

2025 HOUSE AGRICULTURE

HB 1318

2025 HOUSE STANDING COMMITTEE MINUTES

Agriculture Committee
Room JW327C, State Capitol

HB 1318
1/23/2025

A BILL for an Act to create and enact as new section to chapter 28-01.3 of the North Dakota Century Code, relating to pesticide labeling.

10:30 a.m. Chairman Beltz opened the meeting.

Members Present: Chairman Beltz, Vice Chairman Hauck, Representatives Anderson, Dobervich, Henderson, Holle, Hoverson, Kiefert, Nehring, Olson, Rios, Schreiber-Beck, Tveit, Vollmer

Discussion Topics:

- Rigorous scientific review
- Proper safety precautions
- Chemical applicators certification
- EPA process
- Review process

10:30 a.m. Representative Jared C. Hagert, District 20, Emerado, ND, introduced and testified.

10:32 a.m. Greg Amundson, Board member, ND Corn Growers Association, testified in favor and submitted testimony #31064

10:33 a.m. Dan Wogsland, Lobbyist, ND Grain Growers Association, testified in favor and submitted testimony #30948.

10:38 a.m. Justin Sherlock, President ND Soybean Growers Association, testified in favor.

10:45 a.m. Elizabeth Burns-Thompson, Executive Director, Modern Ag Alliance, testified in favor and submitted testimony #30834.

10:48 a.m. Jason L. Hanson, President, ND Crop Consultants Association, testified in favor and submitted testimony #30869.

10:51 a.m. Tom Bodine, Deputy Agriculture Commissioner, ND Agriculture Department, testified in favor.

10:53 a.m. Ryan Gregg, Legislative Specialist, NDFU, testified in favor and submitted testimony #30946.

10:54 a.m. Rachel Gross, Southwest Field Representative, ND Faram Bureau, testified in favor.

10:55 a.m. Jaclyn Hall, Executive Director, North Dakota Association for Justice, testified in opposition and submitted testimony #30959.

11:02 a.m. Representative Nehring moved Do Pass.

11:02 a.m. Representative Vollmer seconded the motion.

Representatives	Vote
Representative Mike Beltz	Y
Representative Dori Hauck	Y
Representative Karen A. Anderson	Y
Representative Gretchen Dobervich	Y
Representative Donna Henderson	Y
Representative Dawson Holle	Y
Representative Jeff Hoverson	Y
Representative Dwight Kiefert	Y
Representative Dennis Nehring	Y
Representative SuAnn Olson	Y
Representative Nico Rios	Y
Representative Cynthia Schreiber-Beck	Y
Representative Bill Tveit	AB
Representative Daniel R. Vollmer	Y

Motion 13-0-1

11:06 a.m. Representative Vollmer will carry the bill.

Additional written testimony:

Steve Perdue, President, US Durum Growers Association, submitted testimony in favor #30822.

Brent Baldwin, Red River Valley Sugarbeet Growers Association submitted testimony in favor #30854.

Sarah Lovas, Hillsboro, ND, submitted testimony in favor #30960.

11:07 a.m. Chairman Beltz closed the hearing.

Diane Lillis, Committee Clerk

REPORT OF STANDING COMMITTEE
HB 1318 ([25.0622.01000](#))

Agriculture Committee (Rep. Beltz, Chairman) recommends **DO PASS** (13 YEAS, 0 NAYS, 1 ABSENT AND NOT VOTING). HB 1318 was placed on the Eleventh order on the calendar.



U.S. Durum Growers Association

PROMOTING THE PRODUCTION AND MARKETING OF DURUM AND SEMOLINA

P.O. Box 1091 • Bismarck, ND 58502 • (701) 214-3203
office@durumgrowers.com • www.durumgrowers.com

Testimony of Steve Perdue
President
HB 1318
January 23, 2025

Chairman Beltz and members of the House Agriculture Committee, my name is Steve Perdue, and I'm a farmer from Ray and serve as the President of the U.S. Durum Growers Association (USDGA). On behalf of the USDGA, we support HB 1318 to protect our tool of pesticides to maintain and grow our current production of durum.

USDGA has served to promote the production and marketing of durum wheat and semolina since 1978. The association represents grower and industry members from 10 states. We have many members from North Dakota as the acres produced in the state account for just over half of the country's durum production. Due to durum's hardness, density, high protein, and color it is milled into semolina which is ideal for use in premium pasta.

Pesticides are a tool used to protect against pests and improve crop yield. Without it, crop losses would be significant. As a result, crop revenue would decrease, and inputs would increase, resulting in higher food prices. With Durum being milled into pasta for human consumption, pesticide limitations on durum would directly impact food prices and consumers.

USDGA believes the Environmental Protection Agency has sufficient pesticide evaluations, regulations, and those registered under the Federal Insecticide, Fungicide, and Rodenticide Act have sufficient labeling. Protecting pesticides and these registrations are vital to maintain current crop production to protect durum and other crop markets and domestic and international trade of these products.

Thank you for the opportunity for USDGA to submit written testimony in support of HB 1318 and urge a favorable consideration of the bill.



Modern Ag Alliance Testimony
North Dakota House of Representatives
Agriculture Committee Hearing 1/23

January 23, 2025

Contact: contact@modernagalliance.org

Introduction

Good morning, Chairman Beltz, Vice Chairwoman Hauck, and members of the Agriculture Committee. My name is Elizabeth Burns-Thompson, Executive Director of the Modern Ag Alliance—a diverse coalition of 90(+) agricultural groups that advocates for U.S. farmers' continued access to the crop protection tools they need to ensure we have a robust and affordable food supply.

Our coalition proudly includes partners from right here in North Dakota, such as the North Dakota Corn Growers' Association, North Dakota Soybean Growers Association, North Dakota Pulse Growers Association, North Dakota Canola Growers Association, and North Dakota Grain Growers Association. As someone who grew up on a family farm growing corn and soy, it's an honor to be here today to stand with North Dakota farmers in support of House Bill 1318.

Glyphosate's Importance to ND

Agriculture is the backbone of North Dakota's economy, contributing \$14 billion annually and providing jobs for nearly a quarter of the state's population.¹ As you all know, our farmers rely on many tools to sustain their success, with crop protection products being some of the most important.

¹ North Dakota State University, "North Dakota Agriculture Industry Economic Contribution Analysis," 2022, <https://www.ndsu.edu/agriculture/sites/default/files/2022-12/Ag%20Summary%2012-6-2022.pdf>.

Glyphosate-based herbicides are farmers' number one tool to control weeds, keep yields high, and implement conservation practices that use less land and resources. As the leading U.S. producer of wheat, North Dakota relies heavily on glyphosate.² Over half of all wheat acres, 80% of all corn acres, and 92% of all soybean acres depend on glyphosate to control invasive weeds, keep costs low, and ensure we have enough to eat.³

Without glyphosate, input costs for North Dakota farmers—facing already challenging market conditions—could more than double.⁴ Those costs would inevitably be passed on in the form of higher food prices to consumers who are still reeling from the effects of historic inflation.

Safety and Regulatory Certainty

For over 50 years, glyphosate has been a proven, trusted tool for farmers helping them reduce crop losses and stay competitive in a global marketplace. Glyphosate's safety has been consistently reaffirmed by regulators here in the U.S. and across the globe, including as recently as 2023.⁵ Backed by over 1,500 studies and five decades of research, glyphosate-based herbicides are among the most thoroughly tested agricultural products available.

Yet, despite the clear science behind glyphosate's safety and benefits, a lack of legislative certainty has invited the litigation industry to file tens of thousands of lawsuits fueled by over \$100 million in expansive marketing and TV ads. This uncertainty has also enabled efforts in states like California to regulate pesticides in a manner inconsistent with federal law, congressional intent, and scientific consensus. This has created unsustainable realities that could threaten the future of glyphosate and other critical innovations.

House Bill 1318 protects access to these critical tools by ensuring certainty and consistency in pesticide labeling regulations. This bill would simply ensure any pesticide registered with the EPA—and sold under a label consistent with the EPA's own determinations—is sufficient to satisfy requirements for health and safety warnings. It does not preclude anyone from suing pesticide manufacturers. In other words, **House Bill 1318 would protect farmers from another layer of conflicting government bureaucracy and stand behind the strong, science-based processes already in place today.**

Conclusion

We all know that farmers already have enough on their plates without having to navigate the potential loss of another critical tool in their toolboxes. House Bill 1318 helps keep things simple

² USDA National Agriculture Statistics Services, “2023 State Agricultural Overview, North Dakota,” https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NORTH%20DAKOTA

³ Aimpoint Research/The Directions Group, “Farm Bill Programs and the Role of Crop Protection Tools,” <https://report-directionsgroup.com/farm-bill/>.

⁴ *Ibid.*

⁵ Bayer, “Glyphosate Safety Record,” <https://www.bayer.com/en/is-glyphosate-safe>.

and ensures they can focus on what they do best: growing the food, fuel, and fiber we all depend on.

Thank you for giving me the opportunity to testify and thank you for standing up for North Dakota farmers. I welcome any of your questions.



1401 32nd Street SW • Fargo, ND 58103 • Phone: 701-239-4151 • Fax: 701-239-4276

email: information@rrvsga.com

January 22, 2025

Mr. Chairman and members of the House Agriculture Committee,

I am Brent Baldwin, a farmer from Saint Thomas, North Dakota. Thank you for the opportunity to submit testimony. I am representing the Red River Valley Sugarbeet Growers Association. Our members are the sugarbeet grower-owners of American Crystal Sugar Company. Each year, our members plant around 400,000 acres of sugarbeets, or about 40% of our nation's sugarbeet crop. We are submitting testimony in SUPPORT of House Bill 1318.

The use of various pesticides is vitally important to modern crop production. We have seen an influx in attacks on modern agriculture practices such as applying pesticides, and opponents will use every avenue possible to accomplish their goal of completely eliminating the use of all pesticides no matter how much science has proven them safe.

We believe this bill will help alleviate the unreasonable and baseless attacks that farmers are facing more and more often when using pesticides to protect their crop.

We encourage this committee to provide a DO PASS recommendation on HB 1318.

Brent Baldwin – Farmer – Saint Thomas, North Dakota
President - Red River Valley Sugarbeet Growers Association

HB1318
House Agriculture Committee
1/23/25
Jason Hanson
President, North Dakota Agriculture Consultant's Association

Chairman Beltz and members of the House Agriculture Committee. For the record, my name is Jason Hanson and I am from Webster, ND. I currently serve as the president of the North Dakota Agriculture Consultant's Association. We are an association of crop consultants. Crop consultants are agronomists who scout crops and develop recommendations for farmers to help those farmers manage their agronomic practices. A major portion of this business is developing pesticide recommendations and guiding the farmers and applicators as they make their pesticide applications.

I stand before you today in support of HB1318 and ask for your support of this bill. This bill acknowledges that the label is the law and, between the label and MSDS sheet, all safety and health hazards are accurately described. Further, the label is law and it explains exactly how to handle the pesticide safely to avoid any health risks. Specifically the label accurately describes the toxicity through signal words such as caution, warning, and danger. The

label also accurately explains the PPE requirements needed to handle the pesticide safely.

This proposed legislation would help protect North Dakota Agriculture from vacation of pesticide labels without just cause. For example, In 2020, the US Court of Appeals for the Ninth Circuit found that glyphosate is a carcinogen. If this would have resulted in vacating the glyphosate label, North Dakota Agriculture would have been greatly impacted in an extremely negative way. However, the EPA reviewed it and in September of 2022, the EPA found that glyphosate is NOT a carcinogen and therefore the EPA withdrew it's Glyphosate Interim Decision.

It is very difficult as an agronomist to make good recommendations if we don't know what pesticides are available for us to use. Further, it's even more difficult to manage crop production when pesticide registrations are vacated during the growing season. This proposed legislation would help protect North Dakota farmers and applicators from these challenges.

Thank you for your time. I would stand for questions.



Contact:
Ryan Gregg, Lobbyist
rgregg@ndfu.org | 701.952.0104

**Testimony of
Ryan Gregg
North Dakota Farmers Union
Before the
House Agriculture Committee
January 23, 2025**

Chairman Beltz and Members of the Committee,

Thank you for the opportunity to testify on House Bill No. 1318. My name is Ryan Gregg, and I am here on behalf of the North Dakota Farmers Union (NDFU). We support HB 1318, which would prevent duplicative regulations for pesticide labeling.

For more than 50 years, glyphosate has been a trusted tool for farmers. Over half of all wheat acres, 80% of corn acres, and 92% of soybean acres rely on glyphosate-based herbicides to control invasive weeds and keep costs low.¹ Its safety has been consistently reaffirmed by regulators, and five decades of research have demonstrated its efficacy and safety. Despite this, legislators in California have sought to increase regulations on pesticides, creating uncertainty in the marketplace regarding the future of glyphosate.²

Our member-driven policy states:

“We are concerned about the growing number and application of regulations concerning storage and use of farm fuels and chemicals. We urge review of these regulations, development of a clear and concise guide to aid compliance with sensible regulations, and removal from the law of those regulations which are not enforced.”

House Bill 1318 prevents duplicative and inconsistent pesticide-labeling regulations in North Dakota. This legislation clarifies that federal labeling requirements provide sufficient guidance and warnings regarding a crop protection product’s use.

We respectfully request that the committee give House Bill No. 1318 a “Do Pass” recommendation. Thank you for your consideration.

¹ USDA, National Agricultural Statistics Service (NASS). (n.d.). Agricultural Chemical Use Program Surveys. https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Chemical_Use/

² Appeals court blocks California warning requirement for glyphosate. (2023, November 7). Reuters. <https://www.reuters.com/legal/appeals-court-blocks-california-warning-requirement-glyphosate-2023-11-07/>



**North Dakota Grain Growers Association
Testimony in Support of HB 1318
House Agriculture Committee
January 23, 2025**

Chairman Beltz, Members of the House Agriculture Committee, for the record my name is Dan Wogsland representing the North Dakota Grain Growers Association (NDGGA). I appear today to express NDGGA's support for HB 1318 regarding pesticide labeling requirements.

HB 1318 provides crucial clarity and consistency in pesticide labeling requirements by establishing that EPA-approved labels, which undergo rigorous scientific review, serve as sufficient warning labels under North Dakota law. This legislation will benefit our agricultural community in several important ways:

1. Regulatory Consistency

The bill aligns North Dakota's labeling requirements with federal standards, creating a clear and uniform system for pesticide manufacturers, distributors, and users. This consistency reduces confusion and improves compliance while maintaining strong safety standards through EPA oversight.

2. Protection of Agricultural Operations

Our members rely on having access to properly labeled pesticides to protect their crops and maintain productive farming operations. This legislation helps ensure continued access to these vital tools while maintaining appropriate safety standards through federal EPA oversight.

3. Scientific Basis for Labels

The bill recognizes EPA's comprehensive scientific review process, which includes thorough human health assessments and carcinogenicity classifications. These evaluations represent the gold standard in pesticide safety assessment and provide appropriate guidance for safe use.

4. Legal Clarity

By establishing that EPA-approved labels constitute sufficient warning, this legislation provides clear legal standards that protect both manufacturers and users while maintaining robust safety requirements through federal oversight.

5. Economic Benefits

Regulatory clarity and consistency help reduce compliance costs and legal uncertainty, allowing agricultural businesses to operate more efficiently while maintaining appropriate safety standards.

This legislation represents a balanced approach that maintains strong safety standards while providing regulatory clarity and consistency. It supports our agricultural community while ensuring appropriate safety measures remain in place through federal oversight.

Chairman Beltz, members of the House Agriculture Committee, NDGGA urges a "do pass" recommendation on HB 1318 and we would urge the full House to concur.

Thank you for your consideration. I would be happy to answer any questions from the committee.



North Dakota Association for Justice
PO Box 365
Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
jaclyn@ndaj.org

Chairman Beltz and members of the Agriculture Committee, my name is Jaclyn Hall, the Executive Director of the North Dakota Association for Justice.

Today, I am here to testify in opposition to HB1318 as it is currently written.

Our concern about HB1318 is we believe this is a point in time statute that does not have the ability to evolve over time. If the EPA were to update pesticides or other chemicals in the future, is the wording in this statute sufficient?

Today I ask the committee to consider this amendment:

2. Exception Upon EPA or Judicial Action.

If, after any registration or labeling approval described in subsection 1(a), one or more of the following events occurs, compliance with the prior label, usage instructions, or registration terms shall no longer be deemed sufficient for any alleged harm (including harm to persons, property, or the environment) that arises out of, is associated with, or is relevant to the risk or hazard that the EPA or judicial action addresses:

- a. The United States Environmental Protection Agency modifies, revises, or otherwise updates any labeling requirements, usage instructions, restricted-use designations, or other conditions under FIFRA—including but not limited to mitigation or disclosure of risks to humans, property, or the environment;**
- b. The EPA withdraws, cancels, suspends, or otherwise invalidates the pesticide's registration or any material portion thereof; or**
- c. A court of competent jurisdiction issues a final order that strikes down, vacates, or otherwise invalidates the pesticide's registration, underlying document supporting registration, or its material conditions under FIFRA.**



North Dakota Association for Justice
PO Box 365
Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
jaclyn@ndaj.org

For purposes of subsection 2(a), “modifies, revises, or otherwise updates” includes the addition or alteration of warnings, cautionary statements, directions for reducing drift or exposure, reentry intervals, or any other measure designed to mitigate or disclose hazards or risks, including any new or changed instructions requiring or recommending washing or decontamination steps to reduce exposure.

If the EPA updates the label, withdraws or cancels the pesticide, or if a court says the label or registration is not valid, the old label is no longer a defense.

For example, if the EPA decides to ban or change the label for the ChemChina chemical Paraquat because it can lead to Parkinsons, this amendment is sufficient to adjust the label accordingly. This also involves changes the EPA could make to the safe handling of products like Paraquat. Handwashing guidelines or the use of a mask may not be explicitly made, but the update to the label would protect a defense ‘if used in compliance with the label’.

NDAJ is not opposed to using pesticides or other chemicals. Our concern is that as chemicals evolve over time, new chemicals are created and chemicals are retired, this statute does not evolve with it.

This amendment will not reduce the ability to use certain chemicals, rather it will create fluidity so when labels are updated, they will be the new standard for defense.

Without a change as mentioned above, this statute would have to be addressed on a session-by-session basis to update the sufficient labeling standard.

Thank you for your time and consideration of our amendment.

I will stand for questions.

HB1318
House Agriculture Committee
1/23/25
Sarah E Hall Lovas, Agronomist
Hillsboro, ND

Chairman Beltz and members of the House Agriculture Committee, My name is Sarah Lovas and I am an agronomist from Hillsboro, ND. I submit this testimony in support of HB 1318 and ask for a DO PASS recommendation.

I have been involved in agriculture for my entire life. Agronomy and farming have been at the center of it all. As an agronomist, I have worked with farmers and applicators to help them make the best decisions with pesticides and other agronomic inputs for their farming operations. Also, during my career, I have spent a significant amount of time working on environmental impact issues in agriculture. Specifically, I have had the opportunity to work directly with the EPA on a number of issues including pesticide labeling and also education with EPA, so they understand modern agricultural practices.

The EPA has rigorous, scientific process of evaluating the impacts of pesticides to human health and also the environment. The EPA also considers public comments to ascertain the benefits of labeling a specific pesticide. This produces a process where risks and benefits are considered, and scientific data is at the center of the entire process. This

process and the data considered within the process are sufficient to explain the human health risks. The label and the MSDS for each pesticide clearly explain the risks for human health, and the label is explicit for safe pesticide handling. Further, every North Dakota commercial and private applicator are required to recertify with continuing education every 3 years. These training courses emphasize the label as the law.

In recent years it has become somewhat uncertain as the availability of some pesticides during the growing season. Federal court proceedings or the EPA have vacated labels almost instantaneously with little to no warning for agriculture, and with little to no scientific evidence for the label vacation. This creates a challenging situation to manage pests in farming. Further, often alternative pesticides are more expensive and, often, less effective for the pest situation. This proposed legislation would help protect North Dakota agriculture from label vacations with no scientific basis.

Thank you for your time. Please feel free to reach out with any questions you may have.

ASK: Please support HB1318

Sarah Hall Lovas
Agronomist
Hillsboro, ND
701-866-1704



In Favor of HB 1318

House Agriculture

January 23, 2025

Chairman Beltz and Committee members:

For the record, my name is Greg Amundson. I farm in Gilby and serve as a board member for the North Dakota Corn Growers Association. Thank you for the opportunity to testify in favor of House Bill 1318.

Corn growers rely on pesticides to produce affordable and abundant crops. We need safe, appropriately regulated inputs to protect against pests and improve our crop yields. Under the Food Quality Protection Act, the EPA must determine that a pesticide poses a "reasonable certainty of no harm" before it can be registered for use on food or feed. The EPA label provides clear directions for use while minimizing risks to human health and the environment.

Eighty percent of corn acres in North Dakota rely on glyphosate. If we lose access, input costs could more than double, driving food prices higher and putting North Dakota producers at a competitive disadvantage globally.

We urge a "Do Pass" recommendation on HB 1318 to ensure North Dakota farmers continue to have access to the tools we use to safely and affordably feed and fuel the world. Thank you for your consideration, and I will stand for questions.

2025 SENATE AGRICULTURE AND VETERANS AFFAIRS

HB 1318

2025 SENATE STANDING COMMITTEE MINUTES

Agriculture and Veterans Affairs Committee

Fort Union Room, State Capitol

HB 1318

3/14/2025

A bill relating to pesticide labeling.
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8:28 a.m. Chairman Luick opened the hearing.

Members present: Chairman Luick, Vice-Chair Myrdal, Senator Marcellais, Senator Weston, Senator Weber, Senator Enget

Discussion Topics:

- Product liability and duty to warn
- United States Environmental Protection Agency (EPA) and the Food Quality Protection Act
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- Unlawful misbranding of labels
- Blanket immunity and chemical companies
- History of chemical use and effects on humans and animals
- High value crops and reliance on pesticides and other chemicals
- Public trust in pesticide safety and large pesticide companies
- Access to crop protection products
- Dicamba, glyphosate, and other chemical related cases
- Uniformity in pesticide laws across the nation and federal standards
- Increased food prices and organic farming
- The International Agency for Research on Cancer (IARC) and glyphosate as a probable human carcinogen
- ChemChina

8:29 a.m. Representative Jarod Hagert, District 20, testified in favor and introduced the bill.

8:35 a.m. Doug Goehring, Agricultural Commissioner, ND Department of Agriculture, testified in favor and submitted testimony #41566.

8:53 a.m. Stu Letcher, Executive Vice President, ND Agriculture Association, testified in favor.

8:57 a.m. Leslie Icenogle, ND Corn Growers Association, introduced the following speaker.

8:58 a.m. Ben Bakko, board member, ND Corn Growers Association, testified in favor and submitted testimony #41372.

8:59 a.m. Elizabeth Burns-Thomas, Executive Director, Modern Ag Alliance, testified in favor and submitted testimony #41311.

9:06 a.m. Parrell Grossman, Legislative Director, ND Soybean Growers Association, testified in favor and summarized testimony #41438 in favor from Joshua D. Stutrud.

9:09 a.m. Matthew Perdue, ND Farmers Union, testified in favor and submitted testimony #41564.

9:21 a.m. Dan Wogsland, ND Grain Growers Association, testified in favor and submitted testimony #41468.

9:22 a.m. Dr. Sarah Eliza Lockwood, Medical Affairs Lead in Bayer, ND, testified in favor and submitted testimony #41469.

9:26 a.m. Samuel Wagner, Ag and Food Field Organizer, Dakota Resource Council, testified in opposition and submitted testimony #41320.

9:32 a.m. John Bradley, ND Wildlife Federation, testified in opposition and submitted testimony #41461.

9:34 a.m. Jaclyn Hall, Executive Director, ND Association for Justice, testified in opposition and submitted testimony #41448, #41449, #41450, and #41451.

9:45 a.m. Charlene Nelson, interested citizen, testified in opposition and submitted testimony #41385.

9:52 a.m. Sarah Lovas, Director, ND Grain Growers Association, testified in favor and submitted testimony #41420.

9:54 a.m. Chairman Luick closed the hearing.

Additional written testimony:

#40322, #41203, #41258, #41307, #41456, #41458, #41459, #41365, #41378, #41393, #41394, #41395, #41392, #41418, #41434, #41440, #41445

Audrey Oswald, Committee Clerk

Big Ag wants immunity from lawsuits. The rights of individuals, localities, and states to be able to sue agrochemical companies is critically at stake.

Bayer/Monsanto has just hired 20 agrochemical lobbyists to convince us that they should enjoy complete immunity from lawsuits, just like the vaccine companies. In other words, they should be able to produce pesticides, herbicides, and fungicides, and as long as the EPA gives them a license to do so (which does not establish safety for human exposure), then they could *never be sued* for cancer or other harmful impacts due to exposure to their products.

Meanwhile, the drugs they sell that treat the harm their products cause, like cancer, depression, and fertility drugs, will continue to soar. It's a perfect profit circle for them that they want to protect. I believe that rather than our elected officials giving Bayer executives another beach house, they should protect us in our house. The number one reason for bankruptcy, which can lead to homelessness, is medical debt. Taking away their resident's right to sue for harm is unjust and dangerous for our communities. Compensation for harm from any unsafe product is necessary for product accountability and the health and security of our communities.

These bills give Big Ag complete immunity from individuals for **violating** federal labeling law, letting them cover up dangers without consequence. This cannot happen on our watch!

This play for profit is even worse for us, and better for them, than the deal the vaccine manufacturers got. In [H.R.5546 - National Childhood Vaccine Injury Act of 1986](#) the vaccine companies were required to pay .75 cents per vaccine into a special injury fund. A court was set up so that victims of vaccine injury could apply for a hearing and compensation. The proposed bills for agrochemical immunity don't even propose a fund, court, warning on the label, or any accountability whatsoever. Bayer/Monsanto and all agrochemical companies would enjoy complete immunity from ever being sued again. Their strategy is to go state by state, then use the states as precedence to have a federal bill passed.

Their arguments are:

1. If they don't get immunity, the farmers will lose access to important tools like glyphosate and other chemicals, that are "necessary" for farming.
2. If the farmers lose these agrochemicals, the price of food will go up, putting disadvantaged people at an even greater disadvantage.
3. The agrochemical companies should enjoy immunity because the EPA has deemed their products safe.
4. The state-by-state laws are too cumbersome, there should be "uniformity" in pesticide laws, meaning a federal law that allows all chemical companies immunity.

My arguments are:

1. There are millions of farmers around the world who farm without glyphosate or toxic chemicals.
2. If your products aren't safe, you should be held accountable. Reformulate your products to be safe.
3. Your product safety is your responsibility, not the EPA's, they do not do safety testing.
4. The states, localities, and individuals have the right to sue. Period.

Corporate interests must not precede the safety of American farmers, citizens, and our children!

I am urging you to vote NO on HB1318! Thank you for your time.

Sincerely,

Sara Christianson

Testimony in Opposition to North Dakota House Bill 1318**Delivered to the North Dakota Legislative Assembly****March 13, 2025**

Good morning, honorable members of the Senate Agriculture and Veterans Affairs Committee.

My name is Dr. Steve Nagel, DC, and I would like to voice my opposition to House Bill 1318, a piece of legislation that I believe undermines the safety, transparency, and sovereignty of North Dakota's agricultural communities. While this bill is framed as a means to ensure uniformity in pesticide regulation by prioritizing federally approved labels, I urge you to consider the broader implications—particularly the influence of corporate interests like the Modern Ag Alliance and its founder, Bayer, whose troubling history and mounting scientific evidence raise serious concerns that their labeling is simply not enough to protect the people in around their products.

The Modern Ag Alliance, a key proponent of HB 1318, was founded by Bayer, a multinational corporation with a long and checkered legal record. Bayer, known for its dominance in agrochemicals and pharmaceuticals, has faced numerous lawsuits and fines that call into question its credibility as a steward of public health and environmental safety. Most notably, Bayer inherited significant legal liabilities when it acquired Monsanto in 2018, including tens of thousands of lawsuits related to the herbicide Roundup. Courts across the United States have awarded billions in damages to plaintiffs who allege that glyphosate, Roundup's active ingredient, caused cancer—a claim Bayer continues to dispute despite overwhelming jury verdicts. To date, Bayer has agreed to pay over \$10 billion to settle these cases, with additional litigation still pending.

The Monsanto Emails: A Window into Corporate Deception

Perhaps most damning are the internal emails uncovered during the Roundup litigation against Monsanto, which Bayer now owns. These documents, made public in court proceedings starting in 2017, reveal a disturbing pattern of manipulation and disregard for scientific integrity. In one email exchange, **Monsanto executives discussed ghostwriting scientific studies to downplay glyphosate's risks, then having "independent" researchers sign off on them to lend credibility. Another email from a Monsanto toxicologist infamously stated, "If I can kill this, I should get a medal," referring to an EPA review of glyphosate's safety. The emails also showed Monsanto's efforts to influence regulators and discredit critics, including funding smear campaigns against scientists like Dr. Gilles-Éric Séralini, whose research suggested glyphosate's potential harm. These revelations led juries to conclude that Monsanto—and now Bayer—prioritized profits over people, a conclusion that should alarm anyone considering HB 1318's implications.**

Research on Cancer-Causing Effects

Scientific studies increasingly link glyphosate to cancer, contradicting Bayer's claims of safety. A 2019 meta-analysis by Zhang et al., published in Mutation Research, reviewed six human studies with nearly 65,000 participants and found a **41% increased risk of non-Hodgkin lymphoma (NHL)** among those with high glyphosate exposure. The International Agency for Research on Cancer (IARC) classified glyphosate as "probably carcinogenic to humans" in 2015, citing strong evidence

from animal studies where glyphosate induced malignant lymphomas in mice. More recently, a 2023 study from the University of California, Berkeley, reinforced this, identifying glyphosate as a **probable human carcinogen based on updated epidemiological data**. These findings challenge the EPA's stance that glyphosate is "not likely to be carcinogenic," a position critics argue relies on outdated or industry-influenced data.

Research on Neurologic Problems

Emerging research also ties glyphosate to neurologic harm, raising red flags for North Dakota's farming families. **A 2023 study in Journal of Exposure Science & Environmental Epidemiology examined U.S. adults and found a significant correlation between urinary glyphosate levels and elevated serum neurofilament light chain (NfL), a biomarker of neuroaxonal damage, particularly in those over 40. This suggests glyphosate may contribute to neurological disorders.** Additionally, a December 2023 study in Science of the Total Environment exposed mice to glyphosate during pregnancy, **resulting in offspring with anxiety- and depression-like behaviors linked to gut-brain axis disruption.** A 2024 study published in Nature Reviews Neurology further called for renewed scrutiny, arguing glyphosate's neurotoxicity may implicate it in **Parkinson's disease**—a concern echoed by The Lancet in 2023, urging stricter regulations.

Research on Testosterone Destruction

Glyphosate's impact on reproductive health, particularly testosterone, is another alarming finding. For example, a study out of Toxicology In Vitro found that "A glyphosate-based herbicide induces necrosis and apoptosis in mature rat testicular cells in vitro, and testosterone decrease at lower levels". Yes. Their testicles were destroyed.

Other research shows glyphosate directly attacks mitochondria in Leydig cells of mice, inhibiting testosterone synthesis—a compelling case for choosing organic alternatives. A 2019 study in Environmental Health by the Ramazzini Institute found that glyphosate-based herbicides (GBHs) at "safe" doses (1.75 mg/kg/day) increased testosterone in female rats and altered male reproductive hormones, including dihydrotestosterone (DHT), after prolonged exposure. In vitro studies, like Walsh et al. (2000) in Environmental Health Perspectives, showed Roundup disrupted steroidogenesis in Leydig cells, reducing testosterone production at concentrations as low as 25 µg/ml. **These effects on endocrine function could have generational consequences for North Dakotans. As a clinician who measures testosterone multiple times a week, there is no doubt we have a testosterone crisis in North Dakota.**

Bayer's Broader Legal History

Beyond Roundup, Bayer's legal troubles extend further. In 2020, the U.S. Department of Justice secured a \$40 million settlement from Bayer in a kickback case prosecuted in the District of Minnesota. This case involved Bayer's predecessor, Bayer HealthCare Pharmaceuticals, which was accused of **violating the False Claims Act by paying illegal kickbacks to healthcare providers to prescribe its drugs**, defrauding federal healthcare programs like Medicare and Medicaid. The \$40 million fine was part of a broader \$257 million settlement that included penalties for misbranding and other misconduct. In 2019, Bayer paid \$191 million to settle lawsuits over its Essure birth control device, which caused severe injuries to thousands of women. In 2007, Bayer faced fines

and lawsuits after its hemophilia drug was linked to HIV infections in patients during the 1980s. **This pattern of prioritizing profit over ethics should give us pause when considering Bayer's influence on HB 1318.**

HB 1318 seeks to lock in federal pesticide labels as the sole standard, stripping away the ability of local governments and state agencies to impose stricter regulations when necessary. **This is not about uniformity—it's about freeing themselves of liability for already-known risks. When we give unethical companies like Bayer unchecked power: they manipulate science, silence dissent, and leave communities to bear the consequences.** North Dakota farmers and residents deserve the right to protect their land, water, and health from potentially harmful chemicals, especially when federal standards may lag behind emerging science or fail to account for local conditions. Bayer and the Modern Ag Alliance argue that this bill protects farmers, but who is it really protecting? A corporation with a track record of fines, settlements, and deceptive practices has no business overriding our state's autonomy.

I implore you to reject HB 1318. Let's prioritize the voices of North Dakotans—our farmers, our families, and our communities—over the interests of a company like Bayer, whose history, laid bare in courtrooms, email inboxes, and scientific journals, speaks louder than its promises. Thank you for your time and consideration.

Steve Nagel, DC, BSN

180 Health Solutions

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Please DO NOT PASS bill HB1318

Large Corporations need to be held accountable for their products, the health of people in our state matters! If their products are safe, they have nothing to worry about. If not, they should not get a free pass to endanger people's health.



