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Article

Pesticide Usage Is Compromising People's Health in the United States: Ideas for Reducing Damages

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Abstract: The development of synthetic pesticides has provided new tools for addressing troublesome pests. A review of parts of the registration process for pesticides in the United States identifies an outdated evaluation system that undervalues health damages. Registration fails to adequately consider co-formulants and effects of exposure to multiple chemicals. Frustration with failures to protect people and property from damages accompanying pesticide usage has led injured plaintiffs to resort to tort lawsuits to secure relief. However, litigation involves compensating injured persons after they are injured rather than preventing injury. A more proactive approach would be to prevent situations that injure people. This paper offers four ideas to reduce health damages accompanying pesticide usage. Slight adjustments to pesticide registration requirements can offer greater protection for people's health.

Keywords: pesticide; registration; health; exposure; co-formulants



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1. Introduction

Society's use of pesticides has been accompanied by many benefits. Nearly 90% of pesticide use is in agriculture to control weeds, insect pests, fungal pests, and other organisms [1]. Approximately 44% of pesticide use involves herbicides that have been especially important in reducing food production costs [2]. Insecticides and fungicides preventing crop losses can contribute to lower food prices [3,4]. Yet a more valuable use of pesticides is for public health to control vector-borne diseases. By controlling insect and rodent pest populations, pesticides have reduced the spread of deadly diseases, including malaria, Yellow fever, dengue virus, West Nile virus, Zika virus, Lyme disease, plague, hantavirus, and leptospirosis [5]. For example, malaria control programs in Africa have prevented more than six million deaths over a 15-year period [6].

Simultaneously, worldwide pesticide usage is impairing human health and contributing to the demise of thousands of people every year [7]. Applications of pesticides expose people to harmful chemicals. Inadequate worker safety precautions have subjected agricultural workers and others to costly health problems [8]. Pesticide usage contaminates the environment and interferes with ecosystem services, such as insect pollination [9]. The use of organophosphate pesticides in the United States has been estimated to lead to health costs of up to \$44.7 billion per year [10].

Under the U.S. Code of Federal Regulations [11], every synthetic pesticide and many natural pesticides used commercially in the United States must be registered with the Environmental Protection Agency (EPA). Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), manufacturers apply for the registration of a new pesticide and submit data showing the efficacy and safety of the product. The EPA evaluates a new pesticide under its risk management process looking at ecological risks, human health risks, and cumulative risks [12]. A cost-benefit analysis is performed to determine whether the benefits outweigh the costs to justify the registration [13]. Each registration has limitations on how to use the pesticide and the purposes for which the pesticide may be used. Most agricultural pesticides delineate restrictions on the crops, dosage levels,

time of applications, number of applications, and other details that circumscribe the use of the registered pesticide. Other mitigation measures such as buffers may be employed to help reduce the costs of adverse effects [14]. Any use of a pesticide beyond what is permitted by the registration has not been assessed for risks. Although usage beyond permitted registration is illegal, a lack of enforcement may mean that unauthorized usage is common [15]. Under FIFRA's requirements, pesticide usage places considerable costs on society and the environment [16,17].

An evaluation of FIFRA's registration provisions and accompanying harm raises questions of whether the United States should be doing more to curtail the negative externalities that accompany usage of insecticides, herbicides, and fungicides. A comparison with the European Union, Brazil, and China disclosed that the United States often continued to use pesticides banned in these other major agricultural regions [18]. The United States continued to allow paraquat and phorate, which were banned in these other regions. The European Union and Brazil banned bensulide, dichlobenil, dicrotophos, S-ethyl dipropylthiocarbamate, norflurazon, oxytetracycline, streptomycin, and tribufos before uses were terminated in the United States [18]. The EU also banned chlorpyrifos [19]. The regulatory provisions overseeing the use of pesticides in the United States do not prevent significant health damages to children, agricultural workers, and persons exposed to pesticides. Recent litigation has disclosed that registered pesticides are impairing human health and causing property damages [20,21]. The identification of limitations of current pesticide registration provisions provides a background for identifying four ideas to reduce damages accompanying pesticide usage in the United States that would offer greater protection for human health.

