list below shows common mild symptoms, depending on the pesticide used, that can occur up to a day after application of a product.

Headaches, fatigue, loss of appetite, dizziness, weakness, perspiration, thirst, diarrhea and irritation of the skin nose or throat.

Other conditions that are often attributed to the flu can be examples of moderate toxicity symptoms:

Nausea, trembling, mental confusion, rapid pulse, blurred vision, and tightening of the throat or chest.

These symptoms can easily be discounted as the flu, a cold or just tiredness from early morning sprays. It is important to recognize these symptoms and take precautions to prevent them in the future.

Poison Control Centre for Nova Scotia: **1-800-565-8161** or **1-902-428-8161**

Safety Equipment and Precautions

Although different pesticides may require different safety precautions, there are some basic items most applicators should have and use. If you are applying pesticides with a tractor, that has a cab, it is essential that a carbon filter system be maintained and that all windows and doors have tight seals. Normal dust filters do not prevent pesticide fumes from entering the cabin. If spraying in an open tractor, a spray resistant spray suit (Tyvek™), respirator, goggles and gloves should be used. After spraying with a tractor, it is important to wash the tractor prior to use for another purpose. Pesticide residue on a tractor is often an overlooked safety concern.

When mixing pesticides, it is important to have a respirator (with a carbon filter), chemical resistant gloves, chemical resistant goggles, non-lined rubber boots and a full length splash bib. Mixing is the most critical time for exposure and it is important to take the proper precautions. It is important to not take soiled safety equipment into a cab tractor, as this will potentially contaminate things like the steering wheel.

Conclusion

It is critical to always follow the label instructions of the specific pesticide that is being used. If this is done correctly, pesticides can be used effectively while insuring a high level of safety for the applicator, neighbors and the end users of the crop you are growing. Pesticides are a valuable tool for managing pests in our cropping systems. Pesticides need to be treated with a healthy level of respect.

For more information, please contact:

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