U.S. Durum Growers Association

PROMOTING THE PRODUCTION AND MARKETING OF DURUM AND SEMOLINA

P.O. Box 1091 • Bismarck, ND 58502 • (701) 214-3203
office@durumgrowers.com • www.durumgrowers.com

Testimony of Steve Perdue
President
HB 1318
March 14, 2025

Chairman Luick and members of the Senate Agriculture and Veterans Affairs Committee, my name is Steve Perdue, and I'm a farmer from Ray and serve as the President of the U.S. Durum Growers Association (USDGA). On behalf of the USDGA, we support HB 1318 to protect our tool of pesticides to maintain and grow our current production of durum.

USDGA has served to promote the production and marketing of durum wheat and semolina since 1978. The association represents grower and industry members from 10 states. We have many members from North Dakota as the acres produced in the state account for just over half of the country's durum production. Due to durum's hardness, density, high protein, and color it is milled into semolina which is ideal for use in premium pasta.

Pesticides are a tool used to protect against pests and improve crop yield. Without it, crop losses would be significant. As a result, crop revenue would decrease, and inputs would increase, resulting in higher food prices. With Durum being milled into pasta for human consumption, pesticide limitations on durum would directly impact food prices and consumers.

USDGA believes the Environmental Protection Agency has sufficient pesticide evaluations, regulations, and those registered under the Federal Insecticide, Fungicide, and Rodenticide Act have sufficient labeling. Protecting pesticides and these registrations are vital to maintain current crop production to protect durum and other crop markets and domestic and international trade of these products.

Thank you for the opportunity for USDGA to submit written testimony in support of HB 1318 and urge a favorable consideration of the bill.



Modern Ag Alliance Testimony

North Dakota Senate

Agriculture and Veterans Affairs Committee

Testimony

To: Chairman Luick, Vice-Chairwoman Myrdal, and members of the Agriculture and Veterans Affairs Committee

Introduction

Good morning, Chairman Luick, Vice-Chairwoman Myrdal, and members of the Agriculture and Veterans Affairs Committee. My name is Elizabeth Burns-Thompson, and I'm here today on behalf of the Modern Ag Alliance—a diverse coalition of nearly 100 agricultural groups that advocates for U.S. farmers' continued access to the crop protection tools they need to ensure we have a robust and affordable food supply. Our partners in North Dakota include the North Dakota Corn Growers, Soybean Growers, Grain Growers, Northern Canola Growers, and Northern Pulse Growers Associations.

It's an honor to represent the Modern Ag Alliance and North Dakota farmers as I speak in support of HB 1318. Growing up on a farm myself, I have experienced firsthand the challenges our farmers face and the importance of providing them with the certainty they need to keep feeding America.

The Future of Farming is at Stake

From falling commodity prices to rising input costs, North Dakota's farmers are already navigating significant challenges. In an industry that operates at the mercy of Mother Nature and the markets, the last thing farmers need is more uncertainty. For those reasons, North Dakotans are deeply concerned by the actions of the litigation industry and California activists relentlessly targeting the tools our farmers rely on to produce safe, affordable, and abundant food. The Modern Ag Alliance's most recent Ag Insights Survey found that 81% percent of North Dakotans, including 90% of farmers, oppose litigation that could limit access to critical crop protection products.¹

If the litigation industry and California activists win, U.S. agriculture could face a crisis felt not just by farmers nationwide, but at every dinner table across America. Absent legislative clarity

¹ Modern Ag Alliance, "North Dakotans Overwhelmingly Support Farmers' Access To Crop Protection Tools, https://modernagalliance.org/wp-content/uploads/2025/03/MAA_Survey_NorthDakota_2025.pdf

around pesticide labeling, farmers will be forced to make difficult decisions that weigh their livelihoods, our food security, and ultimately, national security.

The Issue

As the nation's leading wheat producer and a major producer of soybeans, corn, and sugar beets, North Dakota farmers depend on herbicides for successful harvests.² Without these tools, crop yields would decline, production costs for North Dakota farmers could more than double, and food prices would climb even higher.³

Unfortunately, a growing wave of meritless lawsuits and attacks from those who don't understand agriculture are jeopardizing North Dakota farmers' access to these tools. How did we get to this point? The herbicides in question undergo more than a decade of rigorous research, analysis, and regulatory review before reaching the market—followed by continuous re-evaluation to ensure their safety and effectiveness.

Yet, the litigation industry has made it clear that they will continue suing American crop protection tool manufacturers until additional warning labels are added to these products. However, regulators have firmly stated that such labels will not be approved. This puts agriculture in an impossible position. Worse yet, this avalanche of lawsuits disproportionately targets American manufacturers while leaving foreign competitors untouched, creating an uneven playing field that disadvantages domestic agriculture and American farmers.

While crop protection tools with a track record of safety and effectiveness spanning over 50 years are the topic today, this situation serves as a bellwether for what's ahead. The uncertainty threatens not just existing technologies but also the future of innovation in agriculture.

Left unaddressed, North Dakota farmers and consumers could face severe consequences:

- Reduced crop yields that threaten our food security.
- Rising input costs that could push thousands of farmers out of business.
- Food inflation more than doubling at a time when North Dakota families are already struggling with sky-high grocery bills.

The Path Forward – HB 1318: Ensuring the Label is the Law

Fortunately, legislators here in North Dakota have offered a path forward. HB 1318 provides the certainty North Dakota farmers need to keep feeding America. That's why it passed the House **unanimously** with strong bipartisan support.

² USDA National Agriculture Statistics Services, "2023 State Agricultural Overview, North Dakota,"

³ Aimpoint Research, "Farm Bill Programs And The Role Of Crop Protection Tools,"
<https://report-directionsgroup.com/farm-bill/>

In short, HB 1318 simply restates that the federally approved label is the law, and a company can't be subject to relentless litigation for following the law. Despite misleading claims pushed by California-based activist groups, HB 1318 is **not** a blanket immunity bill, and it does not change the responsibilities or duties of any manufacturer. Those duties are the same today as they would be the day this bill is signed into law. What it does provide is much-needed clarity on how companies can meet their legal obligations regarding labeling and warnings, helping provide a more level playing field for domestic manufacturers

Additionally, this bill does not impact liability for issues related to product application, such as drift damage or off-label use. Nor would this legislation change North Dakota's authority to regulate the sale and use of pesticides within the state.

This isn't just good policy—it's an issue that enjoys broad, bipartisan support. Our survey found that 100% of farmers and 91% of North Dakotans are more likely to support leaders who stand with farmers over trial lawyers.⁴ When this issue came before the North Dakota House, lawmakers upheld the will of the people, passing it with a unanimous 88-0 vote.⁵

Conclusion

Let me be clear—this legislation is about protecting the backbone of our food system: America's farmers. They already face enough challenges without the added burden of losing another critical tool in their toolbox. North Dakotans recognize the threat of this spiraling issue and want to see lawmakers stand up for farmers by supporting HB 1318, legislation ensuring farmers can focus on what they do best: growing the food and fuel we all depend on.

⁴ Modern Ag Alliance, "North Dakotans Overwhelmingly Support Farmers' Access To Crop Protection Tools, https://modernagalliance.org/wp-content/uploads/2025/03/MAA_Survey_NorthDakota_2025.pdf

⁵ North Dakota Legislature, HB 1318, <https://ndlegis.gov/assembly/69-2025/regular/bill-actions/ba1318.html>

Testimony HB1318

Sam Wagner
 Ag and Food Field Organizer
 Dakota Resource Council
 1902 E Divide Ave
 Bismarck ND 58501
 Testimony in opposition for HB1318

Testimony HB1318

Sam Wagner
 Ag and Food Field Organizer
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 1902 E Divide Ave
 Bismarck ND 58501
 Testimony in Opposition for HB1318

To the Honorable Chairman and the members of the Committee. We submit these remarks on behalf of DRC.

To the Senate Ag and Veterans Committee,

We oppose this law because out of state corporate interests are trying to mess with our abilities to reasonably defend ourselves in court from pesticide labels that are not doing their job properly. To our knowledge there have been bills like this in Idaho, Florida, Oklahoma, , Florida, Georgia, Missouri, Tennessee, and Iowa. Mississippi, Montana, and Wyoming all have recently defeated this bill. Behind this is the Modern Ag Alliance funded by the Bayer Corporation trying to protect their profits. They have also tried to introduce this language federally and in the Farm Bill I'm asking you all today to reject this legislation.

Their arguments are:

1. *If they don't get immunity, the farmers will lose access to important tools like glyphosate and other chemicals that are "necessary" for farming.*

There are millions of farmers around the world who farm without glyphosate or toxic chemicals. Roundup isn't the only tool for farming, and this is a disingenuous argument. When you have warning labels on your products you do not restrict access to them. This is far more about the fact that you can sue for not being properly informed, and changing the laws to state that labels that have clearly not warned the population properly is disingenuous.

2. *If the farmers lose these agrochemicals, the price of food will go up, putting disadvantaged people at an even greater disadvantage.*

Over the past decade (2014-2024), US food prices have generally increased, especially from 2020 to 2024 with the all-food Consumer Price Index (CPI) rising by 23.6 percent, while the all-items CPI grew by 21.2 percent over the same period. This is because of many factors and cannot be tied to any one reason. Access to glyphosate has not kept food prices low.

3. *The agrochemical companies should enjoy immunity because the EPA has deemed their products safe.*

Your product safety is your responsibility, not the EPA's, they do not do safety testing. If your products aren't safe, you should be held accountable. Reformulate your products to be safe. This is corporate interest talking out of both sides of their mouth, The EPA is at the same time perfectly suited to regulate this but overbearing and killing business at the same time and must be cut. Every time we talk about regulation we get into a game of hot potato, the federal government tells us the state and local governments should handle this, and the state and local government tells us that the federal government should handle this and in the meantime the people suffer from this. In this instance this is Bayer doing the math and realizing that it costs less to lobby and change the laws rather than do the necessary research and development to change their products.

4. *The state-by-state laws are too cumbersome, there should be "uniformity" in pesticide laws, meaning a federal law that allows all chemical companies immunity.*

We at DRC have the right to local control. The states, localities, and individuals have the right to sue. Period.

The International Agency for Research on Cancer (IARC), a world-renowned cancer research center, determined that glyphosate is a probable human carcinogen in 2015. They based this finding on decades of research. For example, one study found that animals that were exposed to glyphosate had organ tumors. Other research found that farmers who utilized Roundup had a higher likelihood of suffering from various forms of cancer.

In August 2018, a California Superior Court jury found that Bayer-Monsanto's Roundup was liable for a former school groundskeeper's terminal cancer. The jury found that Monsanto had failed to warn the groundskeeper of the risks of Roundup use, including the risk of cancer.

In 2019, a U.S. District Court jury found that Monsanto's Roundup also caused a Santa Rosa resident's cancer, and another California Superior Court found that the company was responsible for a couple's non-Hodgkin's lymphoma.

Since then, Bayer-Monsanto has faced over 125,000 claims that Roundup caused farmers, gardeners, and landscapers to develop non-Hodgkin's lymphoma and other cancers. The company has paid over \$10 billion to settle over 100,000 of the claims out of court and made the decision to phase out the sale of glyphosate-based products to homeowners starting in 2023. It can take up to 15 years after exposure to Roundup for its impacts on human health to be detected. That means that Bayer may still face litigation over a decade after it pulls glyphosate from the residential market.

Bayer's decision to stop selling glyphosate to consumers appears to be an attempt to manage the litigation risk of the chemical, not to protect people's health.

Glyphosate will continue to be used in vast quantities in agriculture because the U.S. Environmental Protection Agency goes against IARC's cancer determination and claims that "there are no risks to public health when glyphosate is used in accordance with its current label." But we know the truth. I would like to remind you that Asbestos, DDT, and opioids were deemed safe to use until they weren't.

Bayer should be held accountable for their actions just as much as any other industry that disregards the safety of the public. I urge you to stand up for the people of North Dakota.

Thank you for your consideration. We recommend a **DO NOT PASS** vote on this bill.

HB1318

Senate Agriculture and Veteran Affairs Committee

3/14/25

Jason Hanson

President, North Dakota Agriculture Consultant's Association

Chairman Luick and members of the Senate Agriculture and Veteran Affairs Committee. For the record, my name is Jason Hanson and I am from Webster, ND. I currently serve as the president of the North Dakota Agriculture Consultant's Association. We are an association of crop consultants. Crop consultants are agronomists who scout crops and develop recommendations for farmers to help those farmers manage their agronomic practices. A major portion of this business is developing pesticide recommendations and guiding the farmers and applicators as they make their pesticide applications.

I support HB1318 and ask for your support of this bill. This bill acknowledges that the label is the law and, between the label and MSDS sheet, all safety and health hazards are accurately described. Further, the label is law and it explains exactly how to handle the pesticide safely to avoid any health risks. Specifically the label accurately describes the toxicity through signal words such as caution, warning, and danger. The label also accurately explains the PPE requirements needed to handle the pesticide safely.

This proposed legislation would help protect North Dakota Agriculture from vacation of pesticide labels without just cause. For example, In 2020, the US Court of Appeals for the Ninth Circuit found that glyphosate is a carcinogen. If this would have resulted in vacating the glyphosate label, North Dakota Agriculture would have been greatly impacted in an extremely negative way. However, the EPA reviewed it and in September of 2022, the EPA found that glyphosate is NOT a carcinogen and therefore the EPA withdrew it's Glyphosate Interim Decision.

It is very difficult as an agronomist to make good recommendations if we don't know what pesticides are available for us to use. Further, it's even more difficult to manage crop production when pesticide registrations are vacated during the growing season. This proposed legislation would help protect North Dakota farmers and applicators from these challenges.

Thank you for your time.

Jason Hanson
701-739-4126
Webster, ND



In Favor of HB 1318
Senate Agriculture and Veterans Affairs
March 14, 2025

Chairman Luick and Committee members:

For the record, my name is Ben Bakko. I farm in Walcott and serve as a board member for the North Dakota Corn Growers Association. Thank you for the opportunity to testify in favor of House Bill 1318.

Corn growers rely on pesticides to produce affordable and abundant crops. We need safe, appropriately regulated inputs to protect against pests and improve our crop yields. Under the Food Quality Protection Act, the EPA must determine that a pesticide poses a "reasonable certainty of no harm" before it can be registered for use on food or feed. The EPA label provides clear directions for use while minimizing risks to human health and the environment.

Eighty percent of corn acres in North Dakota rely on glyphosate. If we lose access, input costs could more than double, driving food prices higher and putting North Dakota producers at a competitive disadvantage globally.

We urge a Do Pass recommendation on HB 1318 to ensure North Dakota farmers continue to have access to the tools we use to safely and affordably feed and fuel the world. Thank you for your consideration, and I will stand for questions.

Testimony of Susan Leake

HB1318

ND Senate Agriculture and Veterans Affairs Committee

March 14, 2025

Chairman and committee members:

My name is Susan Leake. I live in central Grand Forks County, where my family farms.

I am in opposition of HB1318 because it implies that the EPA is responsible for product safety and testing. Product safety and product testing are NOT the EPA's job. Product safety and testing are the responsibility of the herbicide/pesticide manufacturer and developer. The EPA has never been in charge of product safety and testing, and to imply that they are is incorrect. If an herbicide/pesticide manufacturer or developer produces and markets a product which is not safe, it is their problem, not the EPA's, and states, localities and individuals have the right to sue.

If a product is not safe, the developer should reformulate it to be safe; selling an unsafe product and telling people that they do not have the right to sue is not something that should happen in North Dakota. North Dakota is not a third-world country.

Thank you for understanding that the EPA is not responsible for product safety and testing, and that the right to sue a herbicide/pesticide manufacturer or developer is a right. Your vote against HB1318 shows you are not afraid to stand up for what is right.

Sincerely,

Susan Leake

Chairman Luick and Members of this Committee,

My name is Charlene Nelson and I am here to enumerate the many reasons I am opposed to HB1318.

This bill would **strip North Dakotans of their legal rights** while granting pesticide and herbicide manufacturers unprecedented immunity from liability. This bill prioritizes corporate interests over public health, farmer safety, and consumer protection.

The proponents argue that **EPA-approved labels provide adequate warnings**. This assumption is deeply flawed. Here's why:

1. EPA Labels Are Not Infallible

The **EPA's pesticide and herbicide approval process is *not* a guarantee of safety**. It is based on limited data, much of which comes from the manufacturers themselves.

- Just like FDA approved medications, there have been many **EPA-approved pesticides** that have later been found to be harmful. A designation of safe does not ensure that the product is *de facto* safe.

Chlorpyrifos, is a good example of this. The EPA said this pesticide was safe and it was used worldwide since the 1960's. But in 1999 the World Health Organization said that studies showed it was acutely toxic and was linked to neurological effects, persistent developmental disorders, and autoimmune disorders. Even with that information, it took the EPA another 22 years before it was banned for commercial food use in the US.

Here's an interesting note about Chlorpyrifos: It was first banned for home use in 2001, but the EPA allowed farmers to use it for another 21 years.

Glyphosate, which is known carcinogen, has taken a similar route: Two years ago Bayer, banned the sale of RoundUp for residential lawns and gardens. Yet Modern Ag Alliance will tell you that the only reason they want this bill to be passed is to help farmers. How does that work? They remove Roundup from the garden centers because they're concerned for the health of the everyday homeowner and gardener but they have no regard for how it will hurt our farmers. Is it because they make so much money from the agricultural use that the lives of the farmers are expendable?

By automatically treating EPA labels as a "sufficient warning," this bill ignores the reality that regulatory oversight is imperfect and subject to political influence.

2. HB1318 Would Block Legitimate Lawsuits, Even When the Products Cause Harm

- Under this bill, if a pesticide or herbicide **causes cancer, neurological disorders, or birth defects**, victims would have no legal recourse **as long as the label complied with EPA standards**.

- This completely **removes accountability** for all chemical manufacturers, even if new science emerges showing their product is dangerous.

- This bill would prevent courts from considering whether a pesticide or herbicide company knew more about its product's dangers than what was disclosed on the label.**

3. North Dakota Should Not Surrender Its Right to Protect Citizens

- The **Federal Insecticide, Fungicide, and Rodenticide Act**

(FIFRA) establishes **minimum** safety requirements—but **states have the right to impose stricter protections** if needed.

- HB1318 **takes away North Dakota's ability to hold agrochemical companies accountable**, leaving us **completely dependent on federal bureaucracies** that may not act quickly enough.

4. The Bill Harms Farmers, Ranchers, and Rural Communities

- Many North Dakotans, especially farmers, are **directly exposed to harmful chemicals**—they deserve the right to sue if they develop illnesses caused by these products.

Numerous court cases have proven that glyphosate causes Non-Hodgkins Lymphoma. And North Dakota has the 7th highest rate of Non-Hodgkins Lymphoma. Modern Ag Alliance has bills almost identical to HB1318 in eight other states, including Florida and Iowa. Curiously, Florida and Iowa also have the highest and second highest rates (respectively) of Non-Hodgkins Lymphoma in the nation. This might be pure coincidence but I think it's a pattern that deserves scrutiny from this body.

- This bill also hurts innocent third parties.** Bayer and the other chemical companies might successfully argue in court that the farmers knew the risks when they read the labels. They'd been warned and they were free to decide if increased crop yields was worth the risk of using these chemicals.

But what about the neighbor whose children were playing outside when the field was sprayed? What about the lawn company that sprays your neighbor's yard and your dog runs through the treated grass? What about those whose ground water is contaminated by these chemicals?

When a pesticide or herbicide **contaminates water supplies or drifts onto neighboring crops**, victims should not be denied justice just because a label met federal guidelines.

5. The "Duty to Warn" is a Fundamental Legal Protection

- For decades, courts have recognized that companies **cannot hide behind regulatory compliance** when their products harm people.

- If this bill passes, agrochemical manufacturers would be treated **differently than every other industry**—drug companies, car manufacturers, and food producers can still be sued when their products cause harm.

A response to Modern Ag Alliance's complaint about frivolous lawsuits

Modern Ag Alliance maintains that this bill is needed to forestall or prevent frivolous and nuisance lawsuits. There are two responses to this assertion:

- Judges are already empowered to dismiss cases that have no merit. This body should assume that any case that survives an evidentiary hearing has sufficient merit that it should be given a fair hearing.
- Lawsuits are one of the best mechanisms for compelling a company to produce a safer product. If you remove all liability, you also remove all incentive for these companies to produce a better, safer product. This harms North Dakota farmers, their neighbors and all consumers of North Dakota's agricultural products.

Conclusion

HB1318 is a **dangerous, sweeping immunity bill** that would:

- Block lawsuits from farmers and rural residents harmed by pesticides and herbicides.
- Prevent courts from holding companies accountable for failing to warn of known dangers.
- Disincentivize the development of safer product.
- Strip North Dakota of its right to protect its people from harmful chemicals.

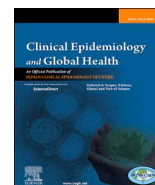
I urge this committee to vote **Do Not Pass on HB1318** and stand with North Dakotans, not pesticide and herbicide manufacturers.



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Cancer incidence and death rates in Argentine rural towns surrounded by pesticide-treated agricultural land

Damián Verzeñassi^{a,c}, Alejandro Vallini^{a,b}, Facundo Fernández^{a,b}, Lisandro Ferrazini^{a,b},
Marianela Lasagna^a, Anahí J. Sosa^{a,b}, Guillermo E. Hough^{d,*}

^a Instituto de Salud Socioambiental, Facultad de Ciencias Médicas de la Universidad Nacional de Rosario (UNR), Santa Fe, Argentina

^b Clínica Ambiental Sede Argentina de la Plataforma de Estudios Ambientales y Sostenibilidad (PEAS) del Centro de Estudios Interdisciplinarios (CEI) de la UNR, Argentina

^c Carrera de Medicina de la Universidad del Chaco Austral (UNCAus), Resistencia, Chaco, Argentina

^d ConCiencia Agroecológica, Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, 9 de Julio, Buenos Aires, Argentina

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ABSTRACT

Background: A number of published reports have linked agricultural pesticides (AP) to different illnesses, one of which is cancer. Our objectives were to estimate cancer incidence and death rates in small Argentine rural towns affected by AP; and to compare these estimations with indexes from Argentina's general population.

Methodology: An epidemiologic house-to-house health survey conducted by last-year medical students was implemented in 8 small rural towns of the Province of Santa Fe- Argentina (8 T), each surrounded by fields sprayed with AP. The survey covered 27,644 people, accounting for 68% of the total 8 T population.

Results: Odd-ratio between cancer incidence rate in 8 T and the general population was 1.37 ($P < 5\%$). For the 15–44 year age-group, odd-ratios between cancer death rates per 100 thousand inhabitants in 8 T and the general population were 2.48 and 2.77 for female and male genders, respectively. Proportion of cancer-deaths in relation to other causes of death varied by age-group and gender, 8 T values were higher than for the general population for all combinations.

Conclusions: Our findings suggest that living in small rural towns affected by nearby AP applications has a negative health impact, namely in cancer outcomes. These results contribute to the need for pesticide-reduction policies, especially in the surroundings of small urban populations.

1. Introduction

In Argentina the central provinces of Buenos Aires, Entre Ríos, East of La Pampa and South of Santa Fe and Córdoba are especially suited for agriculture; this region is known as the Pampas and it produces 85% of Argentina's main crops: corn, wheat and soy.¹ For the 2020–2021 crop season there were 6.1, 14.3 and 6.1 million hectares of the Pampas sown with corn, soy and wheat; respectively. In Argentina agricultural pesticides (AP) use was estimated to be 7.1, 5.4 and 2.8 kg. Hectare⁻¹. Year⁻¹ for corn, soy and wheat; respectively.² This means that approximately 138 million kg of AP are sprayed over this region yearly.

The average total use of AP in Europe in 2017 was 0.62 kg ha⁻¹.³ For soy in the USA this number was 2.3 kg-hectare⁻¹.⁴ UNEARTHED⁵ published that on average 27% of AP used in high-income countries are in the category of highly hazardous, while the percentage increases to

45% for low- and middle-income countries such as Argentina. Thus in Argentina the quantities per hectare are far greater than those used in Europe or the USA, and a greater proportion of them are highly hazardous.

Due to drifts not all AP reach their target, may the target be weeds, fungus or insects. The off-target presence of pesticides has been detected in a number of studies. Some of these performed in the Pampas were: urban or peri urban rain and soil⁶; rural schools⁷; small town environment⁸; and shallow lakes.⁹ From these studies it is clear that pesticides can drift through different mechanisms beyond their target and thus reach urban populations of small rural towns. These drifts are aggravated by the large pesticide quantities used in the Pampas as detailed above. Legislation on pesticide use in Argentina is generally lax, and even where it exists, control is weak.¹⁰ This is another factor which increases drifts into rural towns.

* Corresponding author. Frondizi 1226, 6500, 9 de Julio, Buenos Aires, Argentina.

E-mail address: guillermohough@yahoo.com (G.E. Hough).

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Health risks related to AP exposure are well documented. The IARC classified glyphosate as “probably carcinogenic to humans (Group 2 A)”. In a recent review Weisenburger¹¹ provided evidence that glyphosate and glyphosate-based formulations are a cause of Non-Hodgkin lymphomas in humans. Other AP have also been related to cancer.¹² Evidence of cancer and/or genotoxicity increases in rural workers or communities living close to sprayed fields has been found in different countries and settings.^{13,14,15} In the Pampas increased genotoxicity was found in children living close to sprayed fields¹⁶; and cancer incidence rates were high in a small town where pesticides were present in deposits, machines and fields.⁸

Schinasi and Leon¹⁵ pointed out the lack of investigations on pesticide use and Non-Hodgkin Lymphoma in low- and middle-income countries, despite producing a large portion of the world’s agriculture. A similar observation was made by Arancibia et al.¹⁰ who stated that in Argentina there is a lack of published epidemiological studies on tumor incidences, although exposure to pesticides is much higher than in Europe or North America where such associations have been shown.

The hypothesis of our work was that living in small rural towns affected by nearby AP applications has a negative health impact, manifested in cancer indexes.

2. Methods

2.1. Survey

The final exam for students of the Faculty of Medicine of the Rosario National University- Argentina, from 2010 to 2019, was to participate in a health workshop (HW) in a small town of <10,000 inhabitants. Students were trained during 3 months on the activities they had to perform. One of these was a house-to-house health survey. As the HW was part of the Faculty’s approved curricula, the survey had Institutional approval (Faculty Resolution 2086/2010). The town area was divided by the number of students in order to obtain a survey as complete as possible. Each student had to identify all the housing units in their area to thus survey them. Permanent community living quarters such as care-homes for the elderly were not considered. At each housing unit an individual 18-years or over answered the questionnaire for all household members. If no one answered, the student returned a maximum of three times. Previous to answering the questionnaire respondents signed a consent form. The full questionnaire can be accessed in the Supplemental Material. It covered demographics; housing facilities; health ailments and related issues; and perception of health and contamination problems in the town. The specific questions corresponding to the health issues addressed in this work are presented below. Each student-respondent interview lasted between 15 and 45 min. On returning from the field work in the corresponding town, students passed the data from the paper questionnaires to an Excel file under the supervision of teaching staff. After this, teaching staff controlled the transcription of each questionnaire. Paper questionnaires have all been scanned as backups and Excel data files also have their backups.

Table 1

Surveyed towns and basic demographics. % of total population was estimated from 2001 to 2010 census’. % female and % age distribution are based on surveyed population. The TOTAL row summarizes information from the 8 towns.

Town	Surveyed population	Survey date	% of total population	% Female	% less 14 years	% 15–44 years	% 45 and over
Acebal	3514	Mar 14	63	51.8	19.2	42.6	38.2
Arteaga	2278	Dec 18	64	50.7	18.7	38.8	42.4
Chabás	5594	Dec 14	78	51.8	20.3	40.5	39.2
Luis Palacios	911	Mar 16	93	48.5	27.7	42.0	30.3
San Genaro	5910	Jun 15	64	52.5	21.3	42.4	36.3
Sastre	3645	Mar 17	62	53.3	20.6	39.7	39.8
Timbúes	3725	Dec 16	73	50.4	28.9	46.9	24.2
Villa Eloisa	2067	Set 18	69	52.4	18.3	37.4	44.3
TOTAL	27,644		68	51.8	21.5	41.6	36.9

2.2. Towns and population

Eight towns (8 T) were chosen from the Province of Santa Fe covering an agriculturally intensive region of the Pampas. Since the introduction of glyphosate-resistant soy in 1996, husbandry has been uniform in this region as in most of the Pampas. Demographics are in Table 1.

The white Caucasian ethnicity is uniform over the 8 T. 87% of those between 15 and 44 years and 95% of those 45 or older had lived in their respective towns for at least 5 years; sufficient time for environmental exposures to have possible effects.

The total population of each town was unknown as the last census’ published data in Argentina correspond to 2001 and 2010. The yearly change since 2010 was considered equal to the yearly change between the last census’. This was used to estimate the surveyed population in relation to the total population of each town. The survey covered a total of 27,644 people; approximately 68% of the total 8 T population.

The MAGP¹⁷ agricultural data base was consulted to estimate the land occupied by corn + soy + wheat. The median for the 8 T was 80% (range 49%–87%). People in 8 T live at a distance of 0–400 m from sprayed fields. Other than surrounded by cultivated land, none of the 8 T had an economic activity likely to affect inhabitant’s health.

2.3. Cancer incidence rate

The survey asked: “Has anyone in the household had some type of tumor or cancer in the last 15 years? (*Regardless of whether they died or not*)”. The question included details such as year of diagnosis, age at diagnosis and type of cancer. As the incidence rate had to be corrected by the population’s age distribution and we only had the present age distribution obtained from the survey for each town, only tumors or cancers which had been diagnosed in the last complete year previous to the survey for each one of the towns were considered (See Table 1); counting both diagnosed-living and diagnosed-deceased. Cancer incidence rate for the 8-T was estimated based on diagnosed tumors falling under the international classification of diseases¹⁸ (ICD-10) of C00–C99 and D00–D09. Age distribution correction was performed following the PAHO guidelines.¹⁹

2.4. Cancer deaths

Deaths by cancer were estimated from the following question: “Has any member of the household died in the last 15 years?” The answers included gender, age, year and cause of death. As for cancer incidence rate, cancer deaths were classified under the ICD-10¹⁸ classification. As they can be the first or second death cause, circulatory system deaths were also estimated as those coming under ICD-10¹⁸ I00–I99.

Classifying deaths by age and gender was of interest. Age classification was: Child: 0–14 years; Young: 15–44 years; Old: over 45.

For Child, there were 5 cancer deaths over the 15 years for the 8 T, too few to meaningfully compare to the Argentine general population (GP). For Young, death numbers over the 8 T for year 15 (last year)

amounted to 6, also too few to compare to the GP. To consider more meaningful numbers, we aggregated deaths over years both common to the 8 T (see Table 1) and common to official National Death data availability²⁰; this left 9 years from 2005 to 2013, over which deaths were aggregated.

Considering the Old age category, if a house was approached with the question “Has any member of the household died in the last 15 years?” the following situations could have arisen.

- A respondent could answer for the death of a relative, with relative accuracy regarding age and calendar-year of death.
- A respondent would not report the death of their aged relatives having occurred in a Care Home, these locations were not covered in the survey. These deaths would be recorded by National entities by death certificates.
- In Argentina approximately 21% and 31% of the population live alone or in a single-generation household, respectively.²³ Thus if an aged individual or individuals should die within the 15-year period, the house would become unoccupied or be occupied by a person who would not consider the deceased as their own household members; even if the person who died was related.

Situation (a) could lead to inaccurate reporting; and situations (b) and (c) could lead to number of deaths per 100 thousand inhabitants to be under estimated for 8 T. Even considering these limitations, the question would still provide an adequate sample of old-age deaths and their causes, to thus estimate cancer deaths as a proportion of overall causes of death, and compare them to the GP.

Argentina’s death rates were taken from official health statistics data base,²⁰ which covers years starting 2005. The data bases included province, gender, age and cause of death classified by ICD-10.¹⁸ However, they did not detail deaths in individual towns within each province, such as the 8 T of the present study.

Cancer-death estimations are often expressed per 100 thousand inhabitants. 8 T and National populations at the midpoint of the 9-year cancer-death period were considered for these estimations, that is year 2009, midpoint between 2005 and 2013. As explained above, 8 T 2009 surveyed population was estimated based on 2001 and 2010 census’. The Argentine population estimate for 2009 was taken from DatosMacro.²¹

3. Results

3.1. Cancer incidence rate

In Table 2 are the number of reported cancer cases in 8 T considering the last year previous to each town’s survey, and the gross and age-distribution corrected incidence rates. Argentina’s corrected rates for year 2018 are also presented.²²

Odd-ratios and 95% confidence intervals are also in Table 2. The odd-ratio for the total population was significant (lower interval >1), but this was due to the female population, whose odd-ratio was 1.66. Thus for the female population of the 8 T there was a 66% higher probability of acquiring cancer over the last year in comparison to the GP.

Fig. 1 shows incidence rates for cancer types in the 8 T with rates >10. Corresponding rates for Argentina²² are also shown. Except for

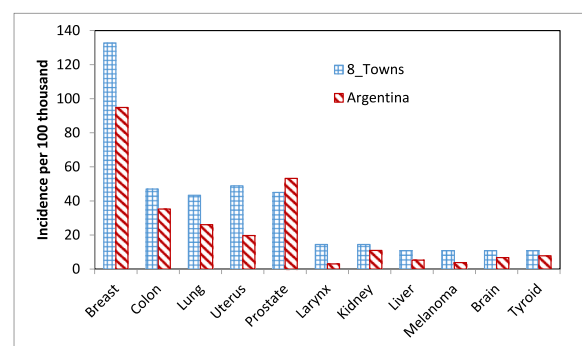


Fig. 1. Cancer incidence rates per 100 thousand inhabitants for the cancer types in the 8 T with rates >10; and corresponding rates for Argentina.

prostate cancer, all other odd-ratios were >1. Confidence intervals were wide due to small number of cases in the 8 T, thus significance ($P < 0.05$) could not be shown, except for uterus and larynx with lower confidence intervals >1. These two cases could be a spurious effect as $P < 0.05$ means 1 in 20 can be by chance.