2. Limitations of Pesticide Registration Procedures and Legal Action

An examination of FIFRA's registration provisions reveals limitations in protecting human health. The registration provisions were adopted in 1972 with major amendments in 1988, and many of the act's provisions have not been markedly changed over the past 30 years. Whereas it may be tempting to applaud the resiliency of the provisions, a more accurate accounting of recent events suggests that new technologies, medical discoveries, and modeling techniques are not employed in a manner to optimize beneficial uses of pesticides and human safety [22]. Registration commences with the submission of information only by the registrant. The EPA allows for public input and input from scientific advisory panels. However, there is no independent creation of evidence and no adversarial mechanism embedded in pesticide registration requirements. Registrants present their information with limited input from groups concerned about public health, safety, and the environment. Due to the absence of input from non-registrants, registration decisions may be made without the best scientific evidence [23].

After registration, registrants have a duty to submit additional factual information in the registrant's possession regarding unreasonable adverse effects on the environment [13]. However, there is little incentive for registrants to look for disparaging information, and no duty to report information or data on adverse effects gathered by others. This means that, after registration, the scientific studies and discoveries by non-registrants establishing a relationship between a pesticide's use and adverse human health issues may be ignored. Greater problems are that pesticide registration does not adequately consider inert ingredients used as co-formulants and the effects of multiple exposures. FIFRA's analysis of potential human health risks understates adverse health effects.

Health and safety assessments of pesticides need to evolve to more accurately assess the expected adverse health effects and to keep pace with changes in cancer epidemiology [24]. Current registration requirements may fail to balance profitable agricultural production with safeguarding human health [22]. A more protective provision applies for pesticide residues in or on food as a residue is deemed unsafe unless shown otherwise [25]. The registration of a pesticide should require more to establish its safety.

2.1. Inadequate Cost-Benefit Analysis

To prevent the registration of pesticides that cause too much harm, FIFRA precludes any use of a pesticide that would have an unreasonable adverse effect on the environment. Unreasonable adverse effects include any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide [13]. The EPA weighs the risks of adverse effects that would accompany the registration of a pesticide against the benefits from its uses [26]. FIFRA's cost-benefit analysis assumes that an activity should only occur if benefits outweigh costs and allows for the consideration of external effects and the quantification of benefits.

Performing a cost-benefit analysis under FIFRA is controversial due to difficulties in the monetization of benefits and costs. Several factors suggest that the cost-benefit analysis fails to address all the costs (Table 1). Since a new pesticide being considered for registration has never been used commercially, the documented costs and benefits are restricted. The registrant makes assumptions concerning benefits that will accompany a pesticide's use and considers likely but unknown potential costs. Whereas the registrant submits data on studies that determine hazards to humans, animals, and nontarget organisms, some unknown damages may not be considered [27]. In some cases, the registration materials fail to correctly describe damages that subsequently occur [17]. The registrant also submits post-application exposure and applicator use exposure studies. However, these often are limited in scope. By failing to evaluate all the potential health issues associated with the use of a new pesticide, registration underreports costs [28].

Table 1. Claimed limitations of FIFRA's provisions that may understate costs.

Issue	Implications	Source
One-sided submissions by registrant	Biased and missing information as no independent input	[17]
Cost-benefit analysis	Disincentive to identify potential costs	[17]
Some co-formulants not considered	Co-formulants may increase the toxicity of the pesticide	[29,30]
Effects of other products ignored	Exposures by other chemicals may exacerbate negative health effects	[20,31]
Off-site damages from drift	Damages not always reported and often not compensated	[32]
Assumption of correct application	Injuries from noncompliance are not factored into the cost-benefit analysis	[17]
Cancellation of nonqualifying registrations	Years of study during which people and property may be harmed	[33]
Vulnerability of children	Inadequate consideration for exposure to children	[34]
Contamination	Accumulations in soils not fully considered	[35]

Furthermore, registration only considers the active ingredients of the pesticide and ignores some co-formulants. Research suggests that many co-formulants increase the toxicity of pesticide products, yet this is not considered under FIFRA's cost-benefit analysis [30,36]. In litigation against Monsanto for damages from the use of Roundup herbicides, the forensic toxicologist testified that Roundup was 50-times more genotoxic than its active ingredient glyphosate [37].

FIFRA's cost-benefit analysis does not consider the effects from exposure to other chemicals even though the chemicals produce a common and adverse outcome on the same target organ as the pesticide [38]. Because humans are exposed to multiple substances, risks and damages from pesticides with a common mechanism of toxicity often do not fully account for a pesticide's potential damages [31]. Moreover, most pesticide registrations do not fully account for all public health impacts and social implications, including suicides and physical and psychological pain experienced as a result of acute and long-term illnesses, long-term low-dose intermittent exposures, bioaccumulations, biomagnifications, pest resistance, environmental impacts to natural resources, and ecosystem disturbances [39].

