IPM, Pesticides, and Risk – Part I: The Untold Story

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Abstract

Integrated pest management and pesticide safety education programs seek to help people minimize risks to people and the environment when managing pests. Yet these programs overlook many relevant risks in their programming. The author discusses the adverse consequences of this and provides an example of how to correct the situation.

Keywords: integrated pest management, nonchemical risks, risk communication, risk perception

There is much disagreement as to the true definition of integrated pest management (IPM), a claim you can easily validate by Googling "definition of integrated pest management." The scope of the definitions has also evolved over time, beginning by focusing on using multiple approaches to attain acceptable control of pests and later adding the concept of minimizing risk. Indeed, in looking over all those Googled definitions in use today—regardless of what terminology, steps, or methods each may highlight—I find they are each based on simultaneously achieving these same two goals:

1) Maintain pest populations at an acceptable level.

2) Minimize health, environmental, and economic risks from both pests and pest management methods.

Accordingly, IPM and pesticide safety education program (PSEP) educators alike always talk about risk and risk mitigation with respect to pesticides. Consider the label statements and International Agency for Research on Cancer (IARC) findings for the products listed in Table 1.

Table 1. Hazards to humans and the environment

Product	Use	Label warnings and IARC* findings
A	Structural pest management	May cause headache, dizziness, nausea Avoid breathing vapors Wear protective gloves and goggles Keep out of reach of children
B	Nonselective vegetation management	Wear eye protection Do not use when other people are in the area Harmful to nontarget vegetation Can impair nervous system IARC determined chemical involved may be carcinogenic

* International Agency for Research on Cancer

Now, ask yourself which of the following points you'd be likely to cover in any training or education that touched on the use of such products:

- Read the label.
- Wear the necessary personal protective equipment.
- Take steps to prevent nontarget injury.
- Do not use around children.

Hold onto your hats, because if you told yourself you'd give most or all of these bits of advice—or even one—I'm almost certain you're mistaken. If Products A and B were pesticides, I'd say you were spot on in your answers. However, given that Product A is a silicone sealant and Product B is a string trimmer, I strongly suspect that, like me, you've rarely (if ever) addressed the hazards and risks associated with their use in your educational programming.

The Issue

With relatively few exceptions, PSEP and IPM educators leave the hazards and risks associated with nonchemical pest management out of the discussion. And until recently, I was very much in the same boat with everyone else. How that boat got so crowded might make for an interesting discussion, but I prefer to focus on why it's time we all jump ship:

- The only way to develop an IPM plan that minimizes risk is to assess and compare the risks associated with all management options being considered.
- The only way to minimize risk when implementing an IPM plan is to be aware of all the risks and how to mitigate them.
- Discounting the risks of nonchemical methods exaggerates the perceived risks associated with pesticides.
- Implying a lack of risk for nonchemical options gives a false sense of safety that makes risky behavior and poor decision making more likely.

Discussing risks associated with nonchemical controls falls under the missions of both IPM and PSE programs. IPM programs teach people how to use multiple tactics to manage pests with the least risk, so addressing all risks is clearly pertinent. PSEPs teach people to use pesticides if the benefits outweigh the risks; sometimes, one of the benefits is that other options pose more risk, but that determination requires a knowledge of such risks.

Therefore, rather than suggesting a shift in program goals or missions, I'm simply advocating for a broader view to help us better achieve our missions' goals. I will start by explaining what led me here before providing an example of taking a broader approach to risk education.

Overboard

I've felt a growing discomfort over this issue for several years. Questions would pop into my head, such as, "I know to immediately wash up if I get pesticide on my skin, so why, when I get sealant on my fingers, do I just wipe it on my work jeans and carry on?" (I suspect this is a shared experience among many of you.) Or, when looking out the bus window on the ride home after a day spent reading Environmental Protection Agency (EPA) assessments of pesticide effects on bees, "I wonder if anyone's ever studied what effect tarping that field of organic vegetables has on ground-nesting bees?"

Such nagging questions nudged me closer to the rail, but a couple of events in fairly rapid succession led me to abandon ship altogether and start swimming. I'll discuss them here without identifiers.

Man of Stihl

A timber manager for a large paper company was explaining that some environmental groups and rural homeowners were lobbying the state to ban the use of glyphosate in silviculture. The company used glyphosate for brush control and cut-stump treatments. The manager said the alternative being pushed was the use of chainsaws. We were onsite, with terrain that was steep, uneven, and rife with slash and other trip hazards. I expressed concern about the implications switching to chainsaws would have for worker safety and asked if he could speak to that, which he did at great length. Later, the timber manager came up to me and said, "I want to thank you for asking that question. No one ever asks about the risks of using alternatives to pesticides."