3.2. Cancer deaths in relation to total live population

For the Young age-group, yearly overall death rates in 8 T and Argentina were similar over the 9-year period, with mean rates of 60 and 56, respectively; and did not show trends over time.

For the Old age-group the mean yearly death rate over the 9-year period was 684 deaths/100-thousand for Argentina (range: 664–714). For 8 T the estimated mean yearly death rate was 439 (range: 310–544); significantly lower than for Argentina. The 8 T death rates were clearly underestimated, especially for the initial years. As mentioned in Section 2.4, and discussed below, this was a consequence of how the survey collected the death data by asking: “Has any member of the household died in the last 15 years?” Due to this under estimation, cancer deaths in relation to the total population for the Old age-group were not considered.

Table 3 shows cancer deaths over the 14-year period in relation to living population for the young age-group, discriminated by location (8 T and Argentina) and gender. As commented above, Child and Old age-groups were not considered for these estimations. For both genders odd ratios showed a higher probability of dying of cancer if living in the 8 T than for the GP. The probability of dying of cancer per 100 thousand young inhabitants was 2.48 and 2.77 times more likely if living in 8 T,

Table 3

Number of cancer deaths in 8 T and Argentina over a 9-year period by gender for the young age-group (15–44 years). Yearly cancer deaths were estimated over 100 thousand young age-group inhabitants. Odd ratios are the quotient (yearly cancer deaths 8 T)/(yearly cancer deaths Argentina). 95% confidence intervals (CI) are included.

	Female		Male	
	8 Towns	Argentina	8 Towns	Argentina
Cancer deaths	25	16,442	21	12,460
Yearly deaths/100 thousand	49.2	19.9	42.5	15.3
Odd ratios (95% CI)	2.48 (1.68–3.67)		2.77 (1.81–4.25)	

Table 2

Number of cancer cases and corresponding incidence rates per 100 thousand inhabitants for the 8 towns (8 T), both gross and age-distribution corrected; and age-distribution corrected incidence for Argentina. Odd-ratios and 95% confidence intervals.

Gender	Number of cases 8 T	Gross incidence 8 T	Age-distribution corrected incidence 8 T	Argentina corrected incidence	Odd- ratios	95% confidence intervals
Female	63	440	347	209	1.66	1.30–2.12
Male	43	323	237	223	1.06	0.79–1.44
Total	106	383	291	212	1.37	1.13–1.66

for females and males, respectively.

3.3. Cancer deaths as a proportion of total deaths

In addition to cancer deaths per 100,000 inhabitants, an index of interest is the proportion in relation to total deaths. In the previous section the Old age-group was excluded due to an under estimation of overall deaths for this group in the 8 T. However, when comparing cancer deaths to total deaths, the number of deaths accounted for by the survey can be considered a representative sample of total deaths for this population. To sustain that this was not a biased sample, %Cancer death over total deaths for each of the 9 years was estimated; both for 8 T and Argentina. There was no tendency over time, neither for 8 T or Argentina. Average %Cancer deaths were 30.0% (range 24.5–34.5) and 19.8% (range 19.1–20.7), for 8 T and Argentina; respectively. 8 T estimations presented higher variability due to lower number of cases compared to the total for Argentina.

Table 4 shows cancer deaths and odd-ratios in the 9-year period discriminated by location (8 T and Argentina), age and gender. As commented in Section 2.4, child age-group was not considered. For both genders and age groups, odd ratios showed a higher probability of dying of cancer than other causes in the 8 T than for the GP. For example, it was 1.95 times more likely for a young-female in 8 T to die of cancer than other causes than a young-female in the GP to die of cancer than other causes.

Considering all age-groups and both genders, in the 8 T over the 9-year period, cancer and coronary related deaths represented 29.2% and 28.7% of total deaths, respectively. The corresponding percentages for the GP were 18.7% and 30.3% for cancer and coronary, respectively. Thus in the 8 T cancer and coronary represented similar percentages over total deaths, while in the GP coronary were clearly higher and cancer lower.

4. Discussion

Three indexes were considered when comparing the presence of cancer in 8 T with the presence of cancer in the GP: incidence rate, deaths per 100 thousand inhabitants for the Young age-group, and percent cancer-deaths in relation to other causes for the Young and Old age-groups. All three indexes showed significantly higher values for 8 T.

A close observation of Table 3 shows that the higher odds-ratio for Young-males in comparison to Young-females (2.77 vs 2.48) was due to either higher female cancer-deaths (CD) in the GP; or higher male CD in 8 T. Looking into the type of cancers that provoked these higher female CD in the GP, they were almost exclusively due to breast- (C50), uterus- (C53–C55) and ovary- (C56) cancers; representing 51% of total CD. In 8 T these same cancers represented 22% of total female CD. In 8 T colon cancer (C18) represented 30% of total male CD; compared to 8% in Argentina.

The IARC²⁴ presented online data on incidence and cancer-deaths for the year 2020, which can be consulted by gender, age-group and country or region. The population-corrected incidence rate for Argentina was 218, slightly higher than the 2018 value of 212 shown in Table 2.

Table 4

Number of cancer deaths in 8 T and Argentina over a 9-year period, by gender and age group. % cancer deaths were the % of cancer deaths in relation to the total number of deaths. Odds ratios are the quotient (% cancer deaths 8 T)/(% cancer deaths Argentina). 95% confidence intervals (CI) are included.

	Female				Male			
	Young		Old		Young		Old	
	(15–45 years)		(>45 years)		(15–45 years)		(>45 years)	
	8 T	Argentina	8 T	Argentina	8 T	Argentina	8 T	Argentina
Number of cancer deaths	25	16,442	140	226,147	21	12,460	212	262,814
% Cancer deaths	49.0	25.1	27.9	18.6	20.0	9.1	31.8	20.8
Odd ratios (CI)	1.95 (1.31–2.90)		1.50 (1.27–1.77)		2.19 (1.43–3.36)		1.53 (1.34–1.75)	

Argentina had a higher value than the average for Latin America and the Caribbean of 187. Argentina death-rates for the year 2020 for the Young age-group were 23 and 14.6 per 100 thousand, for females and males, respectively. These same values for Latin America and the Caribbean as a whole were 21 and 14.6. The IARC²⁴ death-rate values were thus similar to those estimated and presented in Table 3.

Some cancer types have been linked to specific AP, for example non-Hodgkin's lymphoma to glyphosate¹¹ or lung cancer to 2-4-D.²⁵ However, explaining the presence of specific cancer-types in 8 T is difficult due to the wide range of AP active ingredients used close to 8 T. The well-documented data on increased genotoxicity due to chronic AP exposure, both in children²⁶ and adults,^{14,27} can lead to different cancer types depending on each individual's geno- and phenotype. The most likely outcome is that high incidence cancers such as those shown in Fig. 1 are enhanced when genotoxicity is present.

In the introduction a number of articles were mentioned that have shown the association of AP to cancer risk, for example Weisenburger¹¹ and Rani et al.¹² 87% and 95% of the Young and Old populations, respectively, had lived in their respective towns for at least 5 years exposed to chronic AP drifts. Thus it is no surprise that the cancer indexes in 8 T were higher than for the GP.

Regarding the association of AP to cancer, an important event developed in Sastre (one of the 8 T, Table 1) where a 2-year old girl who lived next to a sprayed agricultural field developed a lymphoblastic lymphoma. In spite of medical instructions that she could not be exposed to pesticide drifts, spraying continued. The community reacted with a collective lawsuit against the city council.²⁸ In September 2020, the Judge established an AP restriction of 1000 m surrounding the town. A key witness in the judicial process was given by the director of the health workshops described in Section 2.1, who presented published evidence linking AP to cancer.

Limitations of the present study were.

- The ecological nature of the study meant that there was no data on the nature and duration of specific AP in each town or on each individual. However, as the crop types and AP used in the region are uniform, it can be assumed that population exposure to AP over time was homogenous.
- As the surveys in each town were not simultaneous (Table 1), cancer death-rates had to be estimated over a 9-year period covering 2005–2013. AP applications surrounding these towns have changed since then; however, the variety and quantity of AP have increased, mainly due to an increase in herbicide-resistant weeds and in insecticide-resistant insects.^{29–32} An improvement in AP health-related issues is highly unlikely.
- The study was restricted to 8 T of the Province of Santa Fe, a region of the Argentine Pampas. Here again, the crop types in this region were similar to the Pampas overall.
- Results were based on self-reported data, not on clinical records or medical diagnosis. As interviewers were medical students close to finishing their careers, and had received extensive training on their task, the questionnaire was considered rigorous.

e) Death rates in relation to the living population for the Old population group were under-estimated. This factor has been detected in published research, for example when five methods to estimate mortality were compared, results were biased downwards at the oldest ages.³³ Lankoandé et al.³⁴ attributed under-estimation to “recall errors, the dissolution of households following the death of adults and coverage errors”; these errors were inherent to the present survey question (see Section 2.4). To obtain better estimates of death rates for the old-age population in 8 T, other questionnaire tools such as the sibling survival method could have been used.^{35,36} However, the HW question did provide an adequate sample with which to compare cancer deaths to other causes of death.

5. Conclusion

Overall, and in spite of limitations, we were able to confirm the hypothesis that living in small rural towns nearby AP applications has a negative health impact, namely in cancer outcomes. The present work has added epidemiological knowledge relating tumor incidences to AP; knowledge that is scarce in countries such as Argentina where exposure to AP is much higher than in Europe or North America.¹⁰ Due to the wide range of active ingredients and formulants in AP used close to 8 T, molecular level causality between a specific pesticide and a specific illness is difficult to establish. However, this does not overrule the precautionary principle which should lead to pesticide-reduction policies, especially in the surroundings of small urban populations. One such policy was the lawsuit outcome described above for Sastre, one of the 8 T.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cegh.2023.101239>.

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Dr. Jake Schmitz, DCN, MS, DC
 4233 44th Avenue South, Fargo, ND 58104
 701-770-0185
drjakedc4u@gmail.com

- Business co-owner of several entities in ND involving land, minerals, water, and real estate
- Associates degree at Williston State College, BS in Chemistry at Dickinson State University, Doctor of Chiropractic at Northwestern Health Sciences University, Master's degree in Human Nutrition and Functional Medicine at University of Western States, and Doctorate in Clinical Nutrition at University of Western States
- Married with 5 children

Chairman Luick, Senators of the Agriculture and Veterans Affairs Committee,

My name is Dr. Jake Schmitz, and I am representing myself as a licensed health professional in the state of North Dakota (ND). I have a doctorate in clinical nutrition, which makes food and nutrition science a heavy focus of mine. I have been practicing in Fargo for 13 years. I OPPOSE the proposed bill HB 1318.

This bill sounds simple on the surface. It appears to be a simple "labeling" bill. The people behind this bill (Modern Ag Alliance) did a good job convincing the House members that this bill will help farmers by ensuring the correct labels are put on the chemical products they use in their fields, increasing access to these products and reducing their risk of liability. The products this bill refers to are pesticides, herbicides, fungicides, etc.

The last line of this bill is the issue. If passed, this would satisfy something called "duty to warn". The legal implications of this are clear. Bayer wants a carte blanche liability waiver for their products. With this bill codified in law, a person damaged by these products wouldn't have the ability to sue, outside of a product defect.

The proponents of this bill want you to believe their products are safe. They want you to believe the lawsuits against them are frivolous and they are simply trying to protect ND farmers with this bill. They want you to believe they are here, advocating for farmers. They aren't. They are here to protect their bottom line.

There is only one reason a company would want protection against someone's ability to sue. It is because they know their product is harmful to people, and they don't want to be held liable for damages. There have been over 170,000 lawsuits levied against these large agrochemical businesses for damages caused by these "safe" products.

The passing of this bill could harm ND citizens by removing their legal right to sue for damages caused by these harmful products. I have attached multiple studies to my testimony, proving overwhelmingly how dangerous these products are for human health. The science is clear.

*RoundUp is classified as a carcinogen and is unsafe for humans:

<https://www.sciencedirect.com/science/article/pii/S0045653523018398#fig5>

*You are roughly 2.5x more likely to die from cancer if you live around farming areas:

[https://www.ceghonline.com/article/S2213-3984\(23\)00026-X/fulltext](https://www.ceghonline.com/article/S2213-3984(23)00026-X/fulltext)

*Pesticide usages increases the likelihood of multiple cancers and even Parkinson's Disease:

<https://www.sciencedirect.com/science/article/abs/pii/S0013935121011166>

*Health issues caused by pesticide usage in agricultural workers:

<https://pmc.ncbi.nlm.nih.gov/articles/PMC7879472/>

<https://link.springer.com/article/10.1007/s11356-021-17031-2#Sec11>

The court system has also proven these products to be unsafe, and they cause cancer and other neurological diseases in humans. The main company supporting this bill (Monsanto/Bayer) has lost \$11.4 BILLION in damages from lawsuits because of the damage their products have caused people.

Please vote DO NOT PASS on HB 1318. These products are unsafe, have been proven to cause cancer and other neurological diseases. Do the right thing and protect ND citizens and farmers rights to sue these large companies for damages caused by their products.

Thank you for your consideration in reading my testimony.

Maximum Blessings,

A handwritten signature in black ink, appearing to be 'Dr. Jake Schmitz', written over a horizontal line.

Dr. Jake Schmitz

Version of Record: <https://www.sciencedirect.com/science/article/pii/S0013935121011166>
Manuscript_c32029c25948cd0b6dab30340aefa532

Health impact of occupational pesticide exposure: a review of epidemiological studies in greenspace workers

de Graaf L.^{a,b}, Boulanger M.^{c,d,e}, Bureau M.^{a,b}, Bouvier G.^{a,b}, Meryet-Figuiera M.^{c,d,e}, Tual S.^{c,d,e},
Lebailly P.^{c,d,e}, Baldi I.^{a,b,f}

^aISPED, Université de Bordeaux, 146 rue Léo Saignat, 33076 Bordeaux, France

^bINSERM U1219 Epicene, 146 rue Léo Saignat, 33076 Bordeaux, France

^cINSERM U1086 Anticipo, 3 avenue Général Harris, 14000 Caen, France

^dCentre de Lutte contre le Cancer François Baclesse, 3 avenue Général Harris, 14000 Caen, France

^eUniversité de Caen Normandie, Esplanade de la Paix, 14000 Caen, France

^fService Santé Travail Environnement - CHU de Bordeaux, Place Amélie Raba Léon, 33076 Bordeaux, France

Corresponding author : L. de Graaf, lucie.de-graaf@u-bordeaux.fr, ISPED, Université de Bordeaux, 146 rue Léo Saignat, 33076 Bordeaux, France

Abstract N=279

Context: The health impact of occupational pesticide exposure has mainly been studied among farmers. Other professionals such as greenspace workers are also extremely exposed, presenting specific exposure features (practices, types of pesticide used). The aim of this review was to summarize epidemiological data on the health impact of pesticides among greenspace workers. **Method:** Six main groups of greenspace workers were identified and examined through a systematic literature review based on PubMed and Scopus. The studies were then grouped according to their design, health outcomes and the type of population studied. **Results:** 66 articles were selected among the 1,619 identified. Thirty-two studies were conducted exclusively among greenspace workers, while 22 also studied these workers with other pesticide applicators. Twelve were cohorts from the general population in which greenspace workers were identified. We analyzed 40 publications focused on cancers, six on neurological and psychiatric diseases, and 20 on reproductive disorders and adverse effects on pregnancy outcomes and children. Elevated risks were found in several studies for leukaemia, soft-tissue sarcoma, multiple myeloma and non-Hodgkin lymphoma. Associations were also found for Parkinson's disease, longer time-to-pregnancy, spontaneous abortions, preterm births and malformations. **Discussion:** The majority of studies used rough parameters for defining exposure such as job titles which could lead to the misclassification of exposure, with the risk of false or positive negative conclusions. Health outcomes were mainly collected through registries or death certificates, and information regarding potential confounders was often missing. **Conclusion:** The review identified only 32 studies conducted exclusively among greenspace workers. Elevated risk was for several diseases. Further epidemiological research is needed, conducted specifically on these workers, to better characterize this population, its exposure to pesticides and the related health effects.

Keywords: occupational epidemiology, greenspace workers, non-agricultural workers, pesticides, occupational exposure

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1. INTRODUCTION

Non-agricultural occupational uses of pesticides concern a large and diverse population, working in green spaces, wood industry, public hygiene, the food industry, etc. Greenspaces themselves include a wide variety of occupations and tasks: creation and maintenance of parks and gardens, maintenance of lawns in public places, golf-course and other sports facilities, maintenance of roadsides, railways and other public facilities, floriculture, horticulture, plant and tree nurseries... While these jobs have often been associated with health benefits due to physical exercise and outdoor work (1), some studies have also shown negative health impacts (2–4). Indeed, greenspace workers are exposed to a large range of occupational hazards, including physical hazards (motor vehicle accidents, falls, injuries, electrocution, noise, vibration, environmental conditions, etc.), biological hazards (diseases linked to microorganisms present in soil or water, such as tetanus, toxoplasmosis, and legionnaires' disease, bites or stings from plants or animals, plant and animals allergens etc.) and chemical hazards such as pesticides, combustion products and heavy metals (4).

Among occupational hazards, pesticide exposure is very likely to impact greenspace workers' health as they are frequently vulnerable to such exposure, with specific outcomes depending on the occupations and tasks. At international level, data on occupational exposure to pesticides among gardeners and greenspace workers are scarce. Epidemiological studies on the effects of pesticides have mainly been conducted among farmers, highlighting associations between pesticide exposure and increased risk of cancer for some specific localisations (prostate (5,6), lung, ovarian, rectal, testicular, skin and breast (5)), as well as Non-Hodgkin Lymphoma (NHL), multiple myelomas and leukaemia (5,7). Neurological diseases (Parkinson's disease (8), Alzheimer's disease and amyotrophic lateral sclerosis), and reproduction disorders (spontaneous abortions, stillbirth and sperm quality) have also been associated with pesticide exposure (5).

However, agriculture does not cover all the exposure situations and specificities encountered in greenspaces. In developed countries, about 10% of pesticides are used for non-agricultural purposes (9). In relation to the surface area treated, it has been suggested that the greenspace sector uses larger quantities of pesticide than the agricultural sector (10–12). In the USA, 50% of the top ten active ingredients used by non-agricultural professional pesticide applicators are herbicides (glyphosate ranks first), 40% insecticides and 10% fungicides (13). Herbicides such as glyphosate and 2,4-D are widely used

on turfgrass (11,12,14), sports fields (15) and public facilities such as roads or railroad tracks (16,17). Even if herbicides remain the main treatment on golf courses, fungicides and insecticides are also commonly used to control diseases and insect larvae (11). In floriculture and ornamental plant production, many different pesticides are used. Chemicals such as growth regulators, animal repellents and disinfectants accounted for 47% of the total ingredients applied in nurseries and floriculture in the USA in 2009, followed by fungicides (22.4%), insecticides (17.4%) and herbicides (13%)(18). Pesticide use appears to be higher for greenhouse floriculture in comparison to other types of crops (19). Spraying equipment displays also some specific features, with widespread use of knapsack sprayers, watering cans and hand sprayers. This could result to high exposures, because the distance between the body and the sprayer is very small, and because devices may leak, the worker may not be protected by a cabin like farmers on tractors, and weather conditions such as wind may send the spraying cloud back to the operator (20). Moreover, these workers may spray pesticides in closed environments such as nurseries or horticultural greenhouses, where air containment, lack of ventilation, temperature and humidity will also increase workers' exposure (21). Finally, gardeners and greenspace workers can also be exposed to pesticides through frequent contact with plants during a wide range of manual tasks (planting, sizing, flower picking...)(21,22). Observance and proper use of protective equipment may also differ as, unlike farmers, gardeners often work on different sites in a single day, so they are less likely to have a dedicated place for their equipment (20,23,24). Regarding the pesticides used, some commercial products are the same as those used by farmers, but others are marketed specifically for green spaces, with active ingredients especially dedicated to these uses (e.g., glyphosate...).

Thus, regarding these differences of pesticide use, exposure and equipment between farmers and greenspace workers, the aim of our review was to summarize the epidemiological knowledge available on the health impacts of pesticides on greenspace workers.

2. METHOD

2.1. Literature search

2.1.1. *Identification of research terms*

Since greenspace workers cover a wide range of occupations, the first step in the literature review was to identify all the terms designating jobs of interest. These were defined according to international

classifications of occupations and industrial sectors from 1968 to 2008 (25–30). Six main occupational groups were identified: i) gardeners on public or private property; ii) nursery workers; iii) horticultural farmers; iv) groundsmen and v) municipal workers and vi) road or railroad tracks maintenance workers.

2.1.2. *Algorithm*

The systematic literature search was conducted in PubMed and Scopus. The following algorithm was built and combined with words related to occupational pesticide exposure and health outcomes:

(gardener OR greenkeep* OR horticultur* OR floricultur* OR greenhouse worker OR plant nursery OR municipal worker OR road maintenance OR railway maintenance OR flowers OR floricult* OR golf course OR lawn care OR pesticide applicators OR herbicide applicators) AND (Occupational Exposure OR Occupational diseases OR Pesticide* OR Herbicide OR fungicide OR Biological Control Agents OR Agrochemical OR Occupational Health OR Neoplasm OR Mortality OR Morbidity OR Health)

The search in the databases was conducted on 1st April 2020 and updated on 1st March 2021.

2.2. Eligibility criteria

Only articles in English or French were selected, and no restrictions were applied regarding the date. Workers involved in the cultivation of edible products such as fruit and vegetables, identified as *“Market garden workers”*, *“market gardeners and crop growers”* and *“tree and shrubs crop growers”* in the international classifications of jobs and industries, were excluded. Pesticide applicators specialised in pest-control and designated as *“fumigators and other pest and weed controllers”* and *“building structure cleaners”* were also excluded as their tasks differ too much from those of gardeners. Their main task consists of fighting against domestic and environmental pests such as termites, mosquitos, fleas and other parasites. In the literature, they are identified as *“pest-control operators”* or *“pest-control agents”*. Other workers not related to gardeners, horticultural and nursery workers, greenkeepers, and municipal and road maintenance workers were also excluded, as were i) cohorts based on non-occupational populations and exposure, ii) non-epidemiological studies, and iii) studies with no health data.

2.3. Selection method

The first selection of papers was based on titles, then on the abstracts, and finally on a full reading of the articles. The information extracted covered: i) authors, date and country of the study; ii) study design; iii) study population (sample size, characteristics, occupations); iv) assessment of methods of exposure; v) health outcomes; vi) statistical analysis methods, and vii) the main results and associations found.

3. RESULTS

3.1. Literature review

In the first step, 1,713 references were identified (855 from Pubmed, 858 from Scopus), corresponding to 1,619 non-duplicate papers (Figure 1). After title and abstract reading, 1,169 papers were excluded as they were either non-epidemiological studies (N=84) or case studies (N=46), examining exposure other than pesticides (N=146) or focused on exposure assessment (N=302) (biological monitoring (N=243), exposure assessment of agricultural workers (N=31), greenspace workers (N=18) and environmental measures (N=10)), based on non-occupational populations or on workers excluded from our inclusion criteria (N=417) or off-topic (N=174). After reading the abstracts, 450 papers remained and, after full reading, 395 were excluded as they were either based on other populations or did not specify the population concerned (N=265), studied other exposures (N=22), or focused on exposure assessment only (N=25), were non-epidemiological studies (N=26), case studies (N=4), or were off-topic (N=53). In addition, 11 other papers were included, not found in the database search but identified from references in the selected papers. Finally, a total of 66 articles were retained in our review, published between 1974 and 2019, originating from 49 studies.

3.2. General characteristics of the studies

Most of the studies were conducted in Europe (N=37, 56.3%), mainly in Scandinavian countries (N=28), including Sweden (N=7), Denmark (N=7), Finland (N=4) and Iceland (N=1), followed by the Netherlands (N=5), the United Kingdom (N=2) and Italy (N=2). Fourteen studies were carried out in the USA, four in Canada, five in South America (two in Ecuador and three in Colombia), four in Oceania (two in New-Zealand and two in Australia) and one in Asia (Taiwan). Ten studies were multicentric, eight of which were conducted in Scandinavia. Forty studies were cohorts, with 24 case-control and two cross-sectional studies. Sample size ranged from 121 to 347,325. Thirty-two studies were conducted among

greenspace workers (19 cohorts, 11 case-control studies and two cross-sectional studies). Twenty-two studies combined greenspace workers and other agricultural workers (nine cohorts and 13 case-control studies) and 12 cohorts were conducted in the general population in which greenspace workers were clearly identified.

Among the thirty-two studies focused on greenspace workers, three cohorts and 10 case-control studies were conducted on gardeners, eight cohorts and three case-control studies on floriculturists, four cohorts on public facilities maintenance, three cohorts on lawn-care and municipal workers, one cohort on golf course employees and. Nine cohorts and 13 case-control studies combined gardeners, horticulturists and nursery workers with agricultural workers. Other studies (12 cohorts) included a large range of occupations, including greenspace workers.

We presented the results according to the main health outcomes explored in the studies: i) cancers (N=40) (Table 1), ii) neurological and psychiatric diseases (Parkinson's disease N=3, suicides N=2, motor neuron disease N=1) (Table 2), iii) reproductive disorders and adverse effects on pregnancy outcomes and children (N=20) (Table 3). In each table, the studies were grouped according to their design and the type of population under study (only greenspace workers, greenspace workers and farmers, and a large range of jobs including greenspace workers)

3.3. Risk of cancer

We identified 15 cohorts (12 historical and 3 prospective) and 11 case-control studies that examined cancer in greenspace workers, described in 40 publications. Measures of association have been summarized for each cancer site (according to the 10th revision of the International Classification of Diseases) in men (Figure 2) and in women (Figure 3).

3.3.1. *Cohorts in greenspace workers*

In Denmark, a prospective cohort included 4,015 workers (male and female) in plant nurseries, public gardens, parks and cemeteries, recruited in 1975 through the national union of general workers, regardless of age, and followed until 1984 (31) and 2001 (32). Two analyses were performed in this cohort : the first estimated and compared the incidence of cancers in the general population after a nine-year follow-up (31). The second analysis, after a 17-year follow-up, studied the pattern of cancer incidence after changes

in pesticide use and regulation, using year of birth as a proxy for exposure levels. Workers born before 1915 were considered highly exposed, while workers born after 1935 were considered less exposed. (32). The first analysis showed a significant excess of soft tissue sarcoma (STS) (SIR = 526 [109-1538], 3 observed cases) and chronic lymphocytic leukaemia (CLL) (SIR=275 [101-599], 6 observed cases) among men. A non-significant increase in NHL was also noted (SIR=173 [63-376], 6 observed cases). Regarding the risk of cancer among women, the sample size was too small for any conclusive result. In the second analysis, where only men were considered, the overall risk of cancer decreased, compared to the general population (SIR=0.86 [0.76-0.94], 521 observed cases). The risk of STS and CLL remained high, but did not differ statistically from the general population. However, risk increased in the highly exposed group: SIR=5.9 [1.9-18.2] (3 observed cases) for STS and SIR=2.3 [1.3-4.1] (12 observed cases) for CLL. An increase in the risk of cancer of the reproductive organs (code 177-9 ICD 7th revision) was also observed, although not statistically significant (SIR=1.3 [1.0 – 1.8], 39 observed cases).

In the Netherlands, a retrospective cohort included 1,341 herbicide applicators licensed for “public park work” before 1980, with no details of their exact job, and followed their mortality until 1988 (33). Type and quantity of pesticides were collected from the municipalities where they were employed. Most pesticides used were herbicides (96%), mainly simazine, chlorothiamide, dalapon, dichlobenil and diuron. Overall mortality was significantly lower than in the general population (SMR=76 [58-97], 63 observed cases). However, mortality from cancer was higher for specific locations: pancreas, intestine, skin, brain and Hodgkin lymphoma, with statistical significance reached only for multiple myeloma (SMR=815 [164-2382], 1 case observed). In a subgroup of 921 workers considered as highly exposed (excluding subjects that were only supervisors, based on job titles at the time of licensing), the risk of multiple myeloma increased dramatically (SMR=1 299 [261-3 795], 3 cases observed). Analyses were updated after 12 years, corresponding to a 20-year latency period: the risk of multiple myeloma remained high, but no longer significant (SMR=214.3 [43.1-614.7], 3 cases observed) and the risk of skin cancer increased for herbicide applicators (SMR=357.4 [115.1-827.0], 5 cases observed) (34).

In Finland, a prospective cohort was examined to explore mortality and morbidity among chlorophenoxy herbicide applicators along railroad tracks, highways, electric lines and in forests (35). Almost 2,000 male workers, exposed to pesticides for two weeks or more between 1955-1971, were included in 1972 and

followed-up for mortality until 1980. When compared to the general population, mortality was lower in the overall cohort and also in the most exposed subjects. The results, updated until 1988, confirmed a decreased risk of cancer (SMR=0.8 [0.7-1.0], 77 cases observed), even for the most exposed workers (SMR=0.8 [0.4-1.3], 49 cases observed) (36). It is noteworthy that the risk of prostate cancer was found to be low in this population (SIR=0.3 [0.1-0.8], 5 cases observed).

In Sweden, a cohort of 348 herbicide (amitrole and phenoxy herbicides including 2,4-D and 2,4,5-T) applicators on railroad tracks assessed the incidence of tumours (37). Four sub-cohorts were formed according to the type of herbicide used for more than 45 cumulative days over the period 1957-1972: 207 were exposed to phenoxy herbicides, 152 were exposed to amitrole and 28 were exposed to other herbicides. An excess in cancer mortality was observed in workers exposed to amitrole when a 5-year latency was considered ($p<0.03$) as well as in those exposed to other herbicides when no latency was taken into account or for latency periods of 3 and 5 years ($p<0.01$). The risk of lung cancer increased in amitrole users -regardless of latency periods ($p<0.05$) and in other herbicide users - significantly for 3 to 5 years latency ($p<0.05$). In a nested case-control study including workers with more than 45 days overall herbicide exposure, the risk of tumour (codes 140-205, ICD 7th revision) increased in amitrole users with exposure duration (RR=3.4 for exposure 1 to 45 days and RR=4.1 over 90 days). For phenoxy herbicide, no such pattern was observed. The updated analysis (follow-up until 1978, a latency period of 10 years or more) showed a significantly doubled in overall cancer mortality for individuals exposed to amitrole and a trebling in those exposed to phenoxy herbicides (38). Workers exclusively exposed to phenoxy herbicides had six times greater risk of developing stomach cancer than the general population. These risks were more pronounced for exposures during the 1957-1961 period.

In the United States, mortality among pesticide applicators specialized in turf and lawn care was studied in a retrospective cohort (39). Over 18,000 pesticide applicators hired in a national lawn-care service company were included, and approx. 16,000 of them specialised in lawn, trees and shrubs. Female and male workers were followed from 1969 to 1990. Cancer risk was lower in men employed as applicators than in the general population (SMR=0.7 [0.4-1.1], 16 cases observed). When stratified on tasks and duration of work as lawn applicators, a significant increased risk of NHL was observed in workers who

had applied herbicides for more than three years (SMR=7.1 [1.8-28.5], 2 cases observed) and in men employed after the age of 26, but non significantly (SMR=2.4 [0.3-8.8], 2 cases observed).

A retrospective cohort of 682 male golf course superintendents in the United-States explored causes of death between 1970 and 1992 in comparison with the mortality of white males from the general population (12). Excess mortality was observed for overall cancers (Proportionate Mortality Ratio: PMR=135 [121-151], 203 cases observed) and for tobacco smoking-related diseases like arteriosclerotic heart (PMR=140 [127-155], 236 cases observed), respiratory diseases (PMR=176 [135-230], 49 cases observed), and emphysema (PMR=186 [101-342], 10 cases observed). No data was available on smoking habits. An excess of risk was observed for prostate cancer (PMR=293 [187-460], 18 cases observed), NHL (PMR=237 [137-410], 12 cases observed), brain tumours (PMR=234 [121-454], 8 cases observed), tumours of the nervous system (PMR=202 [123-333], 15 cases observed) and large intestine cancer (PMR=175 [125-245], 32 cases observed).

3.3.2. Scandinavian cohorts based on population census with specific focus on greenspace workers

Thanks to a personal identity number for all inhabitants in Scandinavian countries, census data such as demographic information and occupations have been linked to Nordic cancer registries. This allowing analysis benefiting from a very large number of people; however, exposure assessment was only based on job titles.

3.3.2.1. Analyses in the NOCCA Study

Seven of the papers reviewed here are based on the Nordic Occupational Cancer (NOCCA) Study, a large cohort including workers who participated in national population censuses in Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) between 1960 and 1990.

Within the NOCCA cohort, each cancer site was analysed in relation to occupations from 1960 to 2005 (40). The only cancer occurring statistically more frequently among male gardeners was lip cancer (SIR=1.6 [1.5-1.7], 677 cases observed). This result was confirmed by additional analyses of avoidable cancers (due to poor life habits such as smoking or drinking alcohol) from 1960 to 2005 (41), and in analyses adjusted to alcohol and tobacco consumption (42).

A decrease in cancer risk in Scandinavian gardeners was also found in the NOCCA population i) in a specific analysis conducted in 2015 in Finland, Iceland, Sweden and Norway on skin and oesophagus cancer (SIR=0.8 [0.6-1.0], 83 cases observed) and oesophageal squamous-cell carcinoma (SIR=0.7 [0.6-0.8], 212 cases observed) (43), ii) in an analysis on bladder cancer until 2005 (SIR=0.8 [0.8-0.8], 3,162 cases observed)(44) and in the risk of kidney malignancies (SIR=0.7 [0.6-0.8], 195 cases observed)(45). Regarding female gardeners from 1961 to 2005, the risk of breast cancer was found to be one of the lowest, regardless of the subtype (SIR=0.8 [0.7-0.8], 7,300 cases observed) (46).