Finally, registration assumes that persons using pesticides will follow safe procedures and use them correctly. This often does not occur, as documented in litigation concerning uses of glyphosate and dicamba. In the Pilliod vs. Monsanto Company lawsuit, the plaintiffs claimed that they lacked sufficient safety instructions for applying glyphosate, so they proceeded to apply the pesticide in T-shirts and shorts, during which they were exposed to spray drift [40]. For the use of a dicamba pesticide, soybean farmers wrongfully applied an old volatile version of dicamba on their Xtend soybeans that led to deadly

spray drift damages to neighboring crops [41]. Evidence presented in a lawsuit seeking to overturn registrations for three dicamba products noted that even conscientious applicators would have difficulties complying with the onerous application requirements [17]. To offer greater protection to the public, FIFRA registrations may need more proactive provisions to address illegal uses.

2.2. Neglected Human Health Concerns

FIFRA's provision precluding the registration of a pesticide unless it performs its intended function without unreasonable adverse effects on the environment has been defined to require the consideration of the harm a pesticide may cause to humans and the environment [13]. Considerable research has shown that pesticides harm people. Some studies have shown that pesticides are associated with several cancers, including prostate, breast, colorectal, and non-Hodgkin lymphoma [7,42]. Other health disorders to pesticide exposure include Parkinson's disease, Alzheimer's disease, reproductive disorders, and respiratory disorders [7]. Some pesticides act as endocrine-disrupting chemicals through hormonal or gonadotrophic pathways that affect male and female reproduction [43]. Whereas the EPA has an endocrine disruptor screening program, studies have raised questions about whether humans are sufficiently protected. Organophosphate pesticides produce cognitive and behavioral dysfunction [44,45]. Pesticides can impair the health of humans by damaging DNA and contributing to organ failures, shortened lives, and other problems [36,46,47]. Pesticides in drinking water can cause chronic health problems [48].

A 5-year study of data from 60 poison control centers covering the United States highlighted other dangers associated with pesticides [49]. Poison control centers annually receive more than 130,000 calls about pesticides and disinfectants, with the largest number involving exposure to insecticides. The results showed that more than 98% of the presumed exposures were unintentional. Data from the centers showed 20 deaths per year. The study also looked at emergency room visits, and the data showed 7385 visits per year due to accidental exposure, suicidal attempts, or undetermined reasons.

The Centers for Disease Control and Prevention compiled information on acute pesticide-related illness and injury arising from occupational exposures to pesticides for a 5-year period ending in 2011 [50]. More than 500 persons were adversely affected each year from occupational exposure. Langley and Mort found that 607 persons per year had attempted suicide by ingesting a conventional pesticide [49]. Treatment costs also accompany these hospitalizations. It was estimated that the economic cost associated with pesticide exposures to humans is \$2 billion per year [49].

Another major concern is adverse environmental exposure to children as they are particularly susceptible to health damages from pesticide exposure [51,52]. Children are protected from pesticide residues in food [53], but in other situations, children may be exposed to quantities of pesticides that adversely affect their health (Table 2). For example, children are not protected from pesticide residues in soils [54]. Early-life exposure to pesticides may increase risk for disease outcomes in later life [55]. Prenatal exposure to pesticides can contribute to the probability of fetal growth deficits [47]. Applications of pesticides lead to toxic air pollutants that can be injurious to children [56].

A comprehensive study on children's health related to pesticide exposure led to four observations [34]. First, neurotoxic pesticides are contributors to the rising rates of attention-deficit/hyperactivity disorder, autism, and widespread declines in IQ. Second, pesticides are related to childhood cancers. Third, pesticides may contribute to childhood asthma, obesity, and diabetes. Fourth, extremely low levels of pesticide exposure can cause significant health problems.

Table 2. Inadequate protection of children from exposure to pesticides excluding food products.