Soon after, I was asked to talk about herbicide use in forestry operations and I did some research into the chainsaw alternative, wanting to be certain of any concerns I brought up. In addition to environmental hazards, such as carbon footprint and the amount of bar and chain oil that would be left behind in the soil, here is just a sample of hazards and risks to human health I found:

- **Direct injury:** Chainsaws and slips/falls account for a large proportion of serious injuries in the forest industry. When you consider the terrain of much of our forested lands, you can imagine how those two risks could combine with horrible results.
- **Inhalation hazard:** Gasoline engine exhaust includes toxicants such as benzene and formaldehyde and is listed by IARC as a possible human carcinogen. EPA estimates annual use of a chainsaw emits exhaust equivalent to a car traveling 9,000 miles. Unlike car exhaust, however, chainsaw exhaust is released close to the operator's face. The movements and vibrations associated with chainsawing make respirator use impossible, which means the operator is constantly inhaling the exhaust.
- **Hearing loss:** The National Institute for Occupational Safety and Health has found the frequency of hearing loss in noise-exposed forestry workers to be higher than all other noise-exposed industries combined.

Though directed at the use of chainsaws for forest vegetation management, this recommendation from the British Columbia Ministry of Forests (2003) struck me as one we should all apply to every pest management scenario:

> If manual brush control with power tools is to be used, the ethical and policy implications of the potential accompanying health risks must be given close attention. Such policy decisions are beyond the realm of scientific analysis, but must include an objective and thorough examination of the risks for each option.

The effort to replace glyphosate use with chainsaws is a clear example of how failing to address all risks can lead to a belief that *anything* is safer than a pesticide. As a result, decisions intended to protect people and the environment could do just the opposite.

Naturally Enemies?

A conference speaker was extolling the use of classical biological control—the importation of natural enemies to combat invasive pests. I had recently read a paper on indirect, adverse consequences of using host-specific biological control agents (e.g., ecological replacement, the target pest's compensatory responses, and food-web shifts) and asked his thoughts on assessing and mitigating such risks in the future. I expected a thoughtful response, at least at the level of "Those are questions we are only now starting to ask and are worthy of research."

Instead, he challenged me to provide an example. Not having memorized the paper, I just mentioned the idea of changes in the food web when the biocontrol agent becomes abundant enough to replace native species on predators' menus. Again, he asked for a concrete example. I replied that I'm not an expert steeped in the biocontrol research, which is why I attended his presentation and sought his perspective on the matter. His final reply was along the lines of "Maybe it could happen, but if you don't know, why would you even ask the question?"

I was too stunned to reply to what was essentially the most antiscience comment I'd ever heard from a scientist. I also didn't want to take more time away from other people who had questions, so I just sat down and thought back on my experiences as a pesticide safety educator. A conversation I've had with more than one concerned person goes something like this:

> **Concerned Person**: "We need to ban pesticides on school grounds to protect kids."
>
> **Me**: "What led to your concern? Did something happen where kids were harmed by a pesticide used at school?"
>
> **Concerned Person**: "No, but can you be sure they won't get harmed?"
>
> **Me**: "I wish I could be, but there's always some level of risk, especially since there will always be unknowns. But let me tell you what's being done to learn more and how we use what we do know to minimize risks to kids."

After stewing over these two very different conversations for a bit, I had two revelations. First, the speaker I had questioned wasn't antiscience and didn't mean to be dismissive; it is more likely he simply was not used to being asked about the risks associated with biocontrol—perhaps not even used to thinking broadly about such risks—and my query likely caught him off guard and perhaps made him defensive. In contrast, I fully expect questions about hazards and risk every time I speak on pesticides. And not only was I hired specifically to educate people about such things, I have been honing that craft for over three decades with expert assistance from colleagues from the American Association of Pesticide Safety Educators and the National Pesticide Information Center, among others.

The second revelation was that by failing to address or even entertain questions about risks associated with nonchemical control options, are we to any extent stifling research into such things? After all, research begins with asking a question. For example, when I started this gig over 30 years ago, assessing a pesticide's risk to bees was very straightforward (and equally flawed): all we needed to know was the LD_{50} for honeybees, right? We didn't think about sublethal or colony-level effects or how to even look for or measure them, or even about other kinds of bees. Yet people asked questions, research proliferated, EPA has incorporated testing for some of these effects into the pesticide registration and reregistration process, and now we openly talk about them. Being able to assess and mitigate risks begins with asking and researching questions about risk. We need to do that for every pest management option, both chemical and nonchemical.

Finding My Stroke

Let me provide an example of my self-imposed swimming lessons.