3.3.2.2. Other Scandinavian studies

Four other cohort studies conducted among Scandinavian workers also linked census data with national cancer and death registries.

The risk of gastric cancer was studied in more than six million Swedish workers, followed from 1961 to 2002 (47). In the 1960s, gardeners had the same incidence as the general population (SIR=1.0 [0.9-1.1], 329 cases observed). Between 1960 and 1980, their incidence of gastric cancer increased (SIR=1.5 [1.0-1.9], 39 cases observed), and it rose even more for cardia cancers (SIR=2.4 [1.3-3.8], 14 cases observed). Gardeners were the occupational group with the highest risk of these cancers.

In another retrospective analysis of the Swedish in the period 1971-1989, the link between occupation and multiple myeloma was explored (48). Farmers and horticulturists were pooled, with a distinction made between managers and employees. Among men, managers had a higher risk of developing multiple myeloma, compared to other workers (RR=1.2 [1.1-1.4], 317 cases observed) and a trend was observed for employees (RR=1.7 [1.0-2.9], 166 cases observed). Farmers, horticulturists and foresters belong to one of the most at-risk occupational group. Exploring the role of chemical groups through two job exposure matrices, a relation with pesticide exposures was observed (RR=1.2 [1.1-1.3], 350 cases observed).

The risk of melanoma among more than one million female workers was also studied in Sweden from 1960 to 1989 (49). When compared with the general population, horticulturists had significantly more melanoma (RR=1.6 [1.1-2.3], 30 cases observed) than farmers, even when adjusting UV exposure (RR=1.7 [1.1-2.7]).

Another study in Norway, Sweden, Denmark and Finland analysed the incidence of cancers among 10 million workers from 1970 to 1991 (50). Cancer risk overall and site-specific was lower for gardeners, horticulturists and nurserymen, both for women (SIR=83 [81-84], 15,306 cases observed) and men (SIR=86 [84-88], 8,927 cases observed).

3.3.3. Cohorts based on population census with specific focus on greenspace workers

In Canada, Gallagher et al. (1986) conducted a retrospective cohort study assessing occupational mortality from cutaneous malignancies, including over 600 deaths in British Columbia from 1950 to 1978 (51). Again, gardeners and nurserymen experienced a higher incidence than the general population (PMR=430 [157-937], 6 deaths observed). The results for farmers and other workers exposed to pesticides were not described. The occupational groups with the highest incidence were architects and chemical engineers.

3.3.4. Case-control studies with a focus on greenspace workers

Five case-control studies (52,52–56) in the United States and in Europe, exploring occupational factors of multiple myeloma, were included in a meta-analysis (57). Overall, 1,959 multiple myeloma cases and 6,192 control subjects enrolled from 1977 to 2004 were analysed. In the pooled analysis, gardeners and nursery workers tended to show an increased risk of developing multiple myeloma compared to the control subjects selected from the general population (OR=1.5 [1.0-2.3], 121 cases). However, in three of these studies, the risk decreased for gardeners and/or farmers and associated workers (52–54).

In New Zealand, a case-control study including 291 incident cases of NHL from the national cancer registry in 2003-2004 and 471 control subjects investigated the risk of NHL in various agricultural sectors (58). Using job titles, patients with NHL were three times more likely to be nurserymen (OR=3.2 [1.0-9.7], 10 cases) and five times more likely to be nurserywomen (OR=5.2 [1.0-28], 6 cases). When pooling gardeners and nursery workers, the risk of NHL only remained in women (OR=2.5 [0.9-9.4], 8 cases). Another study analysed the link between leukaemia and occupation with the same control group: patients with leukaemia were four times more likely to have been employed in a plant nursery than patients without any disease (OR=4.2 [1.3-13.5], 9 cases) (59). In females, the odds ratio was even higher: OR=11.7 [2.3-59.9] (8 cases). On the other hand, grounds and greenkeepers to have a very low risk of leukaemia (OR=0.2 [0.0-1.6]), even though the analyses were based on a very limited numbers of subjects

(1 case and 10 control subjects). Analyses by leukaemia subtypes showed an increased risk of CLL in nursery workers (OR=3.9 [1.1-13.9], 6 cases). The number of acute myeloid leukaemia cases was too low for any conclusion.

In Montreal (Canada), a case-control study was conducted on the risk of renal cell carcinoma in relation to occupations among 142 patients diagnosed between 1979 and 1985, and 533 population control subjects (60). Patients hospitalized for a renal cell carcinoma were more frequently employed as farmers or horticulturists (OR=1.6 [1.0-2.6], 22 cases) than the population-based control groups. The risk was even higher for gardeners (OR=4.1 [1.7-10.3], 6 cases). Chemicals used by these workers were analysed and an excess risk of cancer was observed in those exposed nitric acid (OR=2.1 [0.7-6.1], 4 cases) and phosphoric acid (OR=3.4 [1.3-9.2], 5 cases) fertilizers.

A case-control study in Finland included 1,419 incident case of primary malignant pancreatic neoplasms diagnosed between 1984-87 and 3,519 control subjects with stomach, colon or rectum cancer, and highlighted differences between gardeners and farmers (61). Both cases and control subjects were known to have died by 1990. Patients with pancreatic cancer were four times more likely to have worked in the gardening sector (OR=4.1 [1.4-11.8], 8 cases). Conversely, farmers had a decreased risk of developing pancreatic cancer (OR=0.8 [0.7-1.0], 144 cases).

In Sweden, the role of herbicide exposure in STS occurrence was examined in a case-control study including 96 men diagnosed between 1975 and 1982 (64 alive and 32 dead) and 200 control subjects with another type of diagnosed cancer (62). Among workers occupationally exposed to pesticides, wood preservatives, solvents and other chemical, patients with STS were four time more likely to have worked as gardeners (OR=4.1 [1.0-14], 6 cases).

In British Colombia (Canada), the risk of nasal and bladder cancer was investigated according to occupational exposure (63). From 1990 to 1992, 48 cases of nasal cancer, 105 cases of bladder cancer and 159 control subjects from the general population were included. Gardeners appeared to have a higher risk of nasal cancer (OR=2.9 [0.4-19.8], 3 cases) and bladder cancer (OR=3.7 [0.7-25.0], 6 cases). On the other hand, in another study carried out in the US, male groundskeepers and gardeners had a lower risk of bladder cancer (OR=0.8 [0.5-1.4]) (64). In this study, 1,402 cases of bladder cancer diagnosed in 2001-

2004 were included, together with 1,418 control subjects from the general population. However, when the industry code (ISIC) (instead of only the job title) was considered, the risk of bladder cancer was statistically higher for men working in the landscape and horticultural services industry (OR=2.4 [1.2-4.8]).

In the US, the link between occupation and the risk of keratinocyte cancer was studied among 889 cases diagnosed with basal cell carcinoma (BCC) or squamous cell carcinoma (SCC) in 1994-1995, together with 524 healthy control subjects from the same area (65). Male groundskeepers and gardeners had a significantly higher risk of BCC (OR=3.2 [1.5-6.8] (37 cases) and the same applied for SCC (OR=3.3 [1.4-7.8] (16 cases).

In the United Kingdom, a case-control study analysed the risk of STS among farmers, gardeners and groundsmen and foresters, comparing 1,961 male STS cases diagnosed between 1968-76 and 1,961 control subjects with another type of cancer (considered non-related to pesticide exposure), matched for age and area of residence (66). The risk of STS increased between 1968 and 1976 but remained non-significant. After a stratification based on occupations, the relative risk was higher in farmers but not in gardeners/groundmen: RR=1.7 [1.0-2.9] (42 cases observed) and RR=0.7 [0.4-1.4] (17 cases observed) respectively.

3.3.5. Cohorts pooling greenspaces workers and other pesticide applicators

In a Swedish retrospective cohort, 1,856 gardeners or nurserymen and 547 orchardists, members of the national association of horticulturists, were followed from 1965 to 1986 (67). When compared to the general population, a significant decrease in mortality was observed for overall cancer (SMR=0.8 [0.7-0.9], 542 cases observed), for lung cancer, and also respiratory diseases and for cardiovascular diseases. However, mortality was significantly greater for central nervous system tumours (SMR=2.9 [1.1-6.2], 6 cases observed) and melanoma (SMR=2.1 [1.2-3.5], 15 cases observed) in men aged 60 and over. In the overall cohort, non-significant excess risks were also observed for stomach cancers, female reproductive organ cancers (uterus, ovaries and tubes), Hodgkin lymphoma and myeloma. The morbidity ratio for brain tumour was even higher over the period 1975-1979 (SMR=3.5 [1.3-7.7], 6 cases observed), a result that the authors attributed to a possible role of pesticides used after 1960 (c.g., DDT, diquat, metam).

In Iceland, 2,449 horticulturists, orchardists and farmers were enrolled in a prospective cohort to study cancer (68). Six subgroups were defined according to pesticide use and time-period enrolment (from 1941 to 1985). The first subgroup was composed of licenced applicators such as farmers, considered highly exposed, especially to phenoxy acetic acids. The second subgroup enrolled horticultural students, and the others featured members of associations (the Market Gardener's Association, the Horticulturist's Association, the Association of Vegetable Farmers, and the Farmer's Association), all considered as low-exposure groups. At the 1993 follow-up, the incidence of overall cancer was lower than in the general population, both in men (SIR=0.8 [0.6-1.1], 59 cases observed) and in women, (SIR=0.7 [0.4-1.3], 12 cases observed). Nevertheless, in men, the cancer incidence tended to be higher for rectum (SIR=2.7 [0.9-6.4], 5 cases observed) and skin (SIR=2.8 [0.9-6.6], 1 case observed). When both genders were combined, SIR for rectum cancer became significant (SIR=2.9 [1.1-6.4], 6 cases observed) and the association was stronger in the highest exposure subgroup: SIR=4.6 [1.5-10.8] (5 cases observed). In a case-control study nested in this cohort, workers with adenocarcinoma in villous or tubulo-villous adenomas were twenty times more likely to have been occupationally exposed to pesticides than people without this kind of rectal cancer (OR=19.5 [1.5-181.0]). The same results were observed when rectal and colon cancer with the same histology were combined (OR=20.0 [1.8-127.4], 1 case). Within this cohort, the risk of lymphatic and hematopoietic cancers also increased statistically in women (SIR=5.6 [1.1-16.2], 3 cases observed).

A retrospective cohort included around 30,000 male and female workers (greenspace workers as well as farmers and ranchers), identified through the list of pesticide applicators licenced in the State of Florida (US) from 1975 to 1993 (69). For private and commercial greenspace workers (floriculturists, orchardists, public operators), overall mortality was significantly lower in men (SMR=0.7 [0.7-0.8], 1,776 cases observed) and in women (SMR=0.4 [0.4-0.5] (98 cases observed), as well as overall cancer mortality (SMR=0.8 [0.7-0.9] in men (498 cases observed) and SMR=0.6 [0.4-0.8] in women (34 cases observed)) and for some specific cancers mortality: mouth and pharynx (SMR=0.5 [0.2-1.0] for men (7 cases observed) and SMR=0.7 [0.0-4.1] for women (1 case observed), and lymphatic cancers (other than lymphosarcoma, Hodgkin lymphoma and leukaemia) in men (SMR=0.6 [0.4-1.0] (18 cases observed)). On the other hand, a twofold excess in mortality was observed for prostate cancer (SMR=2.4 [1.8-3.0], 64 cases observed), only in men licenced for less than 4 years (SMR=2.6 [1.6-4.0] (21 cases observed) versus

SMR= 0.5 [0.0-2.8] (1 case observed) in those licenced for 16-20 years). Analyses according to the employment status (private vs. commercial/public) did not show any difference. In the same cohort, cancer incidence was also studied and the findings were in line with those mentioned above (70). In addition, the incidence of cancers of the reproductive organs was higher than in the general population: prostate (SIR=1.9 [1.7-2.1], 353 cases observed), testis (SIR=2.5 [1.6-3.7], 23 cases observed), all female genital organs (SIR=2.1 [1.3-3.1], 23 cases observed), cervix (SIR=3.7 [1.8-6.6], 11 cases observed) and uterus (SIR=1.4 [0.7-2.6], 11 cases observed)

Causes of death were analysed in 1977 in 3,827 pesticide applicators in Florida – with a specific focus on lung cancer – and compared to the local population (71). Applicators were identified from the licences delivered by the Florida Department of Health and Rehabilitative Services in 1965-1966, and pooled greenspace workers and home pest killers. Overall mortality was comparable to that of the reference population. However, white men tended to have an increased incidence of lung, skin and brain cancers, and a lower risk of digestive cancers, respiratory diseases and cirrhosis. Moreover, lung cancer mortality increased with the number of years of licence and became significant over 20 years (SMR=289, $p<0.05$, 8 cases observed). The risk was also higher for people aged below 30, described by the authors as less experienced and more prone to pesticide misuse. Workers specialised in lawn-care did not show an excess risk of lung cancer (SMR=93, non-significant, 7 cases observed), while pest-control operators specialized in household pests and rodents did (respectively SMR=168 and 165, $p<0.05$). These results on lung cancer were updated in 1982, taking into account tobacco smoking (72). After adjustment for the number of packs of cigarettes smoked per year, the risk of lung cancer increased significantly in workers licenced before the age of 40 (OR=2.4 [1.0-5.9], 38 cases), those who had worked for more than 20 years (OR=2.1 [0.8-5.5] (13 cases) and those who had started their exposure more than 20 years earlier (OR=2.2 [0.8-5.8], 19 cases). In a nested case-control analysis, an elevated risk of lung cancer was observed in workers exposed to diazinon (OR=2.0 [0.7-5.5], 17 cases), DDT (OR=2.6 [0.5-14.3], 5 cases) and carbamates (OR=16.3 [2.2-122.5], 7 cases).

3.3.6. Case-control studies considering greenspace workers pooled with other pesticide applicators

In a case-control study in the United States, the risk of STS and NHL was investigated among herbicide applicators (in or outside agriculture) (73). The cases involved men diagnosed with STS (N=128) or NHL

(N=576) between 1981 and 1984. The 694 control subjects were frequency-matched by vital status and age. Landscapers, who were considered as low-exposed, did not have an excess risk of STS (OR=0.9 [0.3-2.8]) but presented a non-significant excess risk for NHL (OR=1.7 [0.9-3.1]). On the other hand, gardeners, considered as moderately exposed, did not have any excess risk for STS (OR=1.1 [0.5-2.2] or NHL (OR=0.8 [0.5-1.4]). When all workers were pooled in the analysis, the risk of NHL doubled for workers with more than 15 years of herbicide exposure prior to a 25-year latent period.

In Taiwan, a case-control study was conducted in order to determine occupations associated with the risk of oesophagus cancer (74). In this study, 326 patients with oesophageal squamous cell carcinoma (ESCC) diagnosed between 2000 and 2005 and 386 age-matched control subjects were included. After adjustment for known risk factors such as tobacco and alcohol consumption, gardeners and farmers had a higher risk of developing oesophagus cancer (OR=2.1 [1.0-4.2], 46 cases) than the general population.

3.4. Risk of neurological and psychiatric diseases

3.4.1. *Parkinson's disease*

3.4.1.1. *Cohort in greenspaces workers*

In the prospective Danish cohort described above (31,32), the risk of Parkinson's disease among male gardeners was analysed from 1975 to 2008 (75). The 3,124 gardeners from the cohort were linked with the hospital registry to identify Parkinson's patients. Compared with the general population, the risk of hospital care in relation to Parkinson's disease increased slightly and non-significantly (SHR=1.1 [0.8-1.7], 28 cases observed). However, the risk was higher in greenspace workers born before 1915 (SHR=1.6 [0.8-2.8], 11 cases observed), assumed to have been exposed to more toxic pesticides and/or at a higher dose.

3.4.1.2. *Cohort in greenspace workers and other pesticide applicators*

Also in Denmark, another prospective cohort followed more than 2 million workers from enrolment in 1981 until 1993, exploring the association between Parkinson's disease and agricultural occupations (76). Exposure to pesticides was extrapolated from the name and code of occupation. Hospitalisation in relation to Parkinson's disease was 30% more prevalent in farmers and horticulturists (SHR=1.32 [1.11-1.56], 134 cases observed) than in the general population. Self-employed landscape gardeners experienced the highest risk (SHR=4.48 [5.4-16.17], even if non-significant (2 cases among 553 subjects).

3.4.1.3. Case-control studies in greenspace workers

In Canada, the role of environmental factors on Parkinson's disease occurrence was investigated among 372 patients recruited in 1988 (77). When compared with patients with heart conditions, patients with Parkinson's disease were significantly twice more likely to have been exposed to pesticides (OR=2.0 [1.0-4.1], 33 cases), a result even more pronounced when the general population was considered as the reference (OR=2.3 [1.1-4.9]). Analyses based on occupations demonstrated that male patients with Parkinson's disease were more likely to be gardeners (OR=1.7 [0.9-3.4], 39 cases). No association was found when chemical groups of pesticides were considered (defined by mechanisms of action). The authors suggested that this negative result could be explained by the role of associations of pesticides rather than single ones.

3.4.2. Suicides

3.4.2.1. Case-control studies in greenspaces workers and other pesticide applicators

A case-control study, nested in an Australian cohort of farmers, greenspace workers (sports fields and municipal facilities), horticulturists, nurserymen and employees of pesticide manufacturing, explored the risk of suicide among workers occupationally exposed to pesticides (78). In this study, 90 subjects whose cause of death was intentional self-harm between 1983 and 2004, and 270 living control subjects from the original cohort were considered (thus, the control subjects were also occupationally exposed to pesticides). The risk of dying from suicide was lower for gardeners, horticulturists or nurserymen (OR=0.7 [0.4-1.2], 24 cases). After adjustment for reported pesticide exposure, overexposure to organophosphate/carbamate pesticides and occupational groups, this ratio narrowed to 1 (OR=0.9 [0.5-1.8]). In addition, a non-significant increased risk was observed among those who had been overexposed (i.e., subjects who had a biomonitoring test outside the reference range) to carbamates or organophosphates (OR=2.1 [0.8-5.3], 8 cases).

In the United States, a case-control study analysed the risk of suicide among farmers, animal caretakers, gardeners, nurserymen and veterinarians (79). The study included 4,991 deaths coded as suicide between 1990 and 1999, and 107,692 control subjects who died from other causes. Women occupationally exposed to pesticides were twice as likely to commit suicide than non-exposed women (OR=2.0 [1.0-3.9]). For

men exposed to pesticides, the elevation in risk was very slight (OR=1.1 [1.0-1.3]). In this analysis, no stratification was made for the type of occupation.

3.4.3. Other neurological disease

A New Zealand study including greenspace workers focused on motor neuron disease. In this case-control study, 295 incident and prevalent cases of motor neuron disease diagnosed between 2013 and 2016 were included and 605 population controls were included (80). Patients with motor neuron disease were more likely to have worked as gardeners or horticulturists (OR=2.0 [1.0-3.8], 20 cases) than the control subjects, and the risk increased with the length of time in the job: OR=4.5 [1.3-16.3] for exposure longer than 10 years (p trend=0.03, 7 cases). For grounds and greenkeepers, the results were comparable (OR=3.0 [1.1-8.0], 12 cases).

3.5. Adverse effects on reproduction and foetal development

3.5.1. Adverse effects on reproduction:

3.5.1.1. Greenspace worker cohorts

A study conducted in the Netherlands analysed the time-to-pregnancy (also known as fecundability) among men working in flower production greenhouses (81). 694 exposed men were compared with 613 workers non-exposed to pesticides (cleaners, market stall retail workers...). Couples with men exposed to pesticides took slightly shorter time to conceive than the reference group (Fecundability ratio: FR=1.1 [1.0-1.23]). After adjustment on confounders, time-to-pregnancy (first pregnancy) was longer in floriculturists (FR=0.7 [0.5-0.9]). In 2006, the study extended to women (398 greenhouse workers vs. 524 referents) and observed that women who had been working over 32 hours a week had a non-significant lower fecundability in comparison with women working part-time (FR adjusted=0.8 [0.6-1.0]). Primiparous and workers who picked up flowers also had a decrease in fecundability (FR=0.5 [0.2-1.2]) (82).

These results correlated with the findings from a Finnish study on the association between floriculturists and horticulturists' fertility and pesticide exposure before and during pregnancy (83). 178 couples with men working in greenhouses for one month or more between 1980 and 1990 were included and those

who applied pesticides or handled treated plants were considered as exposed. Workers who had applied pesticides only once a month or had worked with treated plants less than once a week were considered to have low exposure, while those who had sprayed at least once a week or had worked with treated plants 3 days a week were declared as highly exposed. Time to pregnancy was non-significantly longer in exposed workers in comparison with non-exposed workers: the Fecundability Density Ratio (FDR) was below unity which reflected reduced fertility (FDR = 0.8 [0.6-1.0]). This association was even stronger in primiparous women (FDR=0.4 [0.2-0.8] and FDR=0.3 [0.1-1.0] for low and high exposure respectively). Furthermore, exposure to pyrethroids was significantly associated with lower fecundability (FDR=0.4 [0.2-0.8]). A non-significant decrease in fecundability was also found with organophosphates (FDR=0.7 [0.4-1.2]) and carbamates (FDR=0.6 [0.3-1.1]).

In Italy, a comparable study was conducted in women who had worked for six months or more in floriculture at the time of conception (84). Overall, 717 women were included, and 713 pregnancies were considered for the analysis. No decrease in fecundability was observed in women exposed during the month when conception took place (HR=1.0 [0.8-1.1], 287 cases).

Another study in Italy compared fertility between 127 exposed men and 173 administrative workers (85). Greenhouse workers were classified according to the number of hours of pesticide applications per year. A significant increase in time-to-pregnancy was observed in men exposed to pesticides for more than 100 hours a year (OR=2.4 [1.2-5.1], 46 cases). In addition, analyses using the life table technique showed a statistically significant difference between the cumulative non-conception rate of the exposed vs. the unexposed workers ($p=0.006$, Mantel-Cox test), which means that greenhouse workers had a longer time-to-pregnancy than non-exposed workers.

In 2000, Abell et al. compared the time to pregnancy between floriculturists and female members of the Danish gardeners trade union (86). The duration of exposure was defined as the number of hours spent treating flowers. No difference was observed between the floriculturists and the non-exposed workers (FR=1.1 [0.9-1.4], 253 pregnancies). However, when duration of exposure was taken into consideration, time-to-pregnancy was longer in women working more than 20 hours per week (FR=0.7 [0.5-1.0], 220 cases), in those applying pesticides (FR=0.8 [0.6-1.1], 82 cases) and, more especially, in those not wearing gloves (FR=0.7 [0.5-1.0], 156 cases). Combining all these characteristics, fecundability was clearly reduced:

FR=0.6 [0.5-0.9] (202 cases). Moreover, time-to-pregnancy in floriculturists and female members of the gardeners' trade union was found to be longer in comparison with women from the general population (FR=0.8 [0.7-1.0]).

3.5.1.2. Cross-sectional study in greenspaces workers

In Colombia, the fecundability of 2,084 women who had worked in floriculture for 2 years or more before trying to get pregnant was studied, defining exposure levels with a matrix that combined work status and duration of work in floriculture (87). Exposed women had a lower rate of fecundability when compared to women who were unemployed or had another job (fecundability Odd Ratio: fOR=0.9 [0.8-1.0]), and even lower when duration of work in floriculture exceeded 2 years (fOR=0.7 [0.6-0.8]). However, the lowest ratio of fecundability was observed in non-exposed administrative workers (fOR=0.7 [0.5-1.0]).

3.5.1.3. Cohorts in greenspace workers and other pesticides applicators

A study conducted in France and Denmark on the effect of pesticides on fecundability pooled two cohorts of farmers (vine-growers and other farmers) and greenhouse workers (88). In France, exposure was defined as using pesticides during the calendar year before the birth of the youngest child (N=142), and the reference group consisted of rural workers from the same geographic area (N=220). In Denmark, the exposed workers were conventional farmers (N=326) and greenhouse workers (N=123), who were compared to organic farmers (N=123). Danish gardeners had the lowest fecundability ratio (FR=0.9 [0.6-1.2]). No individual information on pesticide use was available but the description of pesticide sales led to the conclusion that gardeners in greenhouses – with the lowest fecundability – were more exposed to fungicides, insecticides and growth regulators.

3.5.2. Adverse effects on pregnancy outcomes

3.5.2.1. Cohort studies in greenspace workers

In Equator, Handal et al. studied the reproductive history of 217 mothers working in floriculture and exposed to pesticides and the risks of adverse pregnancy outcomes between 2003-04 (89). Information about work in floriculture, duration of work during pregnancy, job activities and use of pesticides in the workplace was collected. Women who had worked in floriculture in the past 6 years had an increased risk

of spontaneous abortion (OR=2.6 [1.0-6.7]) and the increase was more pronounced if they had worked more than 3 years in floriculture within the past 6 years (OR=3.4 [1.3-8.8]).

3.5.2.2. Cohorts in greenspace workers and other pesticide applicators

In a prospective cohort study in Denmark conducted between 1997 and 2003, adverse effects on pregnancy outcomes were compared between female gardeners (N=226) and farmers (N=214), with 62,164 women working in other occupations as reference (90). Gardeners experienced the highest incidence of highly preterm births (OR=2.6 [1.1-5.9], 6 cases), but other adverse pregnancy outcomes were not significantly more frequent. Female farmers had no elevation for any risk.

3.5.2.3. Cross-sectional study in greenspace workers

In Colombia, the prevalence of adverse pregnancy outcomes among floriculturists exposed to pesticides was estimated in the 1990s (91). Adverse outcomes were compared among 8,867 workers during pregnancy and at birth in couples where one of the parents had been working in floriculture for at least six months. Exposure was considered high in workers in small companies and levels were also assigned according to the quantity of pesticides used per hectare, the type of job and tasks, and the time spent in the company. In women working in floriculture, a significant increase in spontaneous abortion (OR=2.2 [1.8-2.7]), premature birth (OR=2.9 [1.6-2.2]) and malformation (OR=1.3 [1.1-1.7]) was observed, but the highest increase in adverse outcomes was observed among those who were not occupationally exposed to pesticides (OR=3.2 [1.5-6.7]).

3.5.2.4. Case control studies in greenspace workers

In a case-control study nested the Colombian study mentioned above (91), the risk of birth defects among 222 children with parents occupationally exposed to pesticides in floriculture (443 referents) was analysed (92). Exposure levels were assigned according to the duration of work in floriculture, the size of the company, the types of job during pregnancy, a history of pesticide poisoning, and the use of personal protective equipment. Paternal exposure was statistically associated with an elevated risk of malformation (RR=1.7, $p<0.01$). Maternal exposure during pregnancy was also associated with a higher risk of congenital malformations (RR=1.8 [1.2-2.7]), especially of haemangioma (RR=6.6, $p<0.05$).

3.5.3. Adverse effects in children

3.5.3.1. Cohorts studies in greenspace workers

In the same study of Handal et al. mentioned previously, the link between maternal occupation and pesticide exposures in floriculture and neurobehavioral development in 121 infants (aged 3 to 23 months) was explored (87). Children whose mothers worked in floriculture suffered from impaired neuro-behavioural development, with a lower score in fine motor skills (-13%), higher odds of having poor visual acuity (OR=4.7 [1.1-20]), and a low score for prehension (OR=0.5 [0.2-0.9]). This result was confirmed when considering pesticide use in the workplace.

3.5.3.2. Case-control studies in greenspace workers and other pesticide applicators

In Denmark, several national databases were merged (fertility database, patient registry, malformation registry) to investigate the risk of cryptorchidism and hypospadias among boys born of parents occupationally exposed to pesticides (farmers and gardeners) (93). Compared to 23,273 control subjects from the general population, the 7,522 boys diagnosed between 1983 and 1992 were significantly more likely to have a mother working as a gardener during pregnancy (OR=1.7 [1.1-2.5]). The risk was more pronounced than for mothers working on farms (OR=1.3 [0.9-1.7]). However, definitions of the groups overlapped: greenhouse workers and market gardeners were not considered as farmers, while landscapers were in the non-exposed reference group. Father's occupation was not related to any congenital malformation. Parental occupations were considered only during conception and pregnancy, excluding previous exposures.

In the United States, a case-control study was conducted in children with a diagnosis of acute lymphoblastic leukaemia (ALL) in order to determine the role of parental occupational exposures (94). Analysing 669 children with ALL between 1995 and 2008 and 1,021 referents, no association was found with maternal exposure either during or after pregnancy. Conversely, in children whose fathers had worked in greenspaces or in nurseries, the risk of developing an ALL tended to increase (OR=1.5 [0.7-3.3], 446 cases).

Another US case-control study examined the risk of paediatric multiple sclerosis (MS) in relation to parental occupations (95). Compared to 412 healthy control subjects, 265 children with MS were twice as likely to have a father who worked as a gardener before pregnancy and before the children's first birthday (OR=2.2 [1.1-4.2], 24 cases).

In the Netherlands, the association between child neuroblastoma and parents' occupation at the time of conception, during pregnancy and throughout early childhood was analysed in a case-control study including 504 children diagnosed with neuroblastoma between 1992 and 1996 and 504 matched healthy control subjects (96). Children with neuroblastoma were twice as likely to have a father who had worked as a gardener or landscaper (OR=2.3 [1.0-5.2]). This association was not found in male farmers (OR=0.9 [0.4-1.8]), while a trend was observed in female farmers (OR=2.2 [0.6-8.8]).

In the United States, the associations between paternal occupations and 60 types of birth defects were studied in 9,998 children (birth defects diagnosed between 1997 and 2004) and 4,066 healthy control subjects (97). Children whose fathers had worked in greenspaces (three months before pregnancy until birth) had an excess risk of amniotic band syndrome (OR=1.9 [0.9-4.4], 2 cases), anencephaly (OR=1.4 [1.0-2.1], 8 cases), oesophageal atresia (OR=1.2 [0.9-1.8], 8 cases), biliary atresia (OR=1.7 [1.0-2.8], 3 cases) and total anomalous pulmonary venous return (OR=1.8 [1.2-2.8], 7 cases).

In the United Kingdom, the association between neural tube defect (NTD) and paternal occupation was investigated in 694 pregnancies with a diagnosis of neural tube defect between 1970 and 1987 (98). Paternal exposure to agrochemicals increased the risk of NTD (OR=2.7 [1.1-6.7]), in relation to the job of farmer (15 cases versus 5 control subjects) and gardener (5 cases versus 1 control subjects). Another case-control study in the United States, analysed 538 NTD cases and 539 healthy control subjects between 1989 and 1991 and found that children whose fathers were gardeners or groundsman three months before or after the conception, had a slight non-significantly increased risk of NTD (OR=1.5 [0.7-3.2], 16 cases), while the risk doubled in children of farmers (OR=2.1 [1.2-3.9], 34 cases) (99).

4. DISCUSSION

Reviewing the existing literature on the health impact of pesticide use in greenspace workers, we found 66 publications, but only 32 specifically dedicated to greenspace workers. Indeed, in many studies, these professionals were combined with farmers or other pesticide applicators such as pest control workers. Our review consequently identified six primary occupations in the literature: i.e., gardeners, golf course workers, lawn-care and municipal workers, public facilities maintenance, floriculturists and horticulturists.

4.1. Main results

As with farmers, numerous studies found an elevated risk of lymphatic and hematopoietic cancers among greenspace workers. When subtypes of leukaemia were combined (code C91-C95 ICD10), five studies showed elevated risks in women (48,50,59,68–70) and eight in men (12,31–34,36,68,69,72). Only three studies found decreased risks for men (50,59,70). Among women, three studies found an increase in the risk of multiple myeloma in greenspace workers (48,50,68), while four studies showed elevated risks in men (33,36,48,50) and two found decreased risks (12,72). For NHL, most studies concluded there was an increased risk among male (12,31,39,58,68) and female gardeners (31,58,68), although two studies contradicted these results (50,73). Results for Hodgkin lymphoma appear controversial as two studies found an elevated risk in women (50,69) and one found a decreased risk (70). In men, two studies found an elevated risk (36,50) and three found a decreased risk (69,70,72). The risk of STS appeared elevated among greenspace workers when both genders were combined in the analyses (31,62,67) and in women only (69,70). In men, two studies found an elevated risk (31,73), and three studies showed a decreased risk (66,69,70).

In women, many studies showed a lower risk for several cancer sites: oesophagus (41,43,50,69,70), pancreas, larynx, bladder (41,50,69,70), colon (41,50), liver, brain (50,69,70) and breast (41,46,50,69,70), and for some other sites (tongue, mouth, pharynx, gall bladder, nose and ovary) in a single study (50). An elevated risk was found for other sites of cancer, although in single studies (digestive organs and peritoneum (31), lip (50)). The risk of cervix cancer was found to be more elevated in two studies (69,70), while one study showed the opposite (50).

In men, the results were less consistent. Ten studies found a decrease in the risk of bladder cancer (12,33,36,41,44,50,64,69,70,75). The risk of genital organ cancers (code C60-63 ICD10) was higher in three studies (31,67,70), although differing when risks were calculated for specific sites such as prostate or testis. Indeed, three studies found significantly elevated risk for prostate cancers (12,69,70), while four showed the opposite (36,50,68,72). For testis cancers, four found an elevated risk (68–70,72), while one found a lower number of cases among gardeners (50).

Non-cancerous diseases were also reported in this review. Several studies (four studies in men (12,75–77) and two studies in women (76,77)) have pointed to a positive association between working in greenspaces

and Parkinson's disease, and suggested a dose-response relationship. Results regarding reproductive disorders also showed some consistency. Regarding men, pesticide exposure in floriculture was linked to an elevated risk of longer time-to-pregnancy (81,83,85,88), with an impact related to the duration of work. The same applies in studies focused on women's exposure (82–84,86,87). Other adverse effects on reproduction were highlighted, such as spontaneous abortion (89,91), preterm birth and malformations (90,91), and neural tube defect (98,99). Some of those studies suggested more elevated risks in greenspace workers in comparison with farmers (90,93,96) which could suggest a possible role of specific pesticides used or how they are used in this sector (materials, work environment, use of personal protective equipment etc.).