Distinction for Children	Meaning of the Distinction	Addressed by Worker Protection Standard [11]
Organs not developed	Cannot breakdown and eliminate pesticides	No
Higher surface-to-volume ratio	Absorb more pesticides	No
More time outdoors	More exposure through air	No
Hands and objects in mouth	Greater ingestion from objects and clothing	No
Cannot comprehend warnings	Oral or written information insufficient	Spanish signs help
May be in a sprayed area	Exposure limitations set for adults	Re-entry limitations
May not recognize exposure	Cannot not seek help to address the problem	No
Application of pesticides	Too young to follow safety regulations	Yes, age limit of 18

2.3. Deficiencies in Agricultural Worker Protection

The safety of humans includes that of agricultural workers, one of the groups most likely to be exposed to pesticides. Agricultural workers include both pesticide applicators and workers involved in activities in areas where pesticides have been applied. In balancing costs and benefits, FIFRA limits the analysis to the extent necessary to prevent unreasonable adverse effects on the environment [13]. This means that if benefits to agricultural production are great enough, considerable harm to agricultural workers is allowed. Moreover, children of agricultural workers are sometimes exposed to pesticides when they accompany their parents to areas sprayed with pesticides, and children may also help harvest crops containing harmful residues [57].

The EPA adopted a Worker Protection Standard with detailed requirements to provide a safe working environment for agricultural workers and protect other persons [11]. If these provisions are followed, they should provide reasonable protection for agricultural workers of the agricultural establishment. However, lapses in compliance to the Standard may enable pesticides to adversely affect agricultural workers. A major limitation is that the Standard does not protect workers on neighboring properties [11]. Pesticides may be applied that drift onto workers in an adjacent field or orchard if the property is not owned by the same person who owns the property being sprayed. Workers generally do not know what sprays are applied on neighboring properties owned by someone else. Whereas pesticide drift rules cover these situations, difficulties in discerning the problem, the cost of seeking recompense, and the burden of proof may be so onerous as to preclude recovery [58].

Moreover, as identified in Table 3, lapses may occur so that agricultural workers do not receive adequate protection from harmful pesticides. Furthermore, the Standard may not be enforced except for situations where a problem has been identified or a person has reported a problem [8]. State governments enforce pesticide regulations, including the provisions of the Standard. A yearly report for the state of Texas, a state with more than 45,000 registered pesticide applicators, listed 325 complaints involving the use of pesticides [59]. The maximum fine levied against a violator was USD 1000 [60]. As noted by the court in the National Family Farm Coalition vs. EPA lawsuit, such fines “are viewed among violators ‘as the cost of doing business.’” [17]. It is cheaper to pay a fine than suffer weed growth that diminishes yields. Moreover, state enforcement actions do not compensate those who suffer injuries from pesticide usage.

Table 3. Potential health problems from agricultural worker exposure situations that may result despite the Worker Protection Standard.

Event	Protection Standard [11]	Possible Problem
Greenhouse faulty ventilation	40 CFR § 170.110	Unhealthy pesticide particulates in the air
Permitted early re-entry	40 CFR § 170.112	Inadequate personal protective equipment
Permitted early re-entry	40 CFR § 170.240	
Notice of pesticide application	40 CFR § 170.112	Worker exceeds the 1 h time limit
	40 CFR § 170.120	Not given or not comprehended
Safety training	40 CFR § 170.130	Failure to understand or follow procedures
	40 CFR § 170.230	
	40 CFR § 170.501	
Decontamination supplies	40 CFR § 170.150	Insufficient clean water or single-use towels
Defective equipment	40 CFR § 170.234	Insufficient instruction or damaged equipment
Emergency assistance	40 CFR § 170.260	Nonavailability of timely transport for medical assistance or for decontamination
Showering	40 CFR § 170.491	Not showering soon enough with soap and water
Inadequate washing clothes	40 CFR § 170.401	Not done after single use and separate from other clothing
Mixing, loading, and applying sprays	40 CFR § 170.401	Person not sufficiently trained as a handler
Children in exposure areas	40 CFR § 170.401	Lack of oversight in keeping children away
Pregnant women	40 CFR § 170.401	No knowledge of pregnancy or needs employment
Entry restrictions	40 CFR § 170.401	Inadequate application exclusion zones to protect people
Personal protective equipment	40 CFR § 170.507	Failure to provide appropriate protective equipment

To protect workers from dangers posed by the pesticides in fields, the EPA calibrates a time interval after the end of a pesticide application during which entry into the treated area is restricted [11]. The protection offered by these intervals are limited. First, there are exceptions to the re-entry rules for short-term activities. Second, migrant workers may not appreciate when the last pesticide application occurred and may be asked to work in areas before the restricted-entry interval expires. Third, the restricted-entry interval is calibrated for an adult so the interval may fail to protect children. Whereas these situations may violate worker protection standards, few enforcement actions address violations as claims will often involve an employer's word against the allegations of a worker [8].