Our Right-of-Way pesticide applicator certification training manual has chapters titled "Hazards Associated with Pesticide Use," "Pesticide Overspray and Drift," and "Protecting Water from Pesticide Contamination." In addition, the chapters on vegetation management on roadsides, in utility right-of-ways, and along railroads discuss the hazards and risks of herbicide use specific to those programs. In contrast, concern about nonchemical options is limited to one sentence in one chapter: "Hand mowing weeds under guiderails is dangerous to workers, as well as time consuming and expensive."

Granted, we are pesticide safety educators, and that explains part of this disparity. But as I mentioned earlier, PSEPs teach people to use pesticides if the benefits outweigh the risks; sometimes, one of the benefits is that other options pose more risk, but that determination requires a knowledge of such risks. So, the example I offer below relates to highway authorities looking to switch from herbicides to string trimmers to manage weeds along guiderails. This is being driven by a concern about risks from the use of herbicides, especially glyphosate.

I have already begun incorporating this topic into our program's outreach efforts. This includes using Table 2 to drive home the point that minimizing risk requires an honest and open consideration of all risks.

Table 2. Hazards and risks associated with string trimmer use along guardrails

Hazard	Associated risk
Loud noise	Hearing loss
Vibration	Nerve damage in some people
Whipping action	Rocks thrown at workers or into windshields
Engine exhaust (possible human carcinogen)	Short- and long-term illness from inhaling fumes
Plastic pollution	Small pieces of abraded string resulting from trimming contribute to harming aquatic ecosystems adjacent to or flowing under roadways
Traffic	More staff hours in road shoulder (more time per treatment and more frequent treatment due to incomplete control of perennial weeds) increase risk of being struck by vehicles
Traffic pattern change	Rate of vehicle accidents increases in work zones due to traffic pattern changes, and more staff hours needed (more time per treatment and more frequent treatment due to incomplete control of perennial weeds) increases duration and frequency of traffic pattern changes

Note that Table 2 lacks a third column with the heading “Risk mitigation.” This is deliberate; subjects such as how to best manage work zones or avoid physical injuries such as nerve damage are outside our area of expertise as pesticide safety educators, as they would be for IPM educators as well. However, alerting people to such risks is pertinent to PSEP and IPM program missions and easily within our grasp: the first three rows of Table 2 come from the user’s manual of a standard string trimmer, the next two are obvious consequences of using a trimmer, and the last two come from simply talking to people involved in managing weeds on roadsides.

If you’re thinking, “Well, anyone working for a road crew will already know about these hazards and risks. So what’s the point of bringing those things up?” I would first counter by saying I doubt you’ve ever had a similar thought about pesticides; that is, “Well, anyone working with pesticides for a living will already know about their hazards and risks, so what’s the point of bringing those things up?” The justification for raising the points in Table 2 is the same as for educating people about pesticide hazards and risks.

I would also counter with a reminder that our audiences extend beyond occupational users of pesticides. Over the last four years, I’ve been invited 40+ times to give a presentation on pesticide hazard and risk, using concerns about glyphosate as the hook to get people to learn about pesticide product registration and risk assessment. I would estimate that perhaps half of the over 4,000 people I’ve reached were not professional applicators. They include pesticide regulators; conservation commissioners; college students; highway department personnel; invasive species program managers and

researchers; agricultural, forest, and green industry leaders; Extension specialists; Master Gardener volunteers; lobbyists; legislators; and the general public. These are people who influence public opinion, and many have a voice in advocating for or drafting pesticide-related regulations and legislation. Sadly, while my presentation has always briefly compared hazards between glyphosate and herbicide alternatives, only in the last few presentations have I touched on risks posed by nonchemical weed management options. By not jumping ship sooner, I lost a great opportunity to broaden the discussion of hazard and risk in pest management.

Synchronized Swimming, Anyone?

But one thing about swimming—it's all about moving forward. (OK, not the backstroke, but even that's about getting from Point A to Point B.) And with more people swimming together, we could make more waves and help push each other on. Keep in mind the goal is to reduce risk, period. It's not our job to determine whether using string trimmers or herbicides along guardrails poses less risk, but rather to help ensure people making those determinations are looking at the whole picture. If PSEP and IPM educators can do that, we'll have a better shot at achieving our shared goal of minimizing risk to people and the environment.

So come on in, won't you? The water's fine!

Reference

British Columbia Ministry of Forests. 2003. Toxicology and potential health risk of chemicals that may be encountered by workers using forest vegetation management options. Part I: Risk to workers associated with exposure to emissions from power saws. https://www.for.gov.bc.ca/hfp/publications/00012/3-Dost-PowersawEmissions.pdf. Downloaded April 1, 2022.