4.2. Strengths of the studies

Cohorts of workers were assembled in several countries, but only three studies were conducted exclusively among gardeners (31,32,75), one among golf-course workers (12) and two among herbicide applicators along railroad tracks (37,38). Cohort studies, especially prospective ones, are more likely to take the temporal sequence between exposure and outcome into account than case-control studies. However, most of these cohort studies were retrospective (N=33) for time-efficiency reasons. Consequently, recall bias and exposure misclassification cannot be ruled out. NOCCA cohorts included large population sample sizes of up to 15 million and therefore benefit from high statistical power. However, there is still very little information on exposure, and the risk of exposure misclassification is high. This weakness also applies to other cohorts adopting the same methodology, i.e., only using available information rather than data collected specifically for the study. In this review, 24 case-control studies were identified, a very efficient design for rare or long-latency diseases. This type of study provides good case identification with comprehensive medical diagnosis.

The study population was selected in different ways. In most studies, greenspace workers were identified through worker unions, municipalities and greenspace or floriculture companies. Thanks to company records, there was a lot of generally available information including tasks performed, number of years in the company, hours per week, and demographic information such as age and gender. Direct recruitment through companies and unions provided a good selection of subjects who had worked in greenspaces for

many years. Scandinavian countries have reliable national censuses and a unique personal number which is given to every citizen, enabling large numbers of greenspace workers to be identified (both male and female) and, consequently, investigation of specific health issues with high statistical power (87,94). Some studies also included workers based on their licence to use pesticides (71,72).

In terms of exposure assessment, many studies only relied on job title. However, some used additional information from questionnaires or company records to assign exposure levels, such as gender (31), year of birth (32,75), number of years in the company (39,60,72,74,80,89), number of days of exposure (35–38), number of hours worked per week or per month (81,82,86,91,100), tasks performed (73,81–83,86,87,91), types of pesticide used (37,38,72,78), use of personal protective equipment (83,86), and size of the company (91). When individuals were identified on the basis of their licence to use pesticides, the age when the licence was first granted was used to calculate the duration of exposure (69–71). In other studies, exposure assessment was based on data derived from job-exposure matrices, suitable when only the job and/or the industry is known, or in very large studies. Moreover, job-exposure matrices make it possible to consider multiple exposures for a given job.

To determine health status, cancer registries were the most main source of information (31,32,37,38,40,41,43–50,58,61–63,66–70,73), followed by hospital registries (60,74,76,80,83,90,93–97,99) and death certificates (33–36,51,69–72,78,79). These sources of information are considered reliable and provide comprehensive identification of all cancers or deaths, reducing information bias related to self-reporting health status. However, questionnaires were usually the only source of information for non-cancerous health outcomes, such as on fecundability, adverse reproductive outcomes and birth defects (81,82,84–89,91,92,100), and Parkinson's disease (77).

4.3. Limitations of the studies

Pesticide exposure was frequently implied by job title and/or industry. However, classification of greenspace workers and floriculturists for exposure to a specific pesticide through a 'yes' or 'no' answer remains approximate. Information on individual exposure and work conditions, such as the use of protective equipment, tasks, number of hours worked in contact with pesticides, would be more accurate. The same applies to studies using licences as a proxy. In several countries, the licence is mandatory for all

entities engaged in applying pesticides, with variations in the period of validity of the licence. Studies using the licence as a surrogate for exposure assessment assume that workers used pesticides throughout the period of licence validity, which could lead to exposure misclassification. Some studies combine job title and/or licence information with data on sales or the quantity of products used by companies or municipalities. This can help to improve the classification in relation to exposure levels. Studies that base their exposure assessment on information derived solely from job title or pesticide licence might miss past exposure in other jobs and complex professional careers could not be taken into account. As the latency period between exposure and onset of the cancer can be long, especially for solid tumours, this represents a serious limitation. However, collecting information on past exposure is a real challenge as commercial products and practices fluctuate over time. Pesticide applicators in general are also exposed to a very high number of diverse active substances, adjuvants, and different associations. Systematic traceability of product use can be incomplete and may depend on the activity sector.

Some studies assess exposure through questionnaires which leads to dichotomous classification (“exposed” vs. “non-exposed”) or level classification (“low”, “medium” and “high” exposure). This type of classification also remains highly imprecise as it does not take into account protective equipment, spraying equipment, or even the specific molecules applied. Few studies asked the participants which pesticides they have used. On the other hand, this type of method is likely to be biased as it mostly relies on memory. This method is even more complicated for employees in plant nurseries, greenhouses or municipalities who might not even know what kind of pesticides they used or were exposed to. In most of our review studies, there is a general lack of data on individual exposure. Information on the dose, type of pesticide, equipment and tasks performed are generally incomplete, making it difficult to compare studies. Job definition can also differ from one study to another, and in some cases is also incomplete (e.g., the type of culture can be missing for horticulturists or nurserymen). Five studies from the NOCCA cohort used “gardeners” as a denomination, but only Pukkala et al. (2009) clearly stated the ISCO code used. Two other Scandinavian studies outside the NOCCA project also used the term “gardeners”, although without defining it. Moreover, in most studies, greenspace workers were associated with other pesticide applicators such as farmers, pest-control operators or foresters.

Another important limitation is that information on the tasks performed by workers is often missing, even though the work varies and is associated with very different levels of exposure. This is likely to generate inconsistencies. For instance, one of the studies found that floriculturists had a higher risk of adverse pregnancy outcomes, but the highest odds ratios were seen for clerical workers who were less likely to be exposed than field floriculturists. Field studies have demonstrated that some tasks involve more exposure than others, such as spraying pesticides (82) and handling plants and flowers after treatment (83).

Our review highlighted several positive associations between pesticide exposure in greenspaces and specific cancer sites, Parkinson's disease and reproductive disorders. However, uncertainty remains in several cancer sites, especially among men. These include oesophagus, stomach, rectum, colon, liver, pancreas, kidney, lung, prostate, testis, thyroid, skin and brain cancers.

As the data regarding health outcomes were mostly collected through cancer registries or death certificates, information regarding potential confounding factors is often missing. Only 27 studies (15 case-control studies and 12 cohorts) included them in the analyses. More specifically, information on occupational exposure – other than pesticides - was considered in only 25 studies. Adjustment for tobacco consumption, for instance, was performed in only 13 studies (58,61–63,74,80,84–86,88,97,99) and alcohol consumption in only five studies: four assessing birth defects among workers (61,84,90,95) and one studying oesophagus cancer (74). Moreover, known risk factors for hematopoietic cancer, such as history of chemotherapy or radiation treatment, BMI, presence of genetic diseases or exposure to other pollutants, were not considered. All these shortcomings could have led to bias in the measurement of associations.

5. CONCLUSION

In this review, the studies indicated associations between the greenspace sector and several health outcomes such as lymphatic and hematopoietic cancers (such as NHL, HL, leukaemia, MM and STS), Parkinson's disease, and some adverse effects on reproduction. Other health outcomes are questioned, but the studies remain controversial. Better knowledge of pesticides exposure in greenspace workers is crucial for studies on their health, since many studies used rough parameters to define exposure, like job title or holding a pesticide-use license. To better understand the role of pesticide exposure in the onset of diseases among greenspace workers, further research based on more precise assessment of exposure is

needed. In addition, other occupational exposure should also be assessed to determine the role of each exposure on the onset of diseases. Further studies should also gather information on sociodemographic characteristics, occupational histories and life habits in order to have a better understanding of this population and adjust results on potential cofounders when needed.

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Figure 1: Flow diagram of study selection

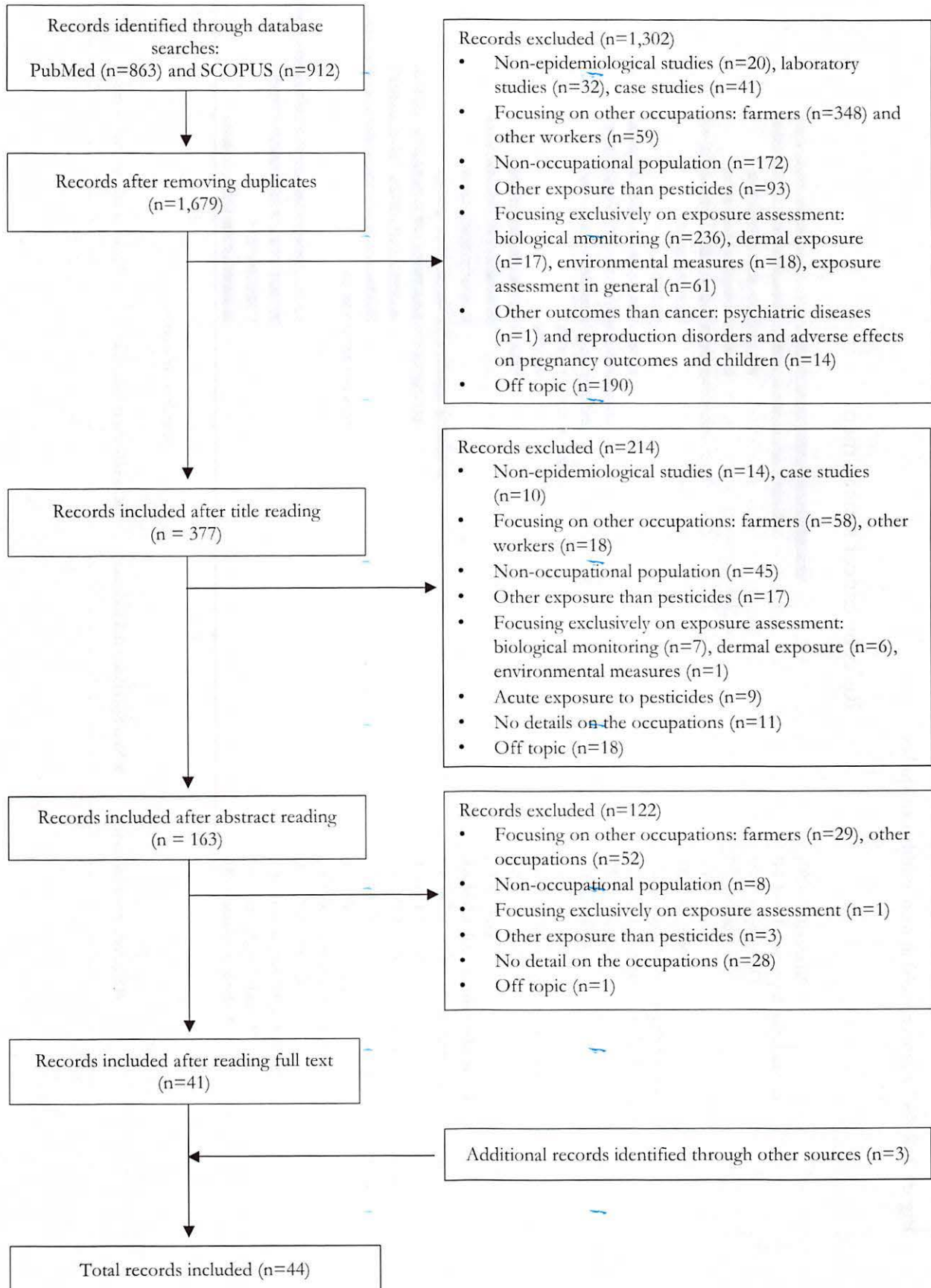


Figure 2: Risks by cancer site(s) in men: number of studies

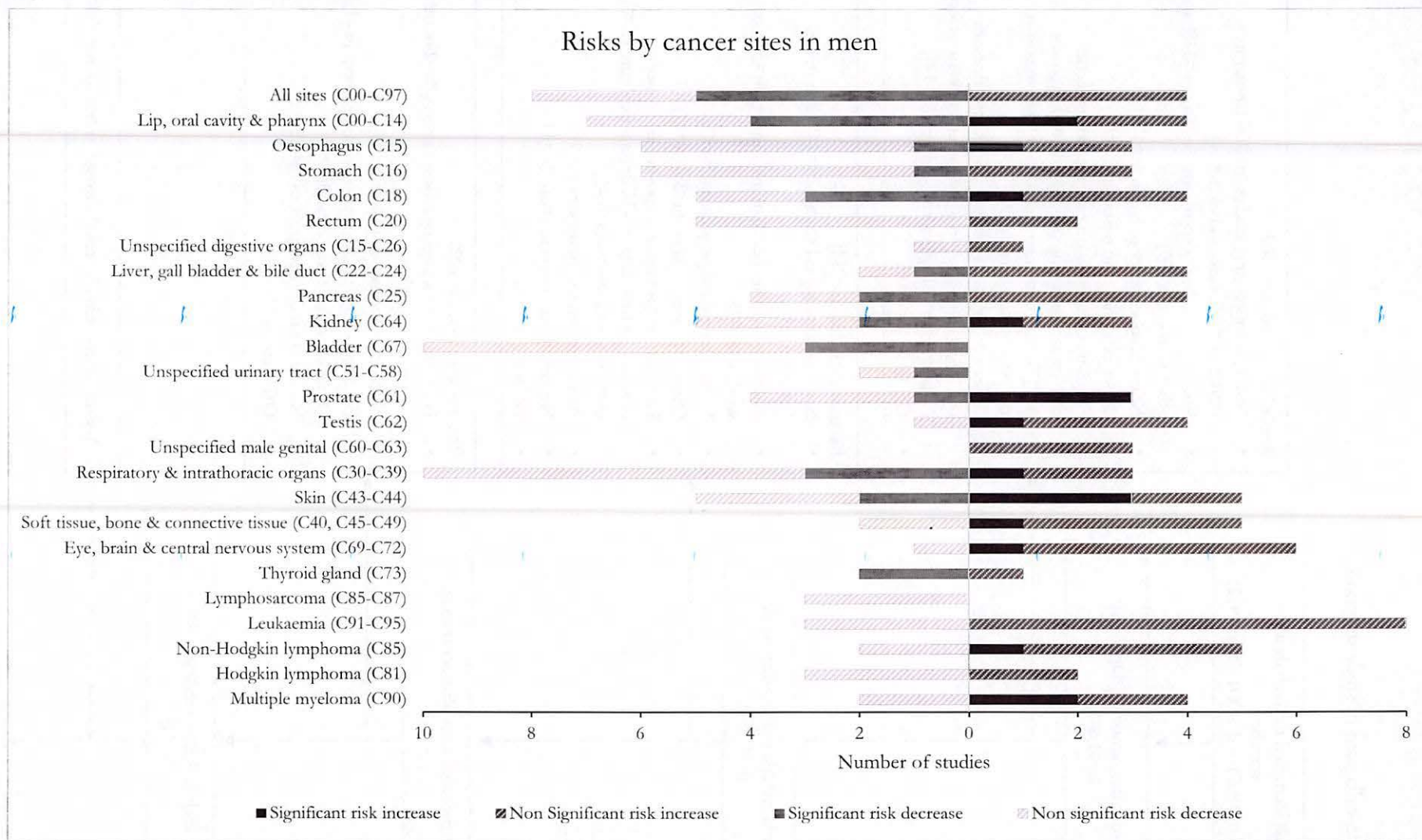


Figure 3: Risk by cancer site(s) in women: number of studies

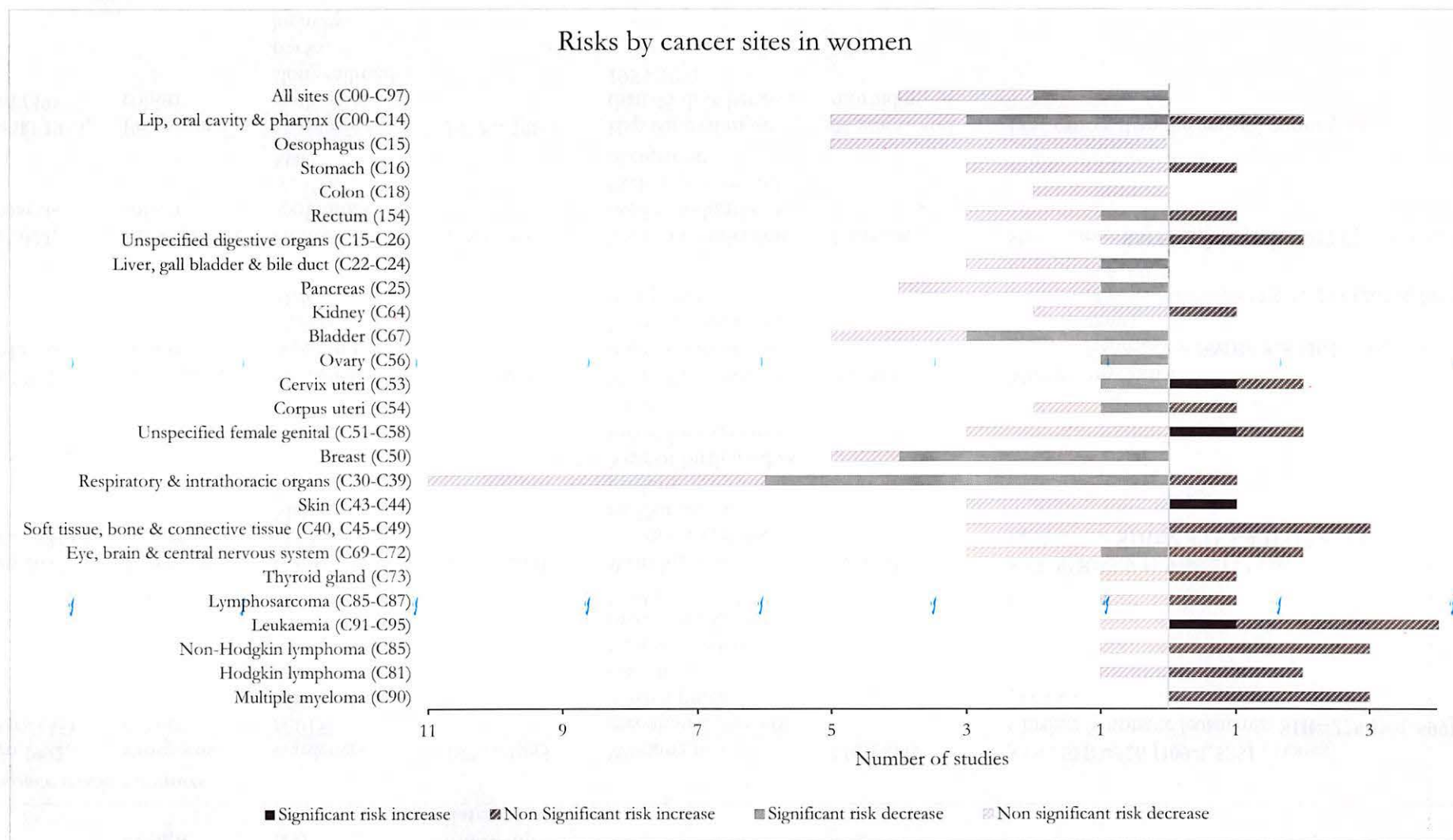


Table 1: Studies assessing cancer risk among greenspace workers and affiliated pesticide applicators

First author	Study design	Population (N)	Inclusion and follow-up dates	Exposure	Health Effects	Main results	R b.
<i>Greenspace worker cohorts</i>							
Hansen 1992, Denmark (35)	Prospective cohort	Gardeners (4,015) Male and female	1975 - 1985	Working in a greenhouse, nursery and/or public gardens Gender used as proxy for exposure levels	Morbidity	STS ^a : SIR=526 [109-1,538] (3 cases) Chronic lymphatic leukaemia: SIR=275 [101-599] (6 cases)	H
Hansen 2007, Denmark (36)	Prospective cohort	Gardeners (3,156) Male	1975 - 2001	Working in a greenhouse, nursery and/or public gardens Year of birth used as proxy for exposure levels	Morbidity	STS: SIR=5.9 [1.9-18.2] (3 cases) Leukaemia: SIR=2.3 [1.3-4.1] (12 cases)	M
Swaen 1992, Netherlands (37)	Retrospective cohort	Herbicide applicators (1,341) Male	1980-1988	Year of certification used as indicator of likely exposure and occupation	Mortality	Multiple myeloma: - Entire cohort: SMR=815 [164-2,382] (3 cases) - Higher exposition: SMR=1,299 [261-3,795] (3 cases)	H
Swaen 2004, Netherlands (38)	Retrospective cohort	Herbicide applicators (1,341) Male	1980 - 2001	Year of certification used as indicator of likely exposure and occupation	Mortality	Skin cancer: SMR=357.4 [115.1-827.0] (5 cases)	H
Riihimäki 1983, Finland (39)	Prospective cohort	Herbicide applicators along railroad tracks, highways,	1972 – 1980	Exposure of more than 45 days between 1955-1971	Mortality and morbidity	Less cancer than the general population	H

Asp 1994, Finland (40)	Prospective cohort	electric lines and forests (1,971) Herbicide applicators along railroad tracks, highways, electric lines and forests (1,909) Male	1972 – 1988	Exposure of more than 45 days between 1955-1971 Questionnaires on exposure after 1972	Mortality and morbidity	<i>All cancer:</i> SMR=0.8 [0.7-1.0] (77 cases) <i>Prostate: SIR=0.3 [0.1-0.8]</i> (5 cases)	M
Axelsson, 1974, Sweden (41)	Retrospective cohort	Herbicide applicators on railroad tracks (348) Male	1957 - 1972	Exposure > 45 days between 1957 and 1972 Amitrol and phenoxy herbicides	Mortality and morbidity	<i>Amitrol exposure:</i> - Lung: obs > exp (p<0.03) (2 cases) - Tumours: obs > exp (p<0.03) (4 cases) <i>Exposure to every herbicide:</i> Tumours: obs > exp (p<0.03) (15 cases)	H
Axelsson, 1980, Sweden (42)	Retrospective cohort	Herbicide applicators on railroad tracks (348)	1957 - 1978	Exposure > 45 days between 1957 and 1972 Amitrol and phenoxy herbicides	Mortality	<i>Amitrol & phenoxy exposure:</i> - Mortality: RR=2.1 (p<0.01) (15 cases) - Cancer: RR=3.4 (p<0.005) (6 cases) <i>Phenoxy exposure:</i> - Stomach: RR=6.1 (p<0.05) (2 cases)	H
Zahm 1997, USA (43)	Retrospective cohort	Pesticide applicators on lawns (18,576) Male and female	1969 - 1990	Working in a lawn care company	Mortality	<i>Worked more than 3 years:</i> - NHI ^b : SMR=7.1 [1.8-28.5] (2 cases)	H
Kross, 1996, USA (12)	Retrospective cohort	Golf course superintendents (686) Male	1970-1992	Working on a golf course	Mortality	<i>Cancers:</i> - All cancers: PMR=135 [121-151] (203 cases) - Brain: PMR=234 [121-454] (8 cases) - NHL: PMR=237 [137-410] (12 cases) - Large intestine: PMR=175 [125-245] (32 cases)	H

- Prostate: **PMR=293 [187-460]** (18 cases)
- Nervous system: **PMR=202 [123-333]** (15 cases)

Scandinavian cohorts based on population census and considering greenspace workers

Pukkala 2009 Scandinavian countries (44)	Retrospective cohort	NOCCA cohort Workers (15 million) Male and female	1960 – 2005	Job title	Morbidity	Gardeners: <i>Lip cancers: SIR=1.6 [1.5-1.7]</i> (677 cases)	M
Kjaerheim 2010, Scandinavian countries (45)	Retrospective cohort	NOCCA cohort Male and female	1960 – 2005	Job title	Avoidable cancers - morbidity	Gardeners: all SIR < 1	M
Kjaerheim 2018, Scandinavian countries (46)	Retrospective cohort	NOCCA cohort Male and female	1960 – 2005	Job title	Morbidity (adjusted on alcohol and tobacco use)	Gardeners: all SIR ≤ 1	M
Jansson 2015, Scandinavian countries (47)	Retrospective cohort	NOCCA cohort Male and female	1960 – 2005	Job title	Oesophageal adenocarcinoma and squamous- cell carcinoma - morbidity	Gardeners: all SIR<1	M
Hadkhale 2016, Scandinavian countries (48)	Retrospective cohort	NOCCA cohort Male and female	1960 – 2005	Job title	Bladder cancer - morbidity	Gardeners male/female: SIR=0.8 [0.8-0.8] / 0.8 [0.7-0.8] (3,162 cases)	M
Michalek 2018, Scandinavian countries (49)	Retrospective cohort	NOCCA cohort Male and female	1960 – 2005	Job title	Renal pelvis cancer – morbidity	Gardeners male/female: SIR=0.8 [0.6-0.9] / 0.7 [0.5-0.9] (52 cases)	M
Katuwal 2018, Scandinavian countries (50)	Retrospective cohort	NOCCA cohort Female	1960- 2005	Job title	Breast cancer - morbidity	Gardeners: - <i>By country</i> , all SIR < 1 except for Iceland: SIR=1.1 [0.3-2.7] (4 cases)	M

Ji 2006, Sweden (51)	Retrospective cohort	Workers (6.1 million) Male and female	1961 - 2002	Job title	Stomach cancer - morbidity	Gardeners male/female: - <i>Gastric cancer</i> : SIR=1.0 [0.9-1.1] (329 cases)/ 0.9 [0.7-1.2] (65 cases) - <i>Corpus cancer</i> : SIR=1.0 [0.8-1.1] (159 cases)/ 0.9 [0.6-1.2] (33 cases) - <i>Cardia cancer</i> : SIR=1.2 [0.9-1.6] (42 cases)/ 0.7 [0.2-1.5] (5 cases)	N
Lope 2008, Sweden (52)	Retrospective cohort	Workers (2,992,166) Male and female	1971 – 1989	Job title	Multiple myeloma - morbidity	Horticultural workers (male): - <i>Entire cohort</i> : RR=1.3 [0.9-1.8] (35 cases) - <i>Subcohort 1960-70</i> : RR=1.4 [0.8-2.4] (13 cases) Agricultural, horticultural and forestry enterprisers (female): - <i>Entire cohort</i> : RR= 1.7 [1.0-2.9] (13 cases) - <i>Subcohort 1960-70</i> : RR=1.8 [0.7-4.8] (4 cases)	N
Pérez-Gomez 2005, Sweden (55)	Retrospective cohort	Workers (1,101,669) Female	1960-1989	Job title	Cutaneous melanoma - morbidity	Horticultural workers: - <i>Entire cohort</i> : RR=1.6 [1.1-2.3] (30 cases)	N
Andersen 1999, Scandinavian countries (56)	Retrospective cohort	Workers (10 million) Male and female	1970-1991	Job title	Morbidity	Gardeners all SIR ≤ 1 except for (male/female): - <i>Lip</i> : SIR= 165 [145-187] (232 cases) - / 111 [82-149] (46 cases) - <i>HL</i> : SIR=102 [80-129] (71 cases)/ 110 [88-136] (85 cases) - <i>MM</i> : SIR=110 [95-128] (176 cases)/ 103 [91-115] (277 cases) For female only: - <i>Acute leukaemia</i> : SIR=105 [90-121] (177 cases) - <i>Other leukaemia</i> : SIR=102 [90-117] (210 cases)	N

Cohorts studies based on population census and considering greenspace workers

Gallagher 1986, Canada (57)	Retrospective cohort	Death certificates of workers (626) Male and female	1950 – 1978	Job title	Melanoma - mortality	Gardeners and nursery workers: - <i>Males 20 and over: PMR=430 [157-937]</i> (6 cases)	H
<i>Case-control studies considering greenspace workers</i>							
Perrotta 2013, Consortium (63)	Meta-analysis of case-control studies	1,959 cases – 6,192 control subjects	1977 – 2004	Job title	Multiple myeloma - morbidity	Gardeners and nursery workers: OR=1.5 [1.0-2.3] (121 cases)	H
Mannetje 2007, New Zealand (64)	Case-control	291 cases – 471 control subjects from the general population	1977 – 2004	Job title	NHL - morbidity	Gardeners and nursery workers (all/male/female) - OR=1.3 [0.6-2.6] (17 cases)/ 0.8 [0.3-1.9] / 2.5 [0.9-9.4] (8 cases) Nursery grower (all/male/female) - OR=3.2 [1.0-9.7] (10 cases)/ 1.8 [0.4-8.5] / 5.2 [1.0-28.0] (6 cases) Horticulture and fruit growing (all/male/female) - OR=2.3 [1.4-3.8] (41 cases)/ 1.6 [0.8-3.3] (17 cases)/ 3.2 [1.5-6.6] (24 cases)	N
McLean 2008, New Zealand (65)	Case-control	225 cases – 471 control subjects from the general population	2003-2004	Job title	Leukaemia - morbidity	Gardeners and nursery workers (all/male/female) - OR=1.5 [0.7-3.0] (15 cases)/ 0.7 [0.3-1.8] (7 cases)/ OR=5.0 [1.4-18.6] (8 cases) Horticulture and fruit growing (all/male/female) - OR=2.6 [1.5-4.6] (32 cases)/ 1.4 [0.7-3.1] / 4.7 [2.1-10.6] (19 cases)	N
Parent 2000, Canada (66)	Case-control	142 cases – 1,900 control subjects with other cancer + 533 control subjects from the general population	1979 – 1985	Job titles	Renal cell carcinoma - morbidity	Nursery workers (gardening): OR=4.1 [1.7-10.3] (6 cases)	M

Partanen 1994, Finland (67)	Case-control	1,419 cases – 3,519 control subjects with stomach, colon or rectum cancer	Diagnosed between 1984–87 and dead by 1990	Job title and sector of activity	Pancreatic cancers - morbidity	By industrial branch: - <i>Gardening</i> : OR=4.0 [1.4-11.8] (8 cases) By job title: - <i>Gardeners/groundsmen</i> : OR=3.6 [1.1-12.0] (5 cases)	H
Wingren 1990, Sweden (68)	Case-control	71 cases – 164 control subjects with other cancer + 315 from the general population	1975 – 1982	Job title and job exposure matrix for herbicide exposure (phenoxy acids and chlorophenols)	STS – morbidity & mortality	Gardeners (cases vs control subjects from the general population): OR=4.1 [1.0-14.0] (6 cases)	M
Teschke 1997, Canada (69)	Case-control	153 cases – 159 control subjects from the general population	1990 – 1992	Job title	Nasal and bladder cancers - morbidity	Gardeners, nasal cancer: - <i>Ever employed</i> : OR=2.9 [0.4-19.8] (3 cases) - <i>Most recent 20 years removed</i> : OR=2.0 [0.2-16.1] (2 cases) Gardeners, bladder cancer: - <i>Ever employed</i> : OR=3.7 [0.7-25.0] (6 cases) - <i>Most recent 20 years removed</i> : OR=2.7 [0.5-19.8] (5 cases)	M
Colt 2010, USA (70)	Case-control	1,402 cases – 1,418 control subjects from the general population	2001 – 2004	Job title and sector of activity	Bladder cancer - morbidity	Occupation: <i>Groundskeepers and gardeners (men)</i> : OR=0.8 [0.5-1.4] (31 cases) Industry: <i>Landscape and horticultural services (men)</i> : OR=2.4 [1.2-4.8] (25 cases)	M
Marehbian 2007, USA (71)	Case-control	889 cases – 524 control subjects from the area	1994 – 1995	Job title	Keratinocyte cancer (BCC ^c & SCC ^f) - morbidity	Groundskeepers and gardeners: - <i>BCC male/female</i> : OR=3.2 [1.5-6.8] (37 cases) / 0.3 [0.0-4.0] (1 case) - <i>SCC male</i> : OR=3.3 [1.4-7.8] (16 cases)	M
<i>Cohorts pooling greenspace workers and other pesticide applicators</i>							
Littorin 1993, Sweden (72)	Retrospective cohort	Farmers, gardeners, foresters &	1965 - 1986	Name and code of occupation	Mortality et morbidity	Under the age of 60: - <i>Tumours in the central nervous system</i> : SMR=2.9 [1.1-6.2] (6 cases)	M

		arborists (2,378) Male and female				<ul style="list-style-type: none"> - Brain tumours: SMR=3.2 [1.6-5.7] (11 cases) - Meningiomas: SMR=6.8 [1.9-17.4] (4 cases) 	
Zhong 1996, Iceland (73)	Prospective cohort	Horticulturists, orchardists and farmers (2,449) Male and female	Inclusion date between 1941 and 1985. Follow-up ending in 1993	Occupation (pesticide applicators considered to have the highest exposure)	Morbidity	Entire cohort: <ul style="list-style-type: none"> - Melanomas: SMR=2.1 [1.2-3.5] (15 cases) Entire cohort: <ul style="list-style-type: none"> - For women, lymphatic and hematopoietic tissues: SIR=5.6 [1.1-16.2] (3 cases) - For men and women, rectum: SIR=2.9 [1.1-6.4] (6 cases) Most exposed group: <ul style="list-style-type: none"> - Rectum: SIR=4.6 [1.5-10.8] (5 cases) 	H
Fleming 1999a, USA (74)	Retrospective cohort	Pesticide applicators (30,155) Male and female	1975-1993	Holding a licence used as indicator of likely exposure	Mortality	Prostate cancer: <ul style="list-style-type: none"> - Overall cohort: SMR=2.4 [1.4-3.0] (64 cases) - Exposed < 4 years: SMR=2.6 [1.6-4.0] (21 cases) 	H
Fleming 1999b, USA (75)	Retrospective cohort	Pesticide applicators (33,658) Male and female	1975 - 1993	Holding a licence used as indicator of likely exposure	Morbidity	Male: <ul style="list-style-type: none"> - Prostate: SIR=1.9 [1.7-2.1] (353 cases) - Testis: SIR=2.5 [1.6-3.7] (23 cases) Female: <ul style="list-style-type: none"> - All genital organs: SIR=2.1 [1.3-3.1] (23 cases) - Cervix: SIR=3.7 [1.8-6.6] (11 cases) 	H
Blair 1983, USA (76)	Retrospective cohort	Pesticide applicators (3,827) Male and female	1965 - 1977	Year of pesticide certification used as indicator of likely exposure	Lung cancer - mortality	Certified for more than 20 years: <ul style="list-style-type: none"> - Lung cancer: SMR=289 ($p<0.05$) (8 cases) Certified between 10 and 19 years: <ul style="list-style-type: none"> - Emphysema: SMR=321 ($p<0.05$) (5 cases) Certified before the age of 40: <ul style="list-style-type: none"> - Lung cancer: SMR=234 ($p<0.05$) (11 cases) 	H
Pesatori 1994, USA (77)	Retrospective cohort and	Pesticide applicators (4,251)	1965 - 1982	Year of pesticide certification used as	Lung cancer – mortality	Entire cohort:	M

nested case-
control

Male and
female

indicator of likely
exposure

- *Lung cancer: SMR=1.4 [1.0-1.8] (54 cases). Increased with the number of years exposed: >20 years: SIR=2.2 [1.1-3.0] (13 cases)*

Case-control study:

- *Licensed < 40yo: OR=2.4 [1.0-5.9] (27 cases)*
- *Carbamate exposure: OR=16.3 [2.2-122.5] (7 cases) and propoxur: OR=12.4 [1.5-100.3] (2 cases)*

Case-control studies considering greenspace workers pooled with other pesticide applicator

Balarajan, 1984, United Kingdom (78)	Case-control	1,961 cases – 1,961 control with another type of cancer Male	1968 – 1976	Name and code of occupation	STS – mortality	Gardeners and groundmen: RR=0.7 [0.4-1.4] (17 cases) Farmers and orchardists: RR=1.7 [1.0-2.9] (42 cases)	H
Woods, 1987, USA (79)	Case-control	704 cases – 694 control subjects from the general population		Name and code of occupation Occupation used as an indicator of likely herbicide exposure	STS and NHL – morbidity	Landscapers (low exposure): - STS: OR=0.9 [0.3-2.8] * - NHL: OR=1.7 [0.9-3.1] * Gardeners (medium exposure): - STS: OR=1.1 [0.5-2.2] * - NHL: OR=0.8 [0.5-1.4] *	N
Huang 2012, Taiwan (80)	Case-control	326 cases – 386 healthy control subjects from the Department of Preventive Medicine Male	2000 – 2005	Working in one of the 33 occupations whose environments are known to have potential exposure to hazards related to cancer development	Oesophageal cancer – morbidity	Farmers or gardeners: OR adj = 2.1 [1.0-4.2] (46 cases)	N

^a Soft Tissue Sarcoma

^b Non-Hodgkin's Lymphoma

^c Hodgkin's lymphoma

^d Multiple Myeloma

^e Basal Cell Carcinoma

^f Squam Cell Carcinoma


* No data available on the number of cases

Table 2: Studies assessing neurological and psychiatric diseases

First author	Study design	Population (N)	Inclusion and follow-up dates	Exposure	Health Effects	Main results	Ref.
<i>Cohorts in greenspace workers</i>							
Kenborg, 2012, Denmark (81)	Retrospective cohort	Gardeners (3214) Male	1975 - 2008	Year of birth used as proxy for exposure levels	Parkinson	Entire cohort: SHR=1.1 [0.8-1.6] (28 cases) Born between 1900-14: SHR=1.6 [0.8-2.8] (11 cases)	M.
<i>Cohort in greenspace workers and other pesticide applicators</i>							
Tüchsen, 2000, Denmark (82)	Prospective cohort	Farmers, horticulturists & gardeners (2 273 872) Male and female	1981 – 1993	Name and code of occupation	Parkinson	Farmers: SHR=132 [111-156] (134 cases) Gardeners: SHR=448 [54-1617] (2 cases)	M.
<i>Case-control studies in greenspace workers and other pesticide applicators</i>							
Hertzman, 1994, Canada (83)	Case-control	127 cases – 245 control subjects (with cardiac disease or from the gen. pop.)	1988	Name and code of occupation Use of pesticides and solvents Classification of pesticides by chemical group	Parkinson	Entire cohort: - <i>Comparison with cardiac controls:</i> OR=2.0 [1.0-4.1] (33 cases) - <i>Comparison with the gen. pop.:</i> OR=2.3 [1.1-4.9] (33 cases) Gardeners: OR=1.7 [0.9-3.4] (39 cases)	H.
Chen, 2018, New-Zealand (84)	Case-control	295 cases – 605 control subjects from the gen. pop.	2013-2016	Name and duration of occupation	Motor neuron disease	Gardeners/horticulturists: OR=2.0 [1.0-3.8] (20 cases) > 10 yrs of exposure: OR=4.5 [1.3-16.3] (7 cases) Grounds/green keepers: OR=3.0 [1.1-8.0] (12 cases)	M.