Despite the significant body of literature showing that pesticide use harms people, the EPA adopted regulatory revisions in 2020 that weakened the application exclusion zone requirements intended to protect people from pesticide exposure [11]. The EPA limited pesticide application exclusion zones to the agricultural establishment, thereby allowing pesticide drift to harm persons on neighboring properties.

2.4. Harm Not Prevented by Post-Injury Litigation

In the past few years, numerous lawsuits involving damages from exposure to Monsanto's Roundup pesticides and three new dicamba products have established tort law as a mechanism to place health and property damages on pesticide manufacturers. Three California juries found that Monsanto should be liable for than USD 130 million in damages related to glyphosate use [61–63]. More significantly, the juries also awarded substantial punitive damages. All these verdicts are being appealed, and some of the punitive damage awards have been reduced. In 2020, Bayer agreed to settle 125,000 filed and unfiled glyphosate claims for USD 10.1 billion [16]. Other litigation against manufacturers of dicamba herbicides involves property damage to crops [21,41]. Bayer also entered a settlement to pay up to USD 400 million for crop losses occurring in the 2015–2020 crop years for injuries resulting from dicamba herbicide applications [16].

Lawsuits against pesticide manufacturers may allege several legal claims under which manufacturers may incur liability (Table 4). The allegations include claims that current pesticide marketing information and practices may be insufficient. Whereas agricultural and commercial applicators applying restricted-use pesticides receive training that acknowledges potential dangers associated with applying pesticides, consumer applicators

of general use pesticides receive no training. In the glyphosate lawsuits against Monsanto, the plaintiffs claimed they did not receive training on how to use Roundup and did not have adequate warnings about the dangers of Roundup. Another claim was that Roundup could have been designed differently to make the product less dangerous. The litigation suggests that the registration provisions for Roundup products ignored significant damages that accompany usage.

Table 4. Legal causes of action for damages from pesticide exposure.

Cause of Action	Basis	Examples
Negligence	Design, research, manufacture, marketing, advertisement, supply, promotion, packaging, sale, and distribution contributing to injury	[37,61]
Inadequate warnings	Absence contributed to injury	[37]
Strict product liability	Defect made the product unreasonably dangerous for its intended or reasonably foreseeable use	[64,65]
Strict liability for defective design	Product was not reasonably safe	[41,61]
Strict liability for failure to warn	Absence of warning caused serious injury	[41,61]
Fraud and misrepresentation	Prevented plaintiffs from knowing of a danger that contributed to injury	[37,65]
Breach of implied warranties	Product was not fit for intended purposes and uses	[61]
Breach of express warranty	Deviation from a manufacturer's voluntary contractual commitment	[64,66]
Consumer protection statutes	Deceptive and/or unfair acts or practices in connection with a pesticide's design, development, marketing, promotion, and commercialization	[41,66]

3. Discussion

Given litigation and settlements, it may be concluded FIFRA is not offering adequate protection to people being exposed to pesticides [16]. For some pesticides, major health maladies from pesticide exposure have been identified that were not considered at the time of registration [67]. The failure of federal law to protect people from dangerous pesticides suggests that changes ought to be considered. An obvious response would be to amend FIFRA, and several ideas are prominent for revising the law so the provisions would more appropriately protect people from damages associated with pesticide use [22]. However, amending FIFRA may not be possible. Thus, other ideas need to be considered so that state governments can elect to do more to protect their citizens. Under this scenario, it may be expected that many states lack the resources to effectively take action to protect people from harm.

3.1. Acknowledge Children Require More Protection

FIFRA's cost-benefit analysis does not fully account for the fact that children are more vulnerable to toxins in pesticide products than adults. This issue was recognized by Congress when they enacted the pesticide residue provisions of the Food Quality Protection Act of 1996 [68]. In setting tolerances for pesticide residues in or on food products, the EPA must find that the tolerance is safe. Safe is defined as a reasonable certainty that no harm will result from aggregate exposure to the pesticide residue in or on food that includes any special risks posed to infants and children [53]. The costs considered during the registration of a pesticide should include potential harm to children from other avenues of exposure so that pesticide use does not compromise their health.

3.2. Augment Protections for Agricultural Workers

Regulations under FIFRA include an Agricultural Worker Protection Standard that offers significant protection for agricultural workers. The provisions have reduced pesticide poisonings, but difficulties in adhering to the provisions mean agricultural workers are exposed to toxins that impair their health. The standard assumes that handlers and

agricultural employers can oversee all the situations during which agricultural workers may be exposed to pesticides. However, numerous circumstances make this problematic. Many seasonal vegetable and fruit crops have a short timeframe for harvesting to optimize size, taste, and perishability. To coordinate pest control, workers may be sent into application exclusion zones prior to the expiration of a safe period in violation of the rules. Low-paid workers need income to provide for their families and pay their bills, and workers with limited ability to comprehend and understand directions in English mean that full compliance with the federal standard does not always occur. Consequently, workers are exposed to pesticides that compromise their health [69].

