Pesticide research must stay transparent and independent

May 7 2019, by Sébastien Sauvé

Credit: AI-generated image (disclaimer)

Few people would make an important purchase on trust alone. The same logic applies to pesticides.

Getting the best scientific information about the safety of pesticides can be challenging. There is almost always some uncertainty in the science,

making it sometimes difficult to navigate the research on pesticides.

I have been researching environmental contaminants for 25 years, focusing on situations where chemical products are found at above-normal concentrations in the environment, and trying to determine when they pose a real environmental threat.

Unbiased study design

The design of a scientific experiment influences its results. The experiment can be engineered to demonstrate a chemical's positive effects or its environmental impact, depending on the desired outcome.

For example, if I did a small pilot study on a number of randomly selected farms, I could determine after my first season which sites showed the most (or the least) variation. The next year, when I do a more thorough study, if my sites are truly chosen at random, the results won't be misleading.

But if I have selectively chosen certain types of sites to obtain a clearer result, and not mentioned it, I will have introduced a sampling bias that may be very difficult to detect when others evaluate the quality of my research. The results may appear valid, but they will in fact have been manipulated to promote the desired results.

Industry funding

When perusing the scientific literature on pesticides, it is difficult to screen out what has been designed objectively and what has been funded by industry with a potentially biased intent. The recent obligation of scientists to declare conflicts of interest has been essential to trust the results. Many of the available studies on pesticides are funded and

designed by the companies that produce the chemicals. Companies that do a large number of studies may set aside the results of some studies, but widely distribute the results of others.

The pesticide industry is more inclined to fund researchers who produce results that are useful to them than those who raise the awareness of potential problems. Those who work on ways to reduce pesticide use or on the benefits of alternative agricultural approaches may find it harder to find funding and may even be in trouble from governmental agencies.

Worse still, some researchers working on the environmental impact of pesticides may face attacks by industry on their scientific credibility, ethics and even their personal lives. For example, Tyrone Hayes, a biologist at the University of California, Berkeley, experienced numerous setbacks. His work on the herbicide atrazine was challenged by Syngenta, the large agribusiness that makes the chemical and attempted to discredit him and invalidate his published work.

Changing dangers

Pesticides are designed to be toxic and used to eliminate pests. Herbicides target weeds, insecticides control insects and rodenticides target harmful rodents.

Unfortunately, given their inherent toxicity, they are never fully selective —all pesticides have the potential to harm plants, fish, insects and birds. Some affect predators, such as marine mammals, eagles and polar bears, and many are persistent organic pollutants.

The challenge for regulators is to figure out how much of the chemical will have a significant deleterious impact on significant individuals or organisms. The scientist can determine the number of species that will be affected and to what extent, but the level of acceptable impact is

often a societal decision.

Uncertainties in risk estimates

When a manufacturer markets a new pesticide, it must produce several risk assessment studies. Toxicological studies need to address a pesticide's effects on humans; ecotoxicological research shows its interactions with the environment. These studies determine maximum doses and threshold criteria to preserve environmental quality in drinking water, soils or aquatic life.

This exercise determines the highest possible concentrations that can be allowed without adverse effects on human health and the environment, and it must be done on the basis of quality scientific studies free from conflicts of interest.

This doesn't always happen. Reportedly objective research on glyphosate, the active ingredient in the herbicide Roundup, was secretly revised by agrochemical giant Monsanto.

If there's any doubt about the environmental or health risks associated with a chemical, regulatory agencies should use the precautionary principle to avoid causing irreparable damage. This approach, however, is often in conflict with the U.S. approach of not regulating a chemical until the damage is demonstrated and proven to prevent any legal challenge.

It's also important to understand that as scientists do more studies and explore more situations, they are more likely to find a species that is particularly sensitive to the pesticide or identify conditions that aggravate its toxicity. The criteria to protect health and the environment almost always evolve over time and the regulations become tighter.

This is why we see pesticides introduced and then banned years later. For example, a century ago, lead arsenate was used to control insects. When DDT (dichlorodiphenyltrichloroethane) was introduced in the 1940s, scientists expected it would be more efficient and without the risks associated with arsenic.

By the 1970s, however, DDT was banned in the United States, based on its harmful effects on wildlife —it killed eagles and falcons —and affected human health. The agriculture industry then switched to organophosphate pesticides. These did not have the same risks as DDT, but were later found to have neurotoxic effects on children, even at low concentrations.

Today, we use neonicotinoids and glyphosate, currently the most widely used herbicide in the world. More than one-third of food samples tested by the Canadian Food Inspection Agency between 2015 and 2018 contained glyphosate residues.

Beware of dogmas

We must also be careful not to fall into a dogmatic approach that rejects the use of all synthetic chemicals. A distinction must be made between cases in which moderate and minimized pesticide use can be beneficial without causing significant impact on human health or the environment.

We must also listen to alternative agronomic approaches that reduce pesticide dependence. Impartial information should be provided to agricultural producers.

We should not expect stakeholders whose livelihood depends on the sale of pesticides to be objective on the debate between conventional pesticide-based agronomic approaches and novel approaches that might be economical and efficient but would lower sales of pesticides and their

revenues.

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