Health problems in agricultural workers occupationally exposed to pesticides

Problemas de saúde identificados em trabalhadores rurais expostos ocupacionalmente a agrotóxicos

Mariana Portela **de-Assis**¹ , Raquel Cristine **Barcella**¹, Janaína Chiogna **Padilha**¹, Hildegard Hedwig **Pohl**¹, Suzane Beatriz Frantz **Krug**¹

Abstract | Agricultural workers are susceptible to several health problems as a result of occupational exposure to toxic substances, especially pesticides. The aim of this review was to describe the health issues associated with occupational exposure to pesticides in agricultural workers. A descriptive study, in the form of an integrative literature review, was conducted based on articles retrieved from the LILACS, SciELO and PubMed databases, published between January 2015 and October 2018. The searches were conducted using the keywords “pesticides,” “workers’ health,” “occupational exposure” and “agricultural workers.” The study was guided by the following research question: what health problems do agricultural workers experience as a result of occupational exposure to pesticides? The screening process led to the selection of 35 studies performed in several countries and continents, all of which shed light on the vulnerability of agricultural workers, especially due to the misuse of personal protective equipment and lack of knowledge about the correct use of these devices. The studies investigated a variety of health issues, and most reported a positive association between these conditions, which include cancer, and the use of pesticides. Educational and preventive measures must be implemented to promote the health of rural workers. Furthermore, it is crucial that governments play an active role in these initiatives and provide alternatives to pesticides for pest control.

Keywords | occupational health; occupational exposure; agricultural workers; pesticides.

Resumo | Os trabalhadores rurais encontram-se suscetíveis a diversos problemas de saúde na execução de suas atividades laborais, decorrentes da exposição a agentes tóxicos, principalmente pelo uso de agrotóxicos. O objetivo deste estudo foi escrever os agravos à saúde relacionados à exposição ocupacional a agroquímicos em trabalhadores rurais. Estudo de caráter descritivo caracterizado como revisão integrativa da literatura foi realizado utilizando-se como fonte de dados artigos publicados em periódicos indexados nas bases LILACS, SciELO e PubMed, referente ao período de janeiro de 2015 a outubro de 2018, com os seguintes descritores em saúde: “agrotóxicos”, “saúde do trabalhador”, “exposição ocupacional” e “agricultores”. A questão norteadora a ser atendida foi: quais os problemas de saúde identificados em trabalhadores rurais devido à exposição ocupacional a agrotóxicos? A seleção de artigos resultou em 35 estudos realizados em vários países e continentes do mundo, nos quais é predominante a evidência da vulnerabilidade de trabalhadores rurais, sobretudo referente ao mau uso dos equipamentos de segurança individual e ao desconhecimento da correta utilização deles. Vários problemas de saúde foram investigados, e, na maioria dos estudos, houve relação positiva entre o uso de agrotóxicos e o desenvolvimento desses problemas, inclusive com neoplasias. Ações educativas e de prevenção devem ser tomadas, enfocando a promoção da saúde do trabalhador rural. Além disso, é fundamental que o governo tenha participação efetiva nessas ações e proporcione alternativas ao combate de pragas com agrotóxicos.

Palavras-chave | saúde do trabalhador; exposição ocupacional; agricultores; agrotóxicos.

¹ Programa de Pós-Graduação em Promoção da Saúde, Universidade de Santa Cruz do Sul, Santa Cruz do Sul, RS, Brazil.

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INTRODUCTION

Most health-related initiatives in Brazil are linked to the Unified Health System (SUS), which oversees and regulates these practices through ordinances and public policies. Issues associated with occupational health are guided by the National Workers' Healthy Policy, established by Ordinance No. 1.823, issued August 23, 2012.¹ As can be gleaned from its publication date, this policy has not been in place for long. Occupational health surveillance is an important tool for addressing workers' health issues, since it provides an understanding of the occupational environment and the risk factors to which workers are exposed in their professional activities, all of which can be harmful to their health. These observations underscore the need for interventions to improve workplace health and safety. As such, workers' health surveillance contributes to the promotion of interdisciplinary strategies to improve quality of life at work.²

Agriculture plays an important role in the economy of most countries and in the lives of local populations, since it provides stable jobs and a steady income to many families.³ Yet agricultural workers are also exposed to several health hazards as a result of their professional activities, including ultraviolet radiation; exhaust toxicity; inhalation of organic dust from spores and minerals when handling feed; exposure to microorganisms such as viruses, bacteria and infectious parasites, and their toxic products; as well as pesticides, which are among the greatest potential hazards to the health of agricultural workers.^{3,4}

Pesticides comprise over one thousand chemical compounds used in agriculture to prevent, eliminate or control insects, weeds and fungal diseases.^{5,6} Given the widespread use of these substances to increase productivity, reduce the need for labor and manage plant diseases, all agricultural workers are likely to have at least some exposure to pesticides during their occupational activities. Pesticide contamination can have acute and chronic effects on exposed individuals, ranging from mild toxicity to neurotoxicity and even death.⁷ Pesticides have been associated with neurological, endocrine, psychological, immunological, respiratory, hematological, skin, kidney and liver issues,

as well as fetal malformation.⁸ In tropical countries, pesticides can remain in the soil and water for a period of 1 to 2 months depending on temperature, sunlight and the presence of microorganisms, increasing the risk of contamination for workers and all other individuals who live in areas where these products are used.^{4,9-11}

Brazil is one of the largest consumers of pesticides in the world, accounting for 86% of the pesticides used in Latin America.^{8,12,13} Currently, the country is experiencing significant changes in this sector due to the approval of Bill No. 6.299/2002 by the Chamber of Deputies. The bill modifies the criteria for approval, risk analysis and nomenclature of pesticides, allowing the indiscriminate use of pesticides, to the detriment of population health and in sharp contrast with the experience of developed countries in the European Union as well as the United States.^{12,14} The State has the duty to provide the population with comprehensive, universal and equitable health care. As such, it is also responsible for the oversight of initiatives implemented by employers in order to protect workplaces and residences. The environment can have a significant effect on workers' physical, mental and social well-being. A major issue that affects the environment, in addition to health and work, is pesticide use and its repercussions on worker health.¹⁵

Given the importance of this issue and the need to understand the health impact of pesticides, we performed a search of the national and international literature to identify studies that discuss the health effects of occupational exposure to pesticides in agricultural workers.

METHOD

An integrative literature review was conducted based on articles in journals indexed in the LILACS, SciELO and PubMed databases, published between January 1, 2015 and October 31, 2018. The searches were carried out using the following keywords: pesticides, workers' health, occupational exposure and agricultural workers. This study was guided by the following research question: what health problems do agricultural workers experience as a result of occupational exposure to

pesticides? Data were collected in October 2018. The inclusion criteria were scientific articles with full-text available online and open access publication in Spanish, English and Portuguese. Duplicate articles and those that did not address the research question were excluded from the review. The study selection process involved screening the titles of the studies retrieved by the literature search, followed by abstract screening and, if necessary, full-text reading to exclude any studies that did not cover the topic of the present review. The articles selected were then read in full and analyzed descriptively.

RESULTS AND DISCUSSION

The database search retrieved 155 articles with the selected keywords. The study selection flow diagram is shown in Figure 1.

The data were extracted and entered into Table 1, which contains information on the following characteristics of the articles reviewed: authors, title, objectives, methodological design and main findings.

Agricultural workers are exposed to a series of physical, chemical and biological health hazards during their professional activities. Pesticides are widely used to increase crop yield in these settings, but the absence of prior assessment, an effective cost-benefit analysis, and evaluations of the amount and time of application result in a significant risk to the health of workers. The lack of assessment of agricultural workers, combined with the negligent attitude of some governments, aggravate the risks of chemical exposure for agricultural workers, who are often unaware of these issues, much like the health care workers they eventually seek, often when their healthy is already severely compromised.^{6,11,40,41} Studies show that agricultural workers tend to consume less alcohol and tobacco than workers in other occupations; their work activities also include regular moderate-intensity physical activity, which contributes to lower morbidity and mortality rates than observed in the general population. Yet pesticide handling exposes these workers to a number of other illnesses, as demonstrated by studies performed in several countries where pesticides are used in agriculture.^{4,21,30}

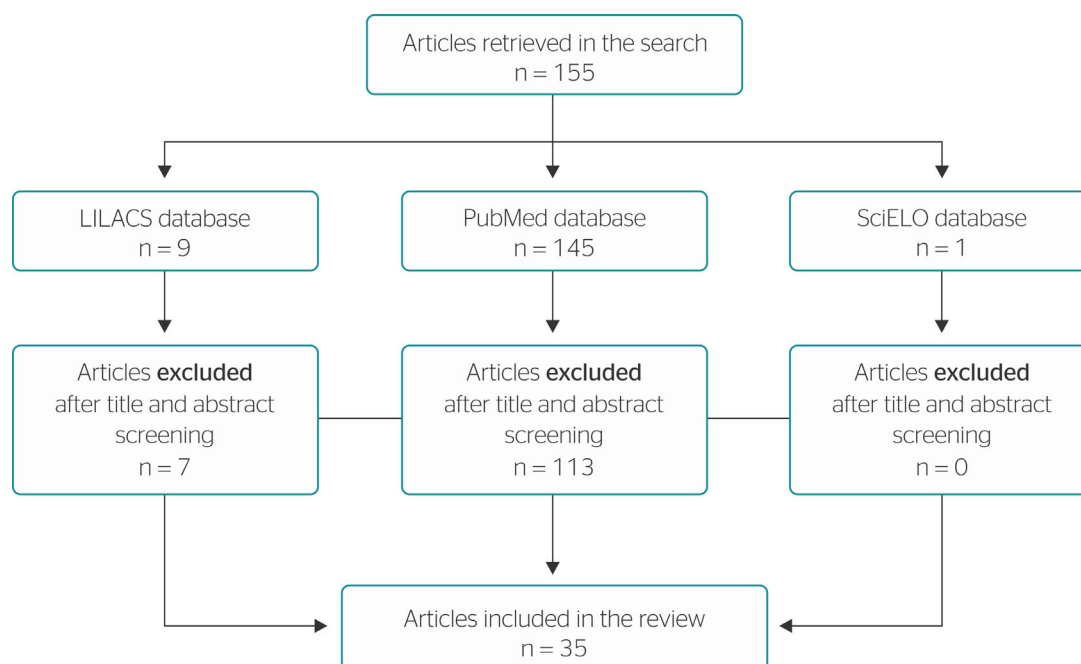


Figure 1. Study selection flow diagram and articles included in the review.

Table 1. Articles included in the review.

Author/ year	Title	Objectives	Methodological design	Main findings
Aroonvilairat et al. ¹⁶	Effect of pesticide exposure on immunological, hematological and biochemical parameters in Thai orchid farmers – a cross-sectional study	To assess the immunological, hematological and biochemical parameters of Thai orchid farmers who had frequent exposure to pesticides.	Cross-sectional study	Some biochemical parameters were altered in orchid farmers, pointing to the need for greater caution in the handling of pesticides.
Avgerinou et al. ¹⁷	Occupational, dietary, and other risk factors for myelodysplastic syndromes in western Greece	To investigate possible risk factors for the development of myelodysplastic syndromes (MDS) in western Greece.	Case-control study	Univariate analysis showed that the risk of MDS was associated with a family history of hematological malignancies or solid tumors; exposure to pesticides, insecticides and herbicides; increased weekly intake of meat and eggs; and increased alcohol consumption. Fruit intake, on the other hand, had a protective effect.
Baumert et al. ¹⁸	Sleep apnea and pesticide exposure in a study of US farmers	To examine the association between pesticide exposure and sleep apnea in pesticide applicators from a rural population in the United States.	Case-control study	There appears to be a positive association between carbofuran exposure and sleep apnea, since the former preceded the latter in all cases examined.
Boulanger et al. ¹⁹	Agricultural exposure and risk of bladder cancer in the agriculture and cancer cohort	To assess the role of a wide range of agricultural activities and tasks in determining the risk of bladder cancer	Prospective cohort study	A possible association was found between specific agricultural activities (such as pesticide use) and bladder cancer.
Campos et al. ²⁰	Exposure to pesticides and mental disorders in a rural population of southern Brazil	To determine the prevalence of common mental disorders and self-reported depression, and analyze their association with pesticide exposure in a rural population in southern Brazil.	Three-stage cross-sectional study using a standardized questionnaire	The sample consisted of 869 participants, of whom 840 filled out the questionnaire completely. The prevalence of common mental disorders was 23% and that of self-reported depression was 21%.
Da Silva et al. ⁶	Pesticide use and self-reported health Symptoms Among Rice Farmers in Zanzibar.	To examine pesticide use by small-scale rice farmers in Zanzibar, and evaluate self-reported symptoms of pesticide exposure.	Exploratory cross-sectional study with convenience sampling	Farmers who did not use PPE were more likely to experience toxicity. There is a need for more intensive training in safe pesticide handling.
Kab et al. ⁹	Parkinsonism signs and symptoms in agricultural pesticide handlers in Washington state	To examine the association of pesticide exposure to signs and symptoms of Parkinsonism.	Clinical and laboratory assessment of pesticide applicator before and after exposure.	Signs and symptoms were moderate or absent. Further studies on the issue are required. When present, the most common symptoms were excessive salivation and action tremor.
Kachuri et al. ²¹	Cancer risks in a population-based study of 70,570 agricultural workers: results from the Canadian census health and Environment cohort (CanCHEC)	To examine cancer risk in agricultural workers using a national Canadian database	Prospective cohort study	Agricultural workers are exposed to carcinogens. They have an increased risk of hematopoietic, prostate and lip cancer, as well as melanoma and brain tumors.
Khan et al. ²²	Occupational exposure to pesticides and resultant health problems among cotton farmers of Punjab, Pakistan	To examine occupational exposure to pesticides due to the handling practices used by agricultural workers; assess the health effects of pesticide use; and identify determinants of health in agricultural workers in two cotton farming districts in Pakistan.	Cross-sectional study	A significant fraction (34%) of agricultural workers reported several symptoms of pesticide toxicity; the most common were irritation of the skin and eyes, headache and dizziness.
Koh et al. ²³	Exposure to pesticide as a risk factor for depression: a population-based longitudinal study in Korea	To investigate the association between depression risk and high vs low level exposure to pesticides in the rural population.	Longitudinal study	Depression was positively associated with exposure to pesticides over a 20-year period, with an OR of 2.35 and 95%CI.

Continued...

Table 1. Continued

Author/ year	Title	Objectives	Methodological design	Main findings
Lemarchand et al. ⁴	Cancer incidence in the AGRICAN cohort study (2005-2011)	To compare cancer incidence rates between the AGRICAN cohort and the general population.	Prospective cohort study	No significant differences were observed in overall cancer incidence, but the AGRICAN cohort showed an increased incidence of prostate, lip, brain, breast (in men) and ovarian (in women) cancer, as well as non-Hodgkin lymphoma and multiple myeloma.
Lewis-Mikhael et al. ²⁴	Organochlorine pesticides and prostate cancer, is there an association? A meta-analysis of epidemiological evidence	To investigate the association between exposure to specific organochlorine pesticides and the risk of prostate cancer.	Meta-analysis	The results of the pooled data analysis did not support an association between any specific organochlorine pesticides and the risk of prostate cancer.
Lyu et al. ²⁵	Case control study of impulsivity, aggression, pesticide exposure and suicide attempts using pesticides among farmers	To investigate the association between exposure to organophosphate pesticides and aggressiveness, impulsivity and suicide attempts.	Case-control study	Individuals with previous suicide attempts had higher impulsivity and aggressiveness scores, and a higher number of symptoms of organophosphate exposure than control participants.
Meyer et al. ²⁶	Pesticide exposure and risk of rheumatoid arthritis among licensed male pesticide applicators in the agricultural health study	To test for a positive association between rheumatoid arthritis and the pesticide use in an agricultural health study.	Prospective cohort study	The results provided evidence of an association between exposure to some pesticides and rheumatoid arthritis in pesticide applicators.
Miranda-Contreras et al. ²⁷	Efectos de la exposición ocupacional a plaguicidas sobre la calidad del semen en trabajadores de una comunidad agrícola del estado Mérida, Venezuela	To analyze whether occupational exposure to pesticides is associated with semen quality and whether the effects of chronic exposure to pesticides on semen quality vary according to age.	Case-control study	The results of the study proved that occupational exposure to pesticides is associated with alterations in sperm quality, and may compromise reproductive function in agricultural workers.
Moisan et al. ²⁸	Association of Parkinson's disease and its subtypes with agricultural pesticide exposures in men: a case-control study in France	To investigate the association between pesticide use and Parkinson's disease in agricultural workers.	Case-control study	Pesticide use was significantly associated with symptoms of Parkinson's disease in men.
Muñoz-Quezada et al. ²⁹	Exposure to organophosphate (OP) pesticides and health conditions in agricultural and non-agricultural workers from Maule, Chile	To investigate pesticide exposure and health status in agricultural workers in the region of Maule, Chile.	A questionnaire was used to assess individuals with and without pesticide exposure.	Government regulations regarding the activity and training of agricultural workers must be implemented. A total of 56% of participants exposed to pesticides presented symptoms of poisoning at some point in time.
Muñoz-Quezada et al. ³⁰	Chronic exposure to organophosphate (OP) pesticides and neuropsychological functioning in farm workers: a review	To identify, assess and summarize available evidence on the neuropsychological effects of chronic exposure to organophosphates in rural workers.	Systematic review	Thirty-three articles met eligibility criteria for the review. Twenty-four of these found an association between chronic occupational exposure to organophosphates and poor neuropsychological performance in workers.
Negatu et al. ³¹	Occupational pesticide exposure and respiratory health: a large-scale cross-sectional study in three commercial farming systems in Ethiopia	To verify whether pesticide exposure affects the respiratory health of agricultural workers and farmers in commercial farming systems.	Two-stage cross-sectional study	Individuals exposed to pesticides had a higher risk of health issues such as chronic cough and shortage of air, despite the short duration of exposure.
Ngowi et al. ³²	Pesticide health and safety challenges facing informal sector workers: a case of small-scale agricultural workers in Tanzania	To describe the health and safety challenges associated with pesticide use faced by small-scale agricultural workers in Tanzania.	Literature review	In addition to occupational exposure to pesticides, agricultural workers may have to contend with contaminated food and water, which can also lead to toxicity. Additional findings included reckless use of pesticides; unfamiliarity with the negative effects of these products; rampant underreporting of acute pesticide toxicity and the need to implement public policies to improve the health of small-scale agricultural workers.

Continued...

Table 1. Continued

Author/ year	Title	Objectives	Methodological design	Main findings
Piccoli et al. ³³	Pesticide exposure and thyroid function in an agricultural population in Brazil.	To investigate the association between thyroid hormone levels and agricultural practices, current use of pesticides and serum pesticide levels in a rural population.	Randomly sampled cross-sectional study	Findings showed that both cumulative and recent exposure to agricultural pesticides can affect thyroid function, producing similar symptoms to those associated with hypothyroidism, especially in men.
Piel et al. ⁵	Central nervous system tumors and agricultural exposures in the prospective cohort AGRICAN	To investigate the association between the incidence of central nervous system tumors and agricultural exposures, pesticide use and livestock rearing.	Prospective cohort study	Increased risk of different types of cancer depending on the agricultural activity performed. The risk was also increased in workers who used pesticides.
Quandt et al. ³³	Olfactory function in Latino farmworkers over 2 years: longitudinal exploration of subclinical neurological effects of pesticide exposure	To compare olfactory function between Latino farmworkers and Latino workers in industries without pesticide exposure, assessing changes in olfaction over a 2-year period.	Case-control study	Pesticide exposure was associated with neurodegenerative markers such as olfactory loss.
Quansah et al. ³⁴	Associations between pesticide use and respiratory symptoms: a cross-sectional study in southern Ghana	To analyze the association between pesticide use and respiratory symptoms in Ghana.	Cross-sectional study	Significant positive associations were observed between fumigants and wheezing, fungicides and wheezing as well as phlegm production; insecticides and chronic cough as well as wheezing; and exposure to pesticides and respiratory symptoms.
Salerno et al. ³⁵	An Italian population-based case-control study on the association between farming and cancer: are pesticides a plausible risk factor?	To investigate the association between agriculture (used as a proxy for pesticide exposure) and cancer in suburban Vercelli (Italy).	Case-control study	The results suggest a possible association between pesticide exposure and cancer incidence.
Sankoh et al. ³⁶	An assessment of the impacts of pesticide use on the environment and health of rice farmers in Sierra Leone	To assess the prevalence of pesticide use among rice farmers in Sierra Leone, focusing on the different application methods and the evaluation of their impact and risks to human health and the environment.	A qualitative and quantitative study using a semi-structured questionnaire and interview	Skin issues, nausea, seizures, respiratory disorders, blurred vision, loss of appetite, lacrimation and nervous system disorders were significantly more frequent among farmers who used pesticides than those who did not.
Sekhotha et al. ³⁷	Exposure to agrochemicals and cardiovascular disease: a review	To assess the relationship between agrochemical formulations and cardiovascular illness in rural workers.	Non-systematic review	There is a close relationship between agrochemical formulations and cardiovascular illness.
Varona et al. ¹¹	Determining social factors related to pesticide poisoning among rice farmers in Colombia	To describe the circumstances of pesticide exposure and subsequent poisoning in agricultural workers.	Multimethod, multilevel study including ethnographic methods, surveys and measurement of pesticide levels in water and biological samples	Precarious working conditions increase the likelihood of pesticide exposure and lead to the exclusion of farmworkers from the occupational health system. Findings: pesticides detected in water samples, and workers presenting with mild (12.86%), moderate (67.98%) or severe toxicity (5.51%).
Zhang et al. ³⁸	Health effect of agricultural pesticide use in China: implications for the development of GM crops	To investigate the association of pesticides used on GM crops to blood chemistry parameters and peripheral nerve conduction in Chinese farmers.	Prospective cohort study	GM crops are likely to benefit a large number of agricultural workers in China and around the world by allowing for changes in pesticide use and the adoption of compounds that are less harmful to occupational health.
Zhang et al. ³⁹	Pesticide poisoning and neurobehavioral function among farm workers in Jiangsu, people's republic of China	To analyze the association between self-reported pesticide poisoning and neurobehavioral impairment in a group of agricultural workers in China.	Case-control study	The findings provided preliminary epidemiological evidence of the association between occupational exposure to pesticides and neurobehavioral function in Chinese agricultural workers.

PPE: personal protective equipment; GM: genetically modified; 95CI%: 95% confidence interval; OR: odds ratio.

All of the articles included in this review evaluated the chemical risks to which agricultural workers are exposed, as they examined the consequences of exposure to pesticides during occupational activities. A study performed in Chile³⁰ found that the pesticides most commonly used in vineyards were associated with health problems in farmers. Several disorders were identified in the sample, with acute poisoning being the most significant and prevalent. The most commonly reported symptoms were headaches, nausea, vomiting, shortness of breath, bradycardia, dermatitis, burns and eye irritation. Gesesew et al.⁴⁰ studied agricultural workers in Ethiopia, and found that acute toxicity was also the main health problem in that population. In the study, agricultural workers expressed awareness of inhalation and ingestion as routes of exposure to pesticides, but were unaware of the possibility of contamination through the skin, which poses a major challenge for preventive measures. Additionally, agricultural workers who experienced symptoms of pesticide toxicity tended to resort to home remedies such as drinking milk and applying creams to the affected area, seeking health care services only in severe cases.

The inadequate use of pesticides can also have neurobehavioral effects. A case-control study conducted in China revealed that chronic occupational exposure to pesticides can lead to symptoms of depression, lack of motivation and anxiety.³⁹ A systematic review³⁰ found that exposure to organophosphates may affect cognitive and motor functions, as well as concentration, agility, memory and coordination. A study performed in Pakistan revealed that the symptoms most frequently cited by cotton farmers after pesticide exposure were irritation of the skin and eyes, headache and dizziness, followed by shortness of breath, vomiting and fever.²²

China is considered a major global supplier of pesticides, in addition to making extensive use of these products in agricultural production. As such, the country has conducted a number of studies to investigate the short- and long-term effects of these substances on the population. A cohort study in which the hematological and neurological parameters of 246 agricultural workers from three Chinese provinces were evaluated over a 30-year period demonstrated that a longer duration of pesticide exposure can trigger

alterations in nervous system functioning. Laboratory analyses also provided evidence of muscle damage. Short-term effects in the form of altered liver and kidney function were also observed within three days of pesticide exposure. Another relevant finding was that only 14% of those interviewed used personal protective equipment (PPE). The study concluded that both short- and long-term exposure were associated with hematological, hepatic and peripheral nervous system alterations.⁴¹

Alterations in hematological parameters due to pesticide use were also reported in Thai orchid farmers, especially those who did not use PPE. Toxicological analyses conducted after pesticide application revealed alterations in immunological factors – B lymphocyte numbers and biochemical marker levels – which were not clinically significant, but suggested caution and emphasized the need for PPE in these settings.¹⁶ In Greece, a case-control study of agricultural workers being treated for myelodysplastic syndrome found that occupational exposure to pesticides increased the risk of developing this condition.¹⁷

A study of rice farmers in Sierra Leone revealed that health issues such as dermatitis, nausea, seizures and respiratory illnesses were significantly more frequent among farmers who used pesticides than those who did not. The authors noted that pesticides are cheap and easily accessible in Sierra Leone, as they are smuggled into the country. The indiscriminate use of these substances has a significant impact on health and the environment, leading to soil and groundwater contamination, and reducing biodiversity. The study also found that the procedures used in the storage, application, handling and preparation of these products were detrimental to human health. Lastly, the health care workers interviewed in the investigation emphasized the lack of national programs to address health and environmental issues, as well as the absence of education and prevention initiatives in the country.³⁶

The main determinants of pesticide exposure include lack of knowledge about correct pesticide use, the inability to comprehend product labels, inadequate storage conditions and the underestimation of the health risks of these products.^{11,40} The studies also showed that many rural workers do not routinely use PPE, which

could protect them from exposure to health and safety risks during their occupational activities. Barriers to the use of this important preventive measure include low education levels, insufficient understanding of the importance of PPE and a lack of training, in addition to the high costs of specialized equipment.^{5,6,10} A study performed in Ethiopia found that 42% of agricultural workers had never used PPE.⁴⁰ Ghafari et al.³ reported that 68% of rural workers in Iran did not use any form of PPE during pesticide application, while Zhang et al.³⁸, in China, reported that only 13.4% of farmers used PPE when handling pesticides. The attention to correct PPE use, which includes removing clothing immediately after use and washing the hands and face after handling pesticides, are as important as the equipment itself.^{5,40} Acute toxicity can also be caused by inadequate storage and the reuse of empty pesticide containers to store water and food, as reported by Muñoz-Quesada et al.³⁰, Gesesew et al.⁴⁰ and Silva et al.⁶.

A study performed in Tanzania found that an estimated 220 thousand people die every year from pesticide exposure in low- and middle-income countries. The authors attribute this to lack of knowledge and low education, in addition to the absence of legislation to protect the health of agricultural workers in these locations. These factors contribute to poor handling practices that increase exposure to dangerous products, leading to toxicity and long-term effects on workers' health. The study highlights the importance of continuing education regarding the effects of these products and their adequate use.³²

The handling of pesticides also exposes workers to an increased risk of depression and other mental and behavioral disorders, in addition to higher levels of aggressiveness/impulsivity and suicide attempts, as shown in studies performed in China²⁵ and Korea.²³ According to the researchers, the exposure to high levels of organophosphate pesticides over several years, with or without episodes of toxicity, inhibits acetylcholinesterase, leading to the accumulation of acetylcholine in cholinergic receptors and decreasing impulse control, contributing to aggressive behavior, depression and suicidal ideation.

The frequency of sleep apnea was also higher in workers exposed to pesticides in an agricultural

community in the United States. According to Baumert et al.,¹⁸ the inhibition of acetylcholinesterase induces respiratory depression, increasing the risk of this condition. Sleep apnea, in turn, contributes to increased morbidity and mortality in individuals exposed to pesticides, interfering with workers' sleep and quality of life. The results of the study showed that in male agricultural workers, exposure to carbofuran was positively associated with sleep apnea.

Olfactory and hearing loss were studied by Quandt et al.³³ and França et al.⁸, respectively. In a study of Latino workers exposed to pesticides in the United States, Quandt et al.³³ found that pesticides can significantly affect olfactory function even when inhaled at low doses. The study also found that olfactory impairment occurs earlier than other symptoms of neurodegenerative diseases such as Parkinson's. Since the study had a short follow-up period, it was not possible to determine whether the duration of exposure was associated with progressive olfactory loss, and it is therefore possible that factors other than pesticide exposure also contribute to the occurrence of this symptom. A separate study of tobacco farmers in Brazil⁸ also found that organophosphates can affect auditory function by inhibiting acetylcholinesterase and interfering with the transmission of action potentials from efferent fibers, thereby affecting peripheral, central and vestibular components of the auditory system. The issue is aggravated by the exposure to multiple risk factors for hearing loss, such as pesticides and noise, both of which are present in agricultural settings.