The housing provided to agricultural workers may exacerbate exposure problems. Pesticides may be sprayed on nearby fields and drift into the housing area. The accumulated exposure during harvesting crops and living in housing contaminated by pesticides may mean that exposure of pesticides by agricultural workers exceeds established safety limits. The calculation of health costs for pesticide registration assumes compliance with the Agricultural Worker Protection Standard. Because this does not always occur, a safety factor might be added in FIFRA's regulations to account for situations where employers fail to follow requirements on worker safety. A state legislature might also provide more protection for agricultural workers, although such would increase production costs.

3.3. Recognize the Dangers of Co-Formulants

Registration under FIFRA generally only considers active ingredients while most uses of pesticides involve mixtures of active ingredients with co-formulants. For example, for its examination of glyphosate in 2016, the EPA only sought to evaluate the active ingredient glyphosate and did not consider the human carcinogenic potential of any formulation [70]. A common co-formulant used with glyphosate herbicides is polyoxyethylene tallow amine, and research suggests that this co-formulant is more toxic than glyphosate [71]. Excluding the consideration of co-formulants is an outdated hazard-identification scheme that was adopted a half-century ago [72]. Because a co-formulant can increase the toxicity of an active ingredient, the registration costs for a new pesticide product may be underestimated. Registration should recognize the danger of the pesticide, not simply the active ingredient. Unless FIFRA's registration provisions are changed, they will continue to underestimate the dangers of pesticide products, sometimes resulting in products being approved that foist more costs on society than are offset by benefits.

3.4. Account for the Effects of All Pesticides and Other Chemicals

Registration under FIFRA considers exposure by the pesticide and pesticides with a common mechanism of toxicity [73]. In conducting its cumulative assessments of risks, the EPA can ignore evidence that people using a pesticide will be exposed to other chemicals that can adversely affect their health. This occurs among off-site workers who are exposed to pesticide spray drift from a pesticide application on a neighboring property. FIFRA is supposed to only allow pesticides that are safe and prevent unreasonable adverse effects on the environment [13]. However, by ignoring the exposure effects of other pesticides, registrations can be approved even though there is knowledge that not all the expected costs are considered. FIFRA's registration provisions understate costs and ignore likely health damages. Because FIFRA's cost-benefit analysis ignores costs of exposure to multiple chemicals, it does not protect people as intended.

Problems involving adverse effects from the use of pesticides under FIFRA may be contrasted to the European Union's (EU's) regulatory framework. The EU mandates that precautionary measures should be employed when inconclusive, insufficient, or incomplete scientific evidence of uncertain risks means the public or environment might not be adequately protected [74]. Employing the EU's precautionary principle, the European Commission adopted Regulation (EU) No 485/2013 of 24 May 2013 restricting uses of neonicotinoid products [75]. In 2021, the Court of Justice of the European Communities dismissed an appeal by Bayer Crop Science contesting the application of the precautionary

principle to three neonicotinoid products on seeds [76]. The court found that the precautionary principle justified the adoption of a prohibition of selling seeds treated with the products. Instilling greater precaution in the registration of pesticides under FIFRA seems warranted as the cost-benefit analysis allows considerable harm to people and the environment.

4. Conclusions

Pesticide law in the United States is governed by provisions that fail to account for significant health damages. Registrants of pesticides control the information considered in the registration process and may fail to consider unexpected health costs, neglect unknown human health concerns, provide inadequate protection for children, and insufficiently protect agricultural workers. Registration declines to recognize the dangers of all co-formulants, fails to account for exposure to other chemicals that produces a common and adverse outcome on target organs, and omits adequate consideration of damages from persons misusing pesticides. The deficiencies of pesticide law led injured persons to resort to costly litigation for damages already suffered. This only compensates a few of the people who have been injured. From an economic perspective, it would be better to prevent damages from occurring rather than reacting to subsequent harm that materializes. Rather than waiting for people to be harmed and seek compensation for damages, pesticide law might be revised to require more mitigation measures for pesticides being registered that would reduce damages. Superior options exist for facilitating the use of new pesticides while protecting human health.

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