The association between pesticide use and Parkinson's disease was investigated by Nielsen et al.¹⁰ in a study conducted in Washington, D.C, in the United States. Clinical and laboratory examinations performed before and after the period of exposure revealed little to no association between pesticide use and the development of the disease. However, these findings may have been influenced by the small sample size of the study. Additionally, factors such as living far from the place of work and correct PPE use may have had protective effects and prevented continuous exposure to the contaminant. A study of French agricultural workers, however, did identify an association between

the intensity of pesticide exposure and tremors associated with Parkinson's disease. Herbicides were the most common type of pesticide used by participants, followed by insecticides and fungicides.²⁸

Some experimental studies suggest that the neurotoxicity caused by exposure to pesticides can induce endocrine alterations, especially in agricultural workers, who, in most cases, come into direct contact with these products. The study was performed in a city in southern Brazil, and its results showed that pesticide toxicity may be associated with mental disorders, since these are more frequent in individuals who use pesticides containing dinitroanilines, pyrethroids, sulfonylurea and aliphatic alcohol. The data obtained in this study also pointed to an association between early pesticide exposure and mental illness.²⁰

A study of agricultural workers in North Carolina, in the United States, focused on the assessment of rheumatoid arthritis. Though few studies have examined the association between these variables, the study in question found that occupational exposure to some types of pesticide was linked to an increase in the prevalence of rheumatoid arthritis, regardless of age, smoking history and educational level. The incidence of rheumatoid arthritis was associated with the frequent use of the organophosphate insecticide fonofos, the carbamate insecticide carbaryl and the sulfonylurea herbicide chlorimuron-ethyl.²⁶ In Venezuela, a study of sperm quality in agricultural workers exposed to pesticides confirmed the risk of infertility in male farmworkers exposed to these products.²⁷

A non-systematic review of the relationship between pesticide particles and cardiovascular disease in agricultural workers also found a close association between these variables. However, the authors noted that further studies are needed to investigate the health hazards associated with pesticide exposure, and that governments and agricultural producers must implement measures to reduce cardiovascular mortality in this population.³⁷ A study of agricultural workers in vineyards in southern Brazil revealed that both currently used and banned pesticides affect the thyroid gland, leading to symptoms similar to hypothyroidism, especially in men, who tend to be exposed to higher concentrations of pesticides than women.¹³

A study conducted in Ethiopia also identified an increased risk of respiratory illness in agricultural workers. The authors described their finding as 'alarming,' since the workers demonstrated significant reductions in pulmonary function - as evidenced by chronic cough and shortness of breath - despite the relatively short duration of pesticide exposure (4 years on average), alerting to the need for urgent intervention.³¹ Another study evaluated the association between pesticide exposure and wheeze in male participants of the Agricultural Health Study (AHS), a prospective investigation of farm workers in North Carolina and Iowa, in the United States. The results showed that 19 pesticides were significantly associated with allergic wheeze; 21 with non-allergic wheeze; and 11 were associated with both, suggesting that commonly used pesticides in agricultural and residential settings can have adverse respiratory effects.⁴²

With regards to cancer, some authors note that rural workers are less likely to develop cancer than the general population, probably due to a lower intake of alcohol and drugs and the level of physical activity in their professional practice. However, some types of cancer are common in this population, either due to exposure to ultraviolet rays, as in the case of lip cancer and myeloma, or pesticide exposure, which is associated with a higher frequency of prostate and hematological cancer, as well as non-Hodgkin's lymphoma and even brain tumors.^{4,21,19} Though a study of pesticide exposure and bladder cancer did not support a conclusive association between these variables, it did reveal a significantly higher incidence of cancer in vegetable farmers, women and non-smokers.¹⁹ A study of agricultural workers in France examined the association between cancer and exposure to some types of pesticides, but could not determine a causal association between these variables due to the high frequency with which workers moved between crops and their handling of multiple types of product. The study also identified an interesting association between pesticide use and an increase in the incidence of central nervous system tumors, especially gliomas and meningiomas.⁵ A case-control study of pesticide exposure which compared agricultural and non-agricultural workers in Italy over a lengthy chronological period (1965-2009) revealed

a higher likelihood of cancer in the former group than in the latter. The association between pesticide use and non-melanoma skin cancer, colorectal and breast cancer also reached statistical significance.³⁵

In female agricultural workers, studies showed an increase in the incidence of ovarian and pancreatic cancer, acute myeloid leukemia and breast cancer.^{3,21} The prevalence of breast cancer among the wives of agricultural workers who used pesticides on their farms was also studied, but no differences were observed between women who handled the pesticides and those who did not, nothing a similar breast cancer risk in both participant groups. The highest risk of breast cancer was observed in premenopausal women and those who used organophosphate pesticides.⁴³ In a meta-analysis performed by Spanish researchers, the analysis of pooled data did not support an association between organochlorine pesticides and the risk of prostate cancer, suggesting the need for further studies in this area.²⁴ In China, a study of genetically modified crop production found it to be associated with decreased pesticide use, as well as blood chemistry markers and peripheral nerve conduction. The results demonstrated that this type of crop requires less pesticide and allows for the use of products that are less hazardous to health, which could be greatly beneficial to agricultural workers.²⁴

CONCLUSIONS

The present review identified several studies that demonstrated the hazardous effects of occupational pesticide exposure on the health of agricultural workers around the world. There also appears to be some concern about the need to conduct further research on this issue. The articles included in this review identified several ways in which excessive pesticide exposure during occupational activities can harm the health of agricultural workers. The conditions associated with

pesticide exposure include hematological alterations, respiratory issues, endocrine dysfunction, neurotoxicity, infertility and, most concerning, an increased risk of some types of cancer.

The use of pesticides and their impact on the health of agricultural workers is a global concern. Governments should acknowledge their role as protectors of public health and create laws and public policies whose aim is not only to increase land productivity, but also promote the protection of workers against possible occupational risks. Studies that investigate the use of less hazardous chemical alternatives are also required. The encouragement of non-pesticide alternatives for pest and weed control would also have a major impact on the health of both producers and consumers of agricultural products, bringing balance and health to the environment and to agricultural workers.

Awareness campaigns, subsidies for the acquisition of PPE and specialized training are crucial for improving occupational safety and working conditions. Adequately trained workers are more likely to use PPE, implement protective measures and use safe handling practices. The labels on pesticides and other agricultural products must also be made more understandable, and workers must be encouraged to pursue formal education and seek basic health services; these steps will allow agricultural workers to access the knowledge and resources necessary to take preventive and effective measures to protect their health and that of their families. Of equal importance is the need to continue conducting short- and long-term studies of pesticides and the harm and illnesses they cause when they come into contact with the human body.

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Correspondence address: Mariana Portela de-Assis - Rua Paulo Hardi Kirst, nº 480, Loteamento Royal Country - Bairro Country - CEP: 96.824-710 - Santa Cruz do Sul (RS), Brazil. E-mail: portela1311@gmail.com



VOTE NO!!!

Too much cancer from chemicals as the studies show. Do not pass this bill for the safety of our children and ourselves!

HB1318
Senate Agriculture and Veteran Affairs Committee
3/14/25
Sarah E Hall Lovas, Agronomist
Director, North Dakota Grain Growers Association
Hillsboro, ND

Chairman Luick and members of the Senate Agriculture and Veteran Affairs Committee,
My name is Sarah Lovas and I am an agronomist from Hillsboro, ND. I submit this testimony in support of HB 1318 and ask for a DO PASS recommendation.

I have been involved in agriculture for my entire life. Agronomy and farming have been at the center of it all. As an agronomist, I have worked with farmers and applicators to help them make the best decisions with pesticides and other agronomic inputs for their farming operations. Also, during my career, I have spent a significant amount of time working on environmental impact issues in agriculture. Specifically, I have had the opportunity to work directly with the EPA on a number of issues including pesticide labeling and also education with EPA, so they understand modern agricultural practices.

HB1318 is NOT about whether glyphosate is carcinogenic and/or safe to use. The EPA has already done that work and has allowed for it's sale and use within the parameters of the label. Rather, HB1318 is about whether the label is sufficient in warning the public about it's hazards. However, I am aware of opposing testimony that will try to make this bill about safety concerns with glyphosate specifically. The LD-50 stands for Lethal Dose 50. LD-50 is a measure of toxicity of a substance. Specifically, the dose at which 50% of a test population is killed. The greater the LD-50 the more of that substance can be tolerated before half of the population is killed. In other words, a substance with a greater LD-50 is safer as opposed to a substance with a lower LD-50. According to the chart below, which is compiled from data from

reputable sources like the World Health Organization and the EPA, glyphosate has a greater LD-50 than caffeine for both acute and chronic toxicity.

However, HB1318 is about the EPA pesticide labeling being effective for ascertaining the health and environmental impacts of various pesticides. The EPA has rigorous, scientific process of evaluating the impacts of pesticides to human health and also the environment. The EPA also

Acute toxicity

Life-threatening one-time doses

SUBSTANCE	FOUND IN	Lethal dose (LD50 mg/kg)	CATEGORY
Water	... Water	90000	Practically non-toxic
Sucrose	Table sugar	30000	
Monosodium glutamate	Flavor enhancer, soy, cheese	16000	
Ethanol	Alcoholic beverages	7000	
Glyphosate	Herbicide (RoundUp)	5600	
Aluminum hydroxide	Antacid, vaccine adjuvant	>5000	Slightly toxic
Fructose	Fruits, component of sucrose	4000	
Spinosad	Organic insecticide	3700	
Sodium chloride	Table salt	3000	
Eugenol	Clove oil, organic pesticide	2700	
Paracetamol (acetaminophen)	Tylenol, Panadol	2400	Moderately toxic
Vanillin	Vanilla bean, vanilla sugar	1600	
Hydrogen peroxide 70%	Bleach, disinfectant	1000	
Theobromine	Chocolate, tea, guarana	950	
Copper sulfate	Organic fungicide	300	
Chlorpyrifos	Organophosphate insecticide	230	Highly toxic
Caffeine	Natural pesticide, coffee plant	190	
Lead	Batteries, cables, paints	155*	
DDT	Restricted insecticide	100	
Rotenone	Restricted organic pesticide	60	
Vitamin D3	Supplements, fish, mushrooms	37	
Nicotine	Natural pesticide, tobacco	10	
Mycotoxin T2	Plant pathogen, moldy grain	5	
Aflatoxin	Soil fungus, moldy foods	5	
Hydrogen cyanide	Fruit pits, bitter cassava	4	
Botulinum toxin	Botox, Clostridium botulinum	0.001	

LD50: Generally rat oral. Botulinum: mouse and human, nicotine: human, cyanide: mouse.
 *Lead: no LD50, lowest human lethal dose included. Colours: EPA toxicity categories.

Sources: EFSA, WHO, EPA, NIH, NHS

Chronic toxicity

Acceptable daily intakes of minimal concern

SUBSTANCE	FOUND IN	Limit mg/kg
Water	You know this one	50000
Sucrose	Table sugar	800
Ethanol	Alcoholic beverages	170
Monosodium glutamate	Cheese, soy, flavor enhancer	120
Sodium chloride	Table salt	60
Vanillin	Vanilla bean, vanilla sugar	10
Eugenol	Clove oil, organic pesticide	1
Glyphosate	Herbicide (RoundUp)	0.5
Copper sulfate	Organic fungicide	0.5
Aluminum hydroxide	Antacid, vaccine adjuvant	0.14
Paracetamol	Tylenol, Panadol	0.093
Spinosad	Organic insecticide	0.024
Hydrogen cyanide	Fruit pits, bitter cassava	0.012
DDT	Restricted insecticide	0.010
Lead	Batteries, cables, paints	0.007
Caffeine	Coffee, tea, chocolate	0.003
Vitamin D3	Supplements, fish	0.002
Chlorpyrifos	Organophosphate pesticide	0.001
Nicotine	Natural pesticide, tobacco	0.0008
Rotenone	Restricted organic pesticide	0.0004
Mycotoxin T2	Fusarium, moldy grain	0.00002

Limits: Reference Dose (RfD or ADI), Reference Intake (RI), Upper Limit (UL), or Tolerable Daily Intake (TDI). Colours for readability (no official categories exist for these limits).

Sources: EFSA, WHO, EPA, NIH, NHS

More at: thoughtscapism.com

considers public comments through a process where risks and benefits are considered, and scientific data is at the center of the entire process. This process and the data considered within the process are sufficient to explain the human health risks. The label and the MSDS for each pesticide clearly explain the risks for human health, and the label is explicit for safe pesticide handling. Further, every North Dakota commercial and private applicator are required to recertify with continuing education every 3 years. These training courses emphasize the label as the law.

In recent years it has become somewhat uncertain about the availability of some pesticides during the growing season. Federal court proceedings or the EPA have vacated labels almost instantaneously with little to no warning for agriculture, and with little to no scientific evidence for the label vacation. This creates a challenging situation to manage pests in farming. Further, often alternative pesticides are more expensive and, often, less effective for the pest situation. This proposed legislation would help protect North Dakota agriculture from label vacations with no scientific basis.

Thank you for your time. I would entertain any questions you may have.

ASK: Please support HB1318

Sarah Hall Lovas
Agronomist
Hillsboro, ND
701-866-1704



1401 32nd Street SW • Fargo, ND 58103 • Phone: 701-239-4151 • Fax: 701-239-4276

email: information@rrvsga.com

March 13, 2025

Chairman Luick and members of the Senate Agriculture & Veterans Affairs Committee,

I am Brent Baldwin, a farmer from Saint Thomas, North Dakota. Thank you for the opportunity to submit my testimony. I am the President of the Red River Valley Sugarbeet Growers Association. Our members are the sugarbeet grower-owners of American Crystal Sugar Company. Each year, our members plant around 400,000 acres of sugarbeets, or about 40% of our nation's sugarbeet acres. We are submitting testimony in SUPPORT of House Bill 1318.

Pesticides are some of the most rigorously tested and regulated products in the United States. It is the Federal Insecticide, Fungicide, and Rodenticide ACT (FIFRA) which governs the use, sales and labeling. FIFRA requires the Environmental Protection Agency (EPA) to evaluate human health, ecological risks, and safety before any pesticide can be registered. As part of the evaluation, the EPA undertakes a thorough scientific review of many things, including potential carcinogenicity. The EPA cannot approve a pesticide unless it confirms it doesn't cause unreasonable adverse effects to the environment or humans.

The issue is that some states, like California, have tried to add labeling requirements that directly contradict the EPA's conclusions on the safety of specific pesticides. This has created a devastating, relentless and often meritless litigation environment which is threatening farmer access to current and future crop protection products.

This bill would ensure that any pesticide already registered with the EPA and sold under a label consistent with the EPA's own determinations, is sufficient to satisfy requirements for health and safety warnings. This bill is not a blanket immunity shield like the opposition may suggest, and this bill will still allow the state to regulate the sale and use of any pesticide within our borders.

This bill is about protecting the use of safe and reliable crop protection products for North Dakota farmers. We encourage this committee to provide a DO PASS recommendation on HB 1318.

Brent Baldwin – Farmer – Saint Thomas, North Dakota
President - Red River Valley Sugarbeet Growers Association



HOUSE BILL NO. 1318
SENATE AGRICULTURE AND VETERANS AFFAIRS COMMITTEE
CHAIRMAN, LARRY LUICK
TESTIMONY IN SUPPORT OF HOUSE BILL 1318
MARCH 14, 2025

Chairman Luick and members of the Senate Agriculture and Veterans Affairs Committee. This testimony is submitted by Joshua Stutrud, a soybean producer in the Rugby area and board member of the North Dakota Soybean Growers Association, and is submitted on behalf of the Association in support of House Bill 1318.

Greetings Senate Ag Committee,

Please vote yes on HB1318. As a ND soybean producer, and Certified Crop Adviser (CCA) I think it's best to keep all pesticide options available to producers. The updated federal FIFRA label is readily available online, and is easy to find with a simple google search. It's hard to find someone without a smartphone in today's world. Therefore, the current label should always be available in your pocket. As long as the FIFRA labels Personal Protective Equipment (PPE) is followed the opportunity for physical contamination is very minimal, and the label is based on sound science. This bill would encourage companies to invest in more research to bring new/more pesticides to the market. Especially with newer technologies like RNAi insecticides, which have the capability to target a specific insect, instead of the beneficial and target insects. These types of technologies might not be introduced to the market with a concern that the burdensome regulations, and potential lawsuits could negate any profit a company may produce. Therefore, I think HB1318 is a piece of needed legislation to keep moving the ag industry forward. Please vote yes on HB1318.

Joshua Stutrud
NDSGA Secretary, ND Farmer, and CCA

HB 1318

Senate Agriculture and Veterans Affairs

Chairman Luick and Committee Members

I strongly urge a Do Not Pass on HB 1318. If HB 1318 passes, the financial burden of pesticide-related harm will be shifted away from pesticide companies and onto the state, taxpayers, and affected individuals.

HB 1318 is a corporate bailout for pesticide manufacturers, shifting the financial burden of pesticide-related harm from billion-dollar companies to North Dakota taxpayers. The Senate must reject this bill to protect public health, farmers, and the state's financial future.

Thank You, Gordon Greenstein

US Navy (Veteran)

US Army-NDNG (Retired)

North Dakota Agricultural Association Testimony
ND Senate Agriculture and Veterans Affairs Committee
March 14, 2025

Chairman Luick and members of the committee, my name is Carter Medalen, I am proud to submit testimony in support of House Bill 1318 on behalf of the North Dakota Agricultural Association (NDAA). Our organization represents agribusinesses, farm supply dealers, manufacturers, distributors, and retailers of crop production inputs and services across North Dakota. Through education, safety initiatives, and legislative advocacy, we work to strengthen the state's agricultural industry.

North Dakota's farmers and agribusinesses are already facing serious challenges. Rising input costs, uncertain commodity prices, and supply chain disruptions have made it harder than ever to plan for the future. In this environment, access to proven, effective crop protection tools is critical. Pesticides are among the most essential tools farmers use to control weeds and ensure strong yields. For example, 98% of all sugar beet acres, 92% of soybean acres, 80% of corn acres, and 58% of all wheat acres rely on the most commonly used herbicide. Losing access to these tools would not only reduce yields but also drive up, costs throughout the entire agricultural supply chain.

Safety is a top priority for North Dakota's farmers and agribusinesses. Earning a pesticide applicator's license requires extensive training and certification to ensure these tools are used correctly. Pesticides undergo rigorous scientific review processes involving multiple agencies and hundreds of experts, taking more than 12 years on average from concept to field. Regulators continuously review new studies and data to ensure these products meet the highest safety standards, and when using these tools, farmers follow strict regulations and product label requirements to protect themselves, consumers, and the environment.

The impact of losing these products would extend far beyond the farm. With fewer effective weed control options, farmers would be forced to rely on more expensive and less efficient alternatives, increasing costs for agribusinesses, food processors, and livestock producers. These rising costs would inevitably be passed on to consumers, driving up grocery prices at a time when North Dakotans are still struggling with the effects of persistent inflation. Food security and affordability start in the fields. When farmers lose access to tools they have relied on for decades, the entire system becomes more fragile. Another aspect of losing herbicide options is that growers are facing more weed resistance issues each season. The best way to manage against weed resistance is to rotate herbicide modes of action. Losing viable herbicides, narrows the options that growers have for rotating those herbicide modes of actions, which will only lead to more herbicide resistance which will be a detriment to North Dakota crop production.

Without action, access to essential crop protection tools will be at risk, leaving farmers and agribusinesses in a state of uncertainty, unable to plan and invest in the future. North Dakota's agricultural community needs stability, and that's exactly what HB 1318 provides. HB 1318

RESTRICTED

simply reasserts that the federally approved label is the law, providing the clarity and consistency needed to keep these products available to North Dakota farmers, retailers, and more. Importantly, this bill is **not** a blanket immunity shield, and individuals would still have multiple avenues if they purported to be harmed by a product.

HB 1318 ensures that farmers can continue producing the food, feed, and fuel that support our state's economy and help keep grocery prices in check. Our industry cannot afford unnecessary disruptions, and North Dakota families cannot afford higher food prices due to the loss of proven farm management tools. Supporting this bill means supporting the future of North Dakota agriculture and the communities that depend on it.

I urge you to support HB 1318 and stand with North Dakota's farmers, agribusinesses, and consumers.

RESTRICTED



North Dakota Association for Justice
 PO Box 365
 Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
 jaclyn@ndaj.org

Chairman Luick and members of the Senate Ag and Veterans Affairs Committee, my name is Jaci Hall, Executive Director of the North Dakota Association for Justice. I am here opposed to HB1318.

HB 1318 says that if a pesticide has an EPA-approved label, that label is automatically considered a **“sufficient warning”** under North Dakota law. This means that farmers cannot sue pesticide manufacturers if their farms are destroyed or they get cancer from those pesticides, even if the label is later proven wrong or misleading.

The bill specifically states that a pesticide label is legally adequate if:

1. It was approved by the EPA during registration, **even if the company misled regulators.**
2. It matches the most recent EPA health assessment, **even if new science later proves the pesticide is more dangerous than previously thought.**
3. It follows the EPA's carcinogenicity classification, **even if independent scientists overwhelmingly link the pesticide to cancer.**

If a pesticide meets any of these conditions, farmers are blocked from holding the manufacturer accountable under North Dakota law. Even when companies knowingly hide dangers, they can point to the EPA-approved label and avoid accountability.

This eliminates all claims under North Dakota law, not just failure to warn. If the label is a "sufficient warning" under North Dakota law, then *by definition* the product can't be "unreasonably dangerous" under North Dakota law either. **Something can't be unreasonably dangerous if it has a sufficient warning.** By deeming the EPA label a sufficient warning, in effect the company gets total immunity.

Farmers deserve the freedom to hold foreign pesticide manufacturers accountable **when labels are false or misleading**—especially with the EPA managing over 16,000 registered products. **Without this amendment, pesticide companies would have total immunity similar**



North Dakota Association for Justice
PO Box 365
Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
jaclyn@ndaj.org

to the vaccine industry. This amendment is essential to preserves **farmers' ability to enforce *existing* FIFRA misbranding rules** and ensures that honest labeling remains the standard.

Today, I am here with a proposed amendment to add Section 2 to HB1318:

Section 2 – Pesticide Labeling - Exception

Nothing in this section shall be construed to apply to any action or claim arising under state law that is equivalent to, and fully consistent with, the misbranding standards set forth in the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136(q)."

What does this amendment do?

1.Misbranding Is a Federal Standard

Under FIFRA, a label is misbranded if it is false or misleading, lacks adequate instructions, or omits necessary warnings is unlawful at the federal level. This amendment simply protects farmers property right to requirements.

2.Consistent with FIFRA and EPA Authority

The EPA registers products and sets labeling standards once every 15 year *at best*. EPA does not actively keep up with the 16000 pesticides in use under their authority, instead relying on pesticide manufacturers to submit updated labels to avoid misbranding. This amendment reinforces FIRRA and the EPA's own regulations.

3. Registration Is Not a Defense under FIFRA

FIFRA explicitly states that registering a pesticide is not an excuse a misbranded product. See 7 U.S.C. § 136a(f)(2). Even if a pesticide passes initial federal review, that does not guarantee the label is accurate or sufficient. This amendment ensures companies are accountable for misbranding, preventing an unlawful label from getting a free pass simply because the product was registered in the past.



North Dakota Association for Justice
PO Box 365
Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
jaclyn@ndaj.org

This amendment is necessary to ensure that state law is consistent with FIFRA's provision that misbranded pesticides are unlawful. Farmers will still bear the burden of proving that a pesticide label is false or misleading, lacks adequate instructions, or omits necessary warnings required by EPA under FIFRA 7 U.S.C. § 136(q). But, this amendment gives them a path to hold companies accountable when they misbrand their pesticide.

4. Without the Amendment, Accountability Is Lost

If we strip away farmers' ability to hold companies accountable for unlawful misbranding, farmers and families are put at risk. For example, 250,000 acres of North Dakota soybeans were destroyed in 2017 by a misbranded dicamba label that failed to prevent drift. Monsanto knew it would drift but hid the data from the EPA. EPA cannot enforce FIFRA to obtain recourse on behalf of farmers and never held Monsanto accountable for actively deceiving them either. Without this amendment, Monsanto and similar companies could dodge responsibility for harm they caused to farmers.

Attached is an article by the USDA that shows after this drift happened, North Dakota imposed additional requirements and restrictions on Dicamba use. With this legislation, these additional restrictions imposed to support farmers would become void.

These restrictions were the result of lawsuits after the drift. Duty of care is the backbone of liability. If you owe a duty of care to someone and you breach that duty, you are responsible. This amendment will hold the companies accountable to not mislead North Dakota Farmers.

5. ChemChina benefits from misbranding.

ChemChina owns Syngenta and is a major manufacturer of pesticides in the United States. ChemChina is labeled by the Department of Defense as a Chinese Military Company Operating in the Untied States. ChemChina complies with FIFRA and would benefit from total immunity for misbranding under HB 1318. **This amendment is necessary to let North Dakota**



North Dakota Association for Justice
PO Box 365
Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
jaclyn@ndaj.org

farmers hold ChemChina accountable for unlawfully misbranding their pesticides under federal law.

Without this amendment, foreign pesticide companies like ChemChina would be given total and complete immunity for violating federal labeling law.

This legislation is a national bill in state legislatures all over the country. Recently, it has failed in Montana, Wyoming, Mississippi. The legislation failed in Missouri and Idaho in 2024.

If this legislation fails, it will not restrict the use of Roundup or other pesticides as the Modern Ag Alliance has indicated. Modern Ag Alliance is a company out of Missouri owned by Bayer Monsanto.

Please consider your neighbor, your constituent and yourself as you debate the merits of this bill. Trusting science is one thing, but providing immunity to chemical companies when they cause harm is simply not right.

North Dakota farmers have the right to hold chemical companies accountable when they misbrand a product and cause harm. Providing the pathway does not initiate legal action, just gives them the opportunity if they need it.

If this amendment is not adopted, I ask you for a Do not Pass on HB 1318.



Amber Waves



The Use of Genetically Engineered Dicamba-Tolerant Soybean Seeds Has Increased Quickly, Benefiting Adopters but Damaging Crops in Some Fields

by Seth J. Wechsler, David Smith, Jonathan McFadden, Sam Williamson and Laura Dodson

10/1/2019

[Feature](#) [Crop & Livestock Practices](#) [Fertilizers & Pesticides](#) [Biotechnology](#) [Soybeans and Oil Crops](#)

Highlights

- The share of soybean acreage planted with dicamba-tolerant seeds increased by 43 percent from 2016 (when these seeds were commercialized) to 2018.

- There was more dicamba-tolerant seed use in States where glyphosate-resistant weed species were prevalent.
- Approximately 4 percent of soybean fields were damaged by off-target movement of dicamba in 2018.

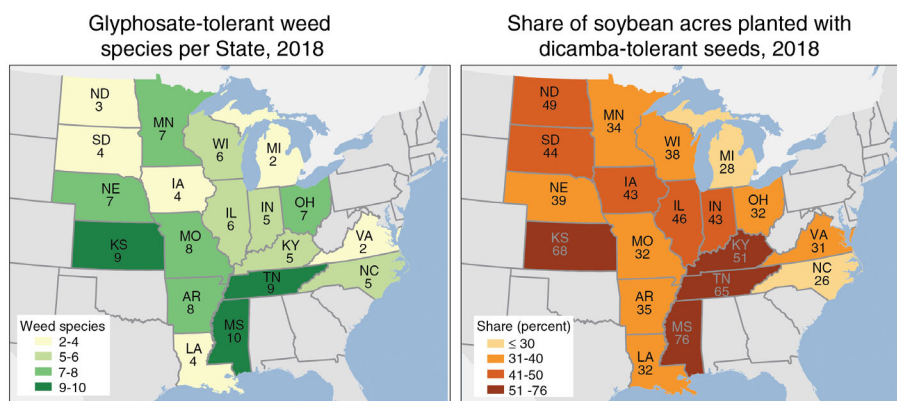
Weeds can cause serious problems for U.S. soybean producers. Left untreated, severe weed infestations can reduce soybean yields by more than 50 percent. Most soybean producers achieve high levels of weed control using modern synthetic herbicides. However, there are risks associated with herbicide use. For instance, herbicides that are improperly applied can move off-target, potentially damaging crops that are on or near the field where the herbicides were applied.

Glyphosate is a broad-spectrum herbicide that kills most broad-leaf weeds and grasses. Before genetically engineered glyphosate-tolerant soybeans were commercialized in 1996, glyphosate was used infrequently in soybean production. When glyphosate was used, it tended to be applied early in the growing season, before soybean seedlings had emerged from the soil. Glyphosate could be applied late in the growing season, but the use of specialized equipment (like hooded sprayers) did not eliminate the possibility of damage from off-target glyphosate movement.

The commercialization of glyphosate-tolerant soybeans practically removed the possibility of damage from late season glyphosate use. Glyphosate-tolerant soybean and glyphosate use increased rapidly in the years that followed. By 1998, more than 4 out of every 10 soybean acres were planted with glyphosate-tolerant seeds. By 2006, almost 9 out of every 10 acres were planted with glyphosate-tolerant seeds.

As glyphosate-tolerant seed use became more common, an increasing number of farmers started using glyphosate, and only glyphosate, for weed control in soybeans. On some fields, a small number of naturally resistant weeds, from a small number of weed species, survived (or “escaped”) glyphosate applications. Over time, these weeds bred and spread, passing on their natural resistance to the next generation. By 2018, there were glyphosate-tolerant weeds in the majority of soybean-producing States. Glyphosate resistance appears to be particularly problematic in States located southwest of the Corn Belt—such as Mississippi, Kansas, Tennessee, Arkansas, and Missouri—where the most glyphosate-tolerant weed species are present.

States where glyphosate-tolerant weed species were prevalent used more dicamba-tolerant seeds in 2018



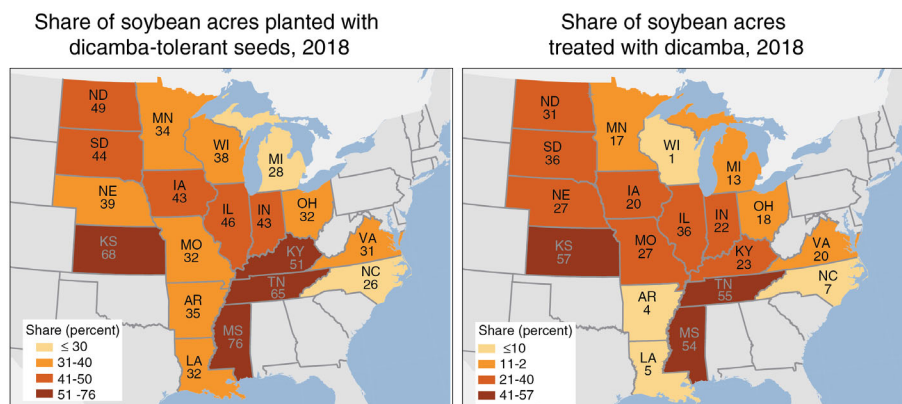
Sources: USDA, Economic Research Service (ERS) using data from the International Survey of Herbicide Resistant Weeds and ERS and USDA, National Agricultural Statistics Service, 2018 Agricultural Resource Management Survey.

[Download chart image](#)

One way to control glyphosate-tolerant weeds is to treat them with herbicides other than glyphosate, such as dicamba or 2,4-D choline. Chemical and seed companies have recently developed new soybean varieties that are tolerant of these herbicides. For instance, Xtend soybeans, which are tolerant of dicamba, were commercialized in 2016. Enlist soybeans, which are tolerant of 2,4-D choline, were commercialized prior to the 2019 growing season.

Farmers' responses to the Soybean Production Practices and Costs Report (commonly referred to as Phase II of the Agricultural Resource Management Survey) for 2018 suggest that approximately 43 percent of U.S. soybean acreage was planted with dicamba-tolerant seeds in 2018. The increase in dicamba-tolerant seed use from 2016 to 2018 is similar to the rate at which soybean farmers adopted glyphosate-tolerant varieties in the years immediately following their commercial introduction, from 1996 to 1998. The States with the most dicamba-tolerant seed use in 2018 were Mississippi, Tennessee, and Kansas—where approximately 79 percent, 71 percent, and 69 percent of soybean acreage was planted with these varieties (respectively). Notably, there appears to be more dicamba-tolerant seed use in the States with the most glyphosate-tolerant weeds.

Though dicamba and dicamba-tolerant seed use were highly correlated in 2018, not every acre planted with dicamba-tolerant seeds was treated with dicamba



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, 2018 Agricultural Resource Management Survey.

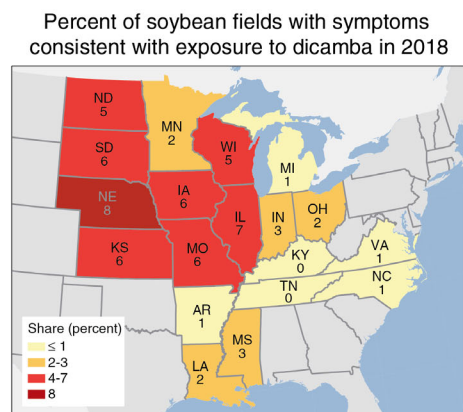
[Download chart image](#)

Not all acres planted with dicamba-tolerant soybeans are treated with dicamba. In all 19 States studied, more acres were planted with dicamba-tolerant seed than were actually sprayed with dicamba. For instance, in Mississippi, 79 percent of soybean acres were planted with dicamba-tolerant seeds, but only 54 percent of these acres were treated with dicamba. In some cases, farmers may only use dicamba if glyphosate-tolerant weeds appear. In other cases, dicamba-tolerant seeds might be planted to prevent yield losses from unintended exposure to dicamba.

Off-target movement of dicamba can damage other plants—particularly non-dicamba-tolerant soybeans, which are highly susceptible to dicamba, even at very low doses. This movement generally occurs when droplets of dicamba “drift” at ground level during application, or when dicamba vaporizes after application, rises into the atmosphere, and floats hundreds to thousands of feet downwind. In some cases, off-target movement also occurs because spray equipment is not thoroughly cleaned following a dicamba application, and small quantities of dicamba are inadvertently mixed with other herbicides.

Farmers’ responses to USDA’s Soybean Production Practices and Costs Report for 2018 suggest that approximately 4 percent of soybean fields were damaged by off-target dicamba movement in 2018. The largest share of fields was damaged in Nebraska and Illinois, where damage from dicamba was reported on approximately 1 in every 13 fields.

Damages from off-target dicamba movement was highest on soybean fields in Illinois and Nebraska in 2018



Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, 2018 Agricultural Resource Management Survey.

[Download chart image](#)

Some of the States with the least damage to soybeans were also the States where the most dicamba was sprayed. For instance, though over half of soybean fields in Mississippi were treated with dicamba, only 3 percent of soybean fields were damaged by off-target dicamba movement in 2018. Largely, this is because 73 percent of the soybeans planted in Mississippi were dicamba-tolerant. However, Federal and State-level restrictions on dicamba use may also have played a role in reducing damages.

In 2018, dicamba use was governed by Federal label rate restrictions, which mandated that:

- Dicamba be classified as a restricted-use pesticide (a designation that prohibits anyone but certified applicators from purchasing or applying dicamba products);
- Licensed applicators complete dicamba-specific training;
- Dicamba be applied when wind speeds are 10 mph and below;
- Dicamba not be applied when the wind is blowing toward crops that are susceptible to dicamba (such as specialty crops or non-dicamba-tolerant soybean varieties);
- Dicamba be applied between sunrise and sunset;
- Spray equipment be thoroughly cleaned before and after dicamba applications;
- Detailed records be made following each dicamba application.

Certain States, including Arkansas, Louisiana, Minnesota, Missouri, North Dakota, and Tennessee, imposed additional restrictions on dicamba use in 2018. In Arkansas, Louisiana, Minnesota, Missouri, and North Dakota, dicamba could only be applied to soybeans early in the growing season—when temperatures are relatively low and some of the risks associated with off-target movement are reduced. In Missouri, North Dakota, and Tennessee, dicamba use was restricted to times of day when dicamba is less likely to drift.

Select States tightened dicamba label rate restrictions in 2018

	Dicamba cannot be applied:		
	Later than...	If temperature is over...	Unless the time is between...
Arkansas	April 16 ¹		
Louisiana	June 15 ²		
Minnesota	June 20	85°F	
Missouri	June 10 ¹ ; July 15		7:30 a.m. and 5:30 p.m.
North Dakota	June 30	85°F	1 hour after sunrise and 1 hour before sunset
Tennessee ³			7:30 a.m. and 5:30 p.m.
Note: ¹ Pastures, rangeland, turf, ornamental, direct injection for forestry, and home use are exempt. ² Cutoff date applies to select geographic locations. ³ Older formulations of dicamba are banned. Source: USDA, Economic Research Service using data from State departments of agriculture.			

Other States—including Indiana, Iowa, and Mississippi—did not impose restrictions on the timing of dicamba applications, but did mandate that applicators attend State-approved training and maintain detailed recordkeeping.

There is not an easily identifiable geographic pattern between the presence of regulations and the fraction of damaged soybean acreage. Some States with relatively high rates of damage (such as Iowa and North

Dakota) had State-level regulations, while others (such as Wisconsin) did not. This may be because States with high levels of damage are more likely to impose regulations. It may also be because dicamba-based products are used for weed control in crops other than soybeans, and many of these products are not subject to the State-level restrictions listed in Table 1.

Controlling weed resistance to herbicides is a constant challenge. ERS economists are currently studying how recently commercialized genetically engineered herbicide-tolerant soybean varieties affect soybean farmers' profits and input costs, the development of weed resistance, and the costs of damages associated with off-target herbicide movement. Until new herbicidal modes of action are developed, or paradigm-shifting weed control technologies are commercialized, genetically engineered herbicide-tolerant varieties are likely to continue playing an important role in domestic field crop production.

This article is drawn from:

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Solid Demand and Stabilized Glyphosate Pricing Expected in 2025



Glyphosate

Branded Glyphosate-Based Herbicide Sales Normalizes as Generic Reference Price Slightly Below Historical Median



Market Trends:

- > Global demand continues to remain strong in 2025 with generic supply and channel inventory consistent with historical levels
- > Generic Chinese glyphosate technical reference spot price continues to trend slightly below 15-year historical median price

Our Strategy:

- > Maintain supply for ~40% global glyphosate market, with focus on the over-the-top markets in the Americas
- > Maintain brand premium over generic glyphosate-based herbicides with agile and strategic pricing; with focus on low-cost operating model
- > Distinctly steered in a competitive commodity market

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'Buy it or else': Inside Monsanto and BASF's moves to force dicamba on farmers - Investigate Midwest



INVESTIGATIVE / ENTERPRISE: ILLINOIS

'Buy it or else': Inside Monsanto and BASF's moves to force dicamba on farmers

Internal company records show the companies knew crop damage from their weed killer would be extensive. They sold it anyway.

by **Johnathan Hettinger**, Investigate Midwest

December 4, 2020



Why you can trust Investigate Midwest



Will Glazik with his organic corn at his farm near Paxton Il on Wednesday, October 28, 2020. photo by Darrell Hoemann/The Midwest Center for Investigative Reporting



This story is supported with a grant from the Fund for Investigative Journalism.

Get poisoned or get on board.

That's the choice soybean farmers such as Will Glazik face. The past few summers, farmers near Glazik's central Illinois farm have sprayed so much of the weed killer dicamba at the same time that it has polluted the air for hours and sometimes days.

As Glazik puts it, there are two types of soybeans: Monsanto's, which are genetically engineered to withstand dicamba, and everyone else's.

Glazik's soybeans have been the damaged ones. His soybean leaves will curl up, then the plants will become smaller and weaker. He's lost as much as 40 bushels an acre in some fields, a huge loss when organic soybeans are \$20 a bushel. He has to hold his breath every year to see if the damage will cause him to lose his organic certification.

His neighbors who spray dicamba are frustrated with him, he said. There's an easy solution to avoid damage, they tell him: Buy Monsanto's seeds.

This reality is what Monsanto was counting on when it launched dicamba-tolerant crops, an investigation by the Midwest Center for Investigative Reporting found.

Monsanto's new system was supposed to be the future of farming, providing farmers with a suite of seeds and chemicals that could combat more and more weeds that were becoming harder to kill.

Instead, the system's rollout has led to millions of acres of crop damage across the Midwest and South; widespread tree death in many rural communities, state parks and nature preserves; and an unprecedented level of strife in the farming world.

Executives from Monsanto and BASF, a German chemical company that worked with Monsanto to launch the system, knew their dicamba weed killers would cause large-scale damage to fields across the United States but decided to push them on unsuspecting farmers anyway, in a bid to corner the soybean and cotton markets.

Monsanto and BASF have denied for years that dicamba is responsible for damage, blaming farmers making illegal applications, weather events and disease. The companies insist that when applied according to the label, dicamba stays on target and is an effective tool for farmers.

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Monsanto, BASF and dicamba: An interactive timeline

the Midwest Center reviewed thousands of pages of government and internal company documents released through lawsuits, sat in the courtroom for weeks of deliberation, interviewed farmers affected by dicamba and weed scientists dealing with the issue up close. This story provides the most comprehensive picture of what Monsanto and BASF knew about dicamba's propensity to harm farmers' livelihoods and the environment before releasing the weed killer.



An oak tree exhibits symptoms of damage from dicamba documented by the Illinois Department of Natural Resources.

The investigation found:

- Monsanto and BASF released their products knowing that dicamba would cause widespread damage to soybean and cotton crops that weren't resistant to dicamba. They used "protection from your neighbors" as a way to sell more of their products. In doing so, the companies ignored years of warnings from independent academics, specialty crop growers and their own employees.
- Monsanto limited testing that could potentially delay or deny regulatory approval of dicamba. For years, Monsanto struggled to keep dicamba from drifting in its own tests. In regulatory tests submitted to the EPA, the company sprayed the product in locations and under weather conditions that did not mirror how farmers would actually spray it. Midway through the approval process, with the EPA paying close attention, the company decided to stop its researchers from conducting tests.
- Even after submitting data that the EPA used to approve dicamba in 2016, Monsanto scientists knew that many questions remained. The company's own research showed dicamba mixed with other herbicides was more likely to cause damage. The company also prevented independent scientists from conducting their

own tests and declined to pay for studies that would potentially give them more information about dicamba's real-world impact.

- Although advertised as helping out customers, the companies' investigations of drift incidents were designed to limit their liability, find other reasons for the damage and **never end with payouts to farmers.** For example, BASF told pesticide applicators that sometimes it is not safe to spray even if following the label to the letter, placing liability squarely on the applicators.
- The two companies were in lockstep for years. Executives from Monsanto and BASF met at least 19 times from 2010 on to focus on the dicamba-tolerant cropping system, including working together on the development of the technology, achieving regulatory approval for the crops and herbicides and the commercialization of crops.
- Monsanto released seeds resistant to dicamba in 2015 and 2016 without an accompanying weed killer, knowing that off-label spraying of dicamba, which is illegal, would be "rampant." At the same time, BASF ramped up production of older versions of dicamba that were illegal to apply to the crops and made tens of millions of dollars selling the older versions, which were more likely to cause move off of where they were applied.

Bayer, which bought Monsanto in 2018, refused to grant an interview with the Midwest Center. Company officials did not respond to requests for comment, instead issuing a statement.



A Monsanto facility in Jerseyville, Illinois, in 2015. Monsanto, which was purchased by Bayer in 2018, released the dicamba-tolerant crops, beginning in 2015. Credit: Darrell Hoemann/Midwest Center for Investigative Reporting

Spokesman Kyel Richard said the company “has seen an outpouring of support from grower organizations and our customers.”

“We continue to stand with the thousands of farmers who rely on this technology as part of their integrated weed management program,” Richard said.

BASF also did not respond to requests for comment, instead issuing a statement.

BASF spokeswoman Odessa Patricia Hines said that the company’s version of dicamba has “different physical properties and compositions” than Monsanto’s. Hines said the company is continuing to improve its dicamba technology.

A federal court **banned the herbicide** earlier this year, but the EPA **reinstated dicamba** for five more years in October.

Earlier this year, a federal jury sided with a Missouri peach farmer who sued the companies for driving his orchard out of business. The jury awarded Bill Bader \$15 million for his losses and \$250 million in punitive damages designed to punish Bayer. Bayer and BASF are appealing the verdict. **The punitive damages were later reduced to \$60 million.**

Hines of BASF pointed out that in the Missouri trial: “The jury’s verdict found that only Monsanto’s conduct warranted punitive damages.”

Following the trial, Bayer announced a \$400 million settlement with farmers harmed by dicamba, including \$300 million to soybean farmers. Bayer said they expect BASF to pay for part of the settlement.

An attorney for Bader called the companies’ conduct “a conspiracy to create an ecological disaster in order to increase their profits” in court filings. The case largely revolved around showing the companies knew dicamba would harm thousands of farmers.

According to court exhibits, in October 2015, Monsanto projected it would receive nearly **2,800 complaints from farmers** during the 2017 growing season, a figure based on one-in-10 farmers having a complaint.

However, even one Monsanto executive knew these projections might be low, according to court records. In late August 2016, Boyd Carey, a Ph.D. crop scientist overseeing the claims process for Monsanto, realized it might be more like one-in-five and asked for **a budget increase** from \$2.4 million to \$6.5 million to investigate claims. Carey testified that he was awarded the increase.

The projected number of complaints rose to more than 3,200 for 2018, before going down. After 2018, Monsanto figured that fewer farmers would be harmed because more farmers would switch to Monsanto’s crops to avoid being damaged, Carey testified in the Bader trial.



Bill and Denise Bader, owners of Bader Farms, pose in front of the Rush Hudson Limbaugh Sr. United States Courthouse in Cape Girardeau, Missouri, on Jan. 27, 2020. Midwest Center for Investigative Reporting file photo.



“This is the first product in American history that literally destroys the competition ... You buy it or else.”

— BILLY RANGLES, ATTORNEY FOR BILL BADER

Dicamba affects all parts of Glazik's operation. He grows organic soybeans to avoid exposure to toxic pesticides. He also likes the higher premiums and the improved soil quality. But with dicamba in the air, he's less likely to be successful.

He now has to plant his soybeans later each year. Soybeans are less likely to be severely damaged when they're small, and planting them later than usual means they'll be smaller when the inevitable cloud of weed killer envelops his crops. Later planting typically means a bit of yield loss. It also means a later harvest, which limits planting of cover crops Glazik uses to improve his soil.

“All crop damage aside,” he said, the weed killer is everywhere. Oaks, hickories and other trees are damaged near his farm, both in the country and in town, he said. “The fact is that the chemical can volatilize and move with the wind and in the air. We're breathing it.”

A 'potential disaster'

For two decades, Monsanto made billions of dollars with Roundup Ready crops, which had been genetically engineered to withstand being sprayed by the weed killer and adopted by nearly every American soybean farmer. But by the mid-to-late 2000s, Roundup was starting to fail. Farmer's fields were overwhelmed with “superweeds” that had developed resistance to Roundup's active ingredient, glyphosate.



Read more: [Dicamba on Trial](#)

In response, Monsanto developed new soybean and cotton seeds that were genetically engineered to withstand being sprayed by both glyphosate and dicamba, a very effective weed killer used since the 1960s. It was also touted as the company's largest biotechnology rollout in company history. In just three years, Monsanto's

dicamba-tolerant system was able to capture up to three-fourths of total soybean acreage, an area the size of Michigan.

Dicamba was not widely used during the growing season because of its propensity to move off-target and harm other plants. Because of its limited use, fewer weeds were resistant to it, making it an effective replacement for Roundup. Monsanto even dubbed the crops as its money-maker's next generation, calling them Roundup Ready 2 Xtend.

But the company faced a problem with dicamba: The weed killer drifted onto non-resistant plants, some as far as miles away. In its own testing over the years, Monsanto had accidentally harmed its own crops dozens of times.

As far back as 2009, Monsanto and BASF received warnings about dicamba from several sources — one company called it a “potential disaster,” according to court records — but they decided to plow ahead anyway.

“DON'T DO IT; expect lawsuits,” wrote one Monsanto employee, summarizing academic surveys the company commissioned about dicamba's use.

In order to commercialize dicamba, both Monsanto and BASF worked to develop new formulations with low volatility.

Off-target movement from dicamba can happen in two main ways: drift and volatilization. Drift is when the chemical's particles move off the field when they are sprayed, generally by wind in the seconds or minutes after it is applied. Volatilization is when dicamba particles turn from a liquid to a gas in the hours or days after the herbicide is applied.

Damage from volatilization frequently occurs through a process called “atmospheric loading,” which is when so much dicamba is sprayed at the same time that it is unable to dissipate and persists in the air for hours or days poisoning whatever it comes into contact with.

Volatilization is particularly concerning because dicamba can move for miles and harm non-target crops, especially soybeans, and even lawns and gardens. Tomatoes, grapes and other specialty crops are also at-risk of being damaged.

Despite being touted as less volatile, the new versions — Monsanto's XtendiMax with VaporGrip Technology and BASF's Engenia — were unable to stop the movement entirely.

During its 2012-2014 testing of an older version of XtendiMax, Monsanto had at least **73 off-target incidents**, according to court documents.

In 2014, Monsanto had significant dicamba damage at a **training facility in Portageville**, Missouri. Even in its own **promotional videos**, Monsanto couldn't prevent non-dicamba tolerant soybeans from showing symptoms of damage.

The EPA took note of an incident where, through volatilization, dicamba turned into a gas and apparently floated **more than 2 miles away**, much farther than it was supposed to. During that incident, no one had measured how badly the crops had been damaged and the EPA was unable to definitively determine the symptoms were caused by dicamba. The EPA decided that was an **"uncertainty" and approved the use of the weed killer with a 110-foot buffer zone**.

In 2015, knowing the EPA was keeping an eye on off-target movement, Monsanto decided to **halt all testing of XtendiMax** with VaporGrip Technology. According to court records, it kept its own employees who were interested in developing recommendations for farmers from testing, and it limited trials by independent academics in order to maintain a **"clean slate."** It **asked BASF to halt its dicamba testing** as well.

When a weed science professor at the University of Arkansas **asked Monsanto for a little bit** of Xtendimax to test its volatility, the company told him it would have difficulty producing enough dicamba for both him and its independent tests.

A Monsanto employee, who worked at the company for 35 years, didn't think much of that explanation when he forwarded the email to a colleague.

"Hahaha difficulty in producing enough product for field testing," he **wrote**. "Hahaha bullshit."

Illegal spraying a 'ticking time bomb'

Weeds cut into farmers' profits. With low profit margins, farmers will use any tool they can to control weeds.



Soybeans with suspected dicamba damage north of Flatville, Illinois, on August 21, 2019. Millions of acres of non-dicamba tolerant soybeans have been damaged by dicamba.

Midwest Center for Investigative Reporting file photo.

Monsanto recognized this in 2015 and 2016 when they released dicamba-tolerant crops without their new versions of dicamba. An internal Monsanto slide shows the company knew that many farmers would likely illegally spray older, more volatile versions and harm other farmers' crops.

But the company decided the benefits of establishing a market share outweighed the risks and launched the cotton crops in 2015. The EPA allowed farmers to spray other weed killers on the crops, and Monsanto decided to launch the seeds with “a robust communication plan that dicamba cannot be used.”

When the seeds were sold, Monsanto put a pink sticker on each bag to indicate it was illegal to spray dicamba on the crops in 2015. The company also sent letters to all growers and retailers, among other tactics, to limit illegal applications of dicamba.

However, in internal communications in April 2015, members of Monsanto's cotton team joked about this risky strategy.

“One sticker is going to keep us out of jail,” one wrote.



Dicamba-resistant soybeans in rural McLean County on August 7, 2017. The Roundup Ready 2 Xtend soybeans were touted as the next generation of glyphosate-resistant soybeans. Midwest Center for Investigative Reporting file photo. Credit: Darrell Hoemann/Midwest Center for Investigative Reporting

In Oct. 2015, a BASF employee reported hearing that growers sprayed older versions of dicamba on the cotton that year.

Monsanto doubled down on this risky strategy in 2016, releasing dicamba-tolerant soybean crops without a weed killer, too. Meanwhile, Monsanto also declined to investigate drift incidents in 2015 and 2016.

At a February 2016 meeting in Puerto Rico, a BASF executive expressed concerns to Monsanto that the “widespread” illegal spraying would likely become “rampant” due to the decision.

BASF also benefited from Monsanto’s decision. The company’s sales of older versions of dicamba spiked in 2016. Retailers sold \$100 million worth of its older versions of the weed killer, compared to about \$60 million annually in 2014 and 2015, according to internal documents. BASF documents indicated the sales increased because of dicamba-tolerant seeds.

In the summer of 2016, BASF sales representatives in the field were reporting older versions of dicamba causing damage, hinting the problem was predictable.

“The one thing most acres of beans have in common is dicamba damage. There must be a huge cloud of dicamba blanketing the Missouri Bootheel,” a BASF employee wrote in a July 4, 2016, report. “That ticking time bomb finally exploded.”

Drift expected to drive sales

Dicamba drift led to widespread news coverage. Monsanto and BASF expected to turn it all into more money.

In an internal document, Monsanto told its sales teams to target growers that weren't interested in dicamba and dicamba-resistant crops. The sales pitch? Purchasing Monsanto's products would protect them from their neighbors.

In April 2017, a market research document prepared by Bank of America found many farmers were doing just that.

“Interesting assessment that much of the Xtend acreage was planted to protect themselves from neighbors who might be using dicamba? Gotta admit I would not have expected this in a market research document,” a Monsanto executive wrote.

In internal slides from a September 2016 meeting, BASF identified “defensive planting” as a potential market opportunity. BASF also had a market research document that found defensive planting was driving sales.

However, a “tough questions” memo distributed to BASF employees in November 2017 told employees the opposite: “We have not considered ‘defensive planting’ in our sales projections.”

Even as thousands of farms across millions of acres of cropland were being damaged, Monsanto officials were touting the damage as a sales opportunity.

“I think we can significantly grow business and have a positive effect on the outcome of 2017 if we reach out to all the driftee people,” another Monsanto sales employee wrote in an email that year.

One of those customers was Bill Bader, the peach farmer who sued Monsanto for destroying his orchard. Bader testified that while he could not protect his peach trees, in 2019 he planted dicamba-tolerant soybeans

to help protect his soybean crops from getting damaged.

“This is the first product in American history that literally destroys the competition,” Bader’s attorney, Billy Randles, said. “You buy it or else.”

Research designed to downplay harm

For years, the EPA told Monsanto it needed to address volatility in its dicamba studies when applying for regulatory approval. But the tests Monsanto conducted did not reflect real-world conditions.

Dicamba would primarily be sprayed on soybeans, but 2015 studies submitted to the EPA were conducted at a cotton field in Texas and a dirt field in Georgia. Neither state has a large amount of soybeans. This guidance followed directives from Monsanto lobbyists that incorporated earlier Monsanto research showing that higher volatility was detected on fields with soybeans.

In addition, Monsanto did not follow the rules that would eventually be codified on the label.

During the testing in Texas, wind speeds were 1.9 to 4.9 miles per hour. In Georgia, wind speeds were 1.5 to 3 miles per hour. According to the label the EPA approved, dicamba can only be sprayed with wind speeds between 3 and 10 miles per hour. Spraying at low wind speeds is more likely to lead to volatilization because there is increased risk of a temperature inversion, which is when cooler air is caught beneath a layer of warmer air making gases more likely to persist near the ground.

After Monsanto submitted the tests to the EPA, the company still had a lot of unknowns about its product’s volatility, according to internal emails.

A Monsanto researcher wrote an email in February 2016 to his coworkers that underscored how little the company knew about the propensity of dicamba to damage crops.



In 2018, about 41% of all soybeans planted were genetically modified to withstand dicamba. In 2019, 70% of cotton seeds planted were genetically modified to withstand dicamba, according to the EPA. File photo. Credit: Photo by Darrell Hoemann/Midwest Center for Investigative Reporting

“We don’t know how long a sensitive plant needs in a natural setting to show volatility damage. We don’t know what concentration in the air causes a response, either,” he wrote. “There is a big difference for plants exposed to dicamba vapor for 24 vs. 48 hours. Be careful using this externally.”

Despite the design of the studies, and the EPA’s own studies that showed dicamba posed a risk to 322 protected species of animals and plants, the agency conditionally approved the herbicide in 2016. The agency determined that mitigation measures — such as not spraying near specialty crops and endangered species habitats, wind speed restrictions, and a ban on aerial applications — would keep spray droplets on target.



“DON’T DO IT; expect lawsuits”

— EMAIL FROM ONE MONSANTO EMPLOYEE, SUMMARIZING [ACADEMIC SURVEYS](#) THE COMPANY COMMISSIONED ABOUT DICAMBA’S USE.

It was only approved for two years, when the agency would review its approval again.

After the conditional approval, BASF knew dicamba still posed risks. While BASF told farmers dicamba drift wouldn’t hurt their bottom lines, the company [privately told pesticide applicators](#) that any drift they caused could decrease farmers’ harvests, according to internal BASF documents. A BASF executive said “from a practical standpoint” [Engenia was not different](#) from older dicamba versions.

Even Monsanto’s sales teams were having problems with dicamba’s reputation after the EPA approved the weed killer.

In an internal email, a Monsanto salesman took issue with BASF changing how it publicly discussed its dicamba product: It used to say volatility was not a problem, but now it said it was. Another chemical company saying volatility was bad could hurt Monsanto’s sales.

“We need to get on this right now!” the salesman [emailed his colleagues](#). “Deny! Deny! DENY!”



A BASF research farm near Seymour, Illinois, on Dec. 3, 2020. BASF released Engenia, a low volatility formulation of dicamba, beginning in 2017.

'Never admit guilt'

In 2017, the first season that the new versions of dicamba were approved, damage reached unprecedented levels. Around 3.6 million acres of soybeans were damaged, according to an estimate from the University of Missouri.

In July of that year, Monsanto executives scheduled a meeting to discuss how to combat coverage of complaints.

“We need REAL scientific support for our product to counteract the supposition happening in the market today,” a Monsanto executive wrote in an email. “To be frank, dealers and growers are losing confidence in Xtendimax.”



In late summer 2017, Monsanto had started to blame damage on a BASF weed killer, which is used on the main competitor to Monsanto's own soybeans. In December 2017, Monsanto agreed to drop that argument as part of a defense strategy with BASF against farmers.

The form Monsanto told its investigators to use when examining farmer complaints was “developed to gather data that could defend Monsanto,” according to an [internal company presentation](#). Later, Monsanto said that [91% of applicators using the form self-reported errors in spraying dicamba](#).

“I was always told to never admit guilt,” he said.

With damage being reported in 2017, Monsanto also declined to pursue a study that would have given the company more information about how dicamba caused damage on real farms. A Monsanto off-target

movement researcher sent a request for a project proposal to Exponent, which helped analyze the data Monsanto submitted to the EPA. The study could be done in less than two weeks and cost \$6,000.

The researcher forwarded the proposal to two Monsanto executives.

The company never acted on it, one testified in the trial.

'The problems have not gone away'

In order to combat the damage, the EPA developed new restrictions on dicamba. In doing so, the EPA dropped an idea that Monsanto opposed, and Monsanto dictated the new restrictions that were adopted.

State officials warned the EPA the changes wouldn't work. They were right. In 2018, at least 4.1 million acres were damaged, according to EPA documents.

Still, the EPA re-approved dicamba for the 2019 and 2020 growing seasons with new restrictions, some of which ignored agency scientists' recommendations.

States also increasingly took measures into their own hands, implementing spraying cut-off dates and temperature restrictions.

The damage continued. Illinois, the nation's largest soybean producing state, had more complaints than ever in 2019. Iowa had "landscape level" damage in 2020.

Aaron Hager, an associate professor of weed science at the University of Illinois, said it is clear the changes haven't worked.

"We have revised the label and revised it again," Hager said. "The problems have not gone away."

The EPA's decision was eventually voided by the Ninth Circuit Court of Appeals for failing to properly consider the impacts on farmers and the environment. The court ruled the agency gave too much deference to Bayer and also was lacking necessary data to show too much harm wouldn't be done.

Dicamba was recently reapproved, and Bayer continues to invest in it. The company will release new soybean seeds designed to be resistant to dicamba and glufosinate, another BASF herbicide, to fill 20 million acres in

2021. The company also **continues to work toward approval of other seeds that are resistant to dicamba and other herbicides.**

Glazik, the organic Illinois soybean farmer, works as a crops consultant advising other farmers on what to plant. As the damage has continued, he said, more and more of his clients are “feeling bullied into” buying the dicamba-tolerant crops. Others tell him, they have to spray dicamba or else they can’t control the weeds.

But as an organic farmer, Glazik said, no single herbicide is necessary. Instead, farmers have a choice. Well-managed fields can be weed-free without using toxic chemicals, he said.

“You don’t have to have the dicamba spray to control weeds in a field,” he said.

**Do Not Pass Testimony
of Doug Sharbono, citizen of North Dakota
on HB1318
in the Sixty-ninth Legislative Assembly of North Dakota**

Dear Chairman Luick and members of the Senate Agriculture and Veterans Affairs Committee,

I am writing as a citizen and believe HB1318 is undesirable legislation shifting more product liability from the chemical manufacturer to the applicator, farmer, and General Public. This legislation includes a "Duty to warn" provision in the last paragraph. This is legal terminology which will substantially limit product liability for the manufacturer if damages result from its usage.

This bill needs to be outright killed. The farmers and General Public need to maintain the protections we currently have, not dismantle them.

Please give HB1318 a Do Not Pass.

Thank you,

Doug Sharbono
1708 9th St S
Fargo, ND 58103

In Opposition of HB1318

Chairman and Senate Committee Members of Agricultural and Veteran Affairs.

I am writing in opposition of this bill. It may sound like a harmless bill, but the underlying issue is to eliminate liability for possible harm and injury that may come from these pesticides.

We have warning labels on many products, and that has been brought on as a necessity because of the carcinogen causing cancer found in these products so readily available without proper testing and/or ignorant approvals. D.C. is finally trying to reduce cancers by banning many unhealthy products found in food (especially food designed for CHILDREN). All agricultural products find their way into the mouths of our youth.

There are always reasons why most of this type of bill comes up before you, and it is often grounded on money and promoting misinformation. A no vote would encourage our farmers to rely on safe products to protect themselves and consumers from proven cancer causing agents.

Please do not fall prey to the big-money corporations and hereby letting your constituents and their children down and allow the suppliers and manufactures to win without consequences.

Thank you for your time and thoughtful consideration regarding this health matter.
I respectfully ask for a DO NOT PASS vote on HB1318.

Connie Samuelson (D-3)
226 Souris Drive
Minot, ND 58701

Lanny Kenner
District 7

Chairman Luick and committee members,
I am opposed to HB 1318 for these reasons:

1. This bill mainly deals with pesticide labeling regulations and the impact on potential lawsuits.
2. This bill tries to say that if a pesticides labeling is approved by the EPA that it serves as a defense against lawsuits.
3. The intent of this bill is to provide a legal defense when they adhere to EPA approved labeling.
4. It could affect lawsuits that claim the warnings and labelings on pesticide products were inadequate. Don't let these manufacturers hide behind labeling!
5. In other words this is a bad Bill only trying to be put in place to protect manufacturers much like the pharmaceutical companies vaccine programs are protected against lawsuits.
6. Anytime a company cannot be held liable for a bad product because of some law, what is stopping that company from putting out bad products over and over again?

For the safety of everyone please vote NO on HB 1318.

Thank you, Lanny Kenner

TESTIMONY OF JOHN BRADLEY
NORTH DAKOTA WILDLIFE FEDERATION
HOUSE BILL 1318
SENATE AGRICULTURE AND VETERANS AFFAIRS COMMITTEE
MARCH 14, 2025

Chairman Luick and Members of the Agriculture and Veterans Affairs Committee:

For the record, I am John Bradley, Executive Director of the North Dakota Wildlife Federation (NDWF). NDWF rises in opposition to HB 1318 and requests a Do Not Pass recommendation from the committee.

In 2017, [over 250,000 acres of North Dakota soybeans](#) were ruined by a herbicide called dicamba. Monsanto (Bayer) claimed their dicamba spray was “safe over the top,” but internal documents show they knew it would drift and destroy neighboring fields. In fact, they hoped it would happen to push farmers into buying dicamba-resistant seeds in the future just to protect themselves from damage.

Now, North Dakota HB 1318 would protect big chemical corporations from lawsuits when their products harm family farms. This bill would hand over all decisions to the EPA, even though Monsanto/Bayer lied to that very agency before. If they lie again, HB 1318 would protect them from accountability.

What Really Happened with Dicamba

- Quarter-Million Acres Destroyed: In 2017, North Dakota farmers [lost at least 250,000 acres of soybeans](#) because dicamba drifted. Across the country, 3.6 million acres were harmed.
- Company Cover-Up: Court evidence shows Monsanto/Bayer and partner BASF hid the truth about dicamba drifting. They pushed it through the EPA anyway.
- Pressure on Farmers: When neighboring fields got wiped out, many farmers felt forced to buy dicamba-resistant seeds so they wouldn't be the next victims.
- Organic Farms at Risk: Organic and other conventional farms have no protection from dicamba drift if they don't use those special seeds. Under HB 1318, they couldn't even sue if they get hurt by false product claims.
- EPA Admits Problems: After the 2017 disaster, the EPA tightened dicamba rules, showing the original label was wrong. But with HB 1318, EPA label approval in 2017 would block local farmers from holding the manufacturer accountable.

How HB 1318 Hurts Our Property Rights

- No Lawsuits Allowed: If the label says it won't drift “when used correctly,” HB 1318 means farmers who lose their crops can't sue.
- Broken EPA System: The EPA often trusts industry data and has missed major problems before, like they did with dicamba. HB 1318 puts even more trust in that same broken system.
- Takes Away Local Control: By removing lawsuits from North Dakota courts, farmers have no recourse if big companies cause damage.

Why We Need the Courts on Our Side

- Past Failures: The dicamba crisis proved that big corporations don't always tell the truth, and the EPA can't always catch it. Farmers need the legal system to step in.

- **Accountability:** When companies fear lawsuits, they have an incentive to make safer products. If HB 1318 passes, that last line of defense is gone.

Reject HB 1318: Protect Our Farms

- **Stop Corporate Immunity:** The dicamba scandal showed how easily companies can shift costs onto honest farmers.
- **Preserve Rural Life:** Farming is a cornerstone of North Dakota's economy and culture. We can't let big chemical companies get a free pass for destroying our fields.

Bottom Line: HB 1318 hands Monsanto/Bayer and other big chemical corporations a free shield against North Dakota farmers' legitimate claims—even when their products cause massive damage. The dicamba disaster shows exactly how high the stakes are. Our lawmakers should stand with North Dakota's farmers and reject this giveaway of legal immunity.

MYTH OR FACTS

PESTICIDE IMMUNITY BILLS

MYTH

#1: These bills do not prevent anyone from suing pesticide manufacturers.



FACT

These bills undermine the foundational legal argument used in thousands of previous and pending cases filed by those who have been harmed by pesticide use and exposure.

#2: EPA's registration process for pesticides is robust, involves rigorous testing, and ultimately leads to safe products.



Substantial scientific literature, inspector general reports, and litigation going up to U.S. Supreme Court point to limitations of pesticide registration, including safety claims.

#3: The weed killer TM glyphosate in Roundup will be taken off the market if state legislation is not passed. We need a fair legal climate!



Failure-to-warn claims have been a basic right in state courts going back to 1947. Users of pesticides are better protected by fair warning of product hazards in the marketplace.

#4 Farmers will be reliant on unsafe products developed in foreign countries if legislation is not adopted.



Current ability to sue for a manufacturer's failure to warn protects farmers, gardeners, and users of chemical products because it incentivizes truthful labeling of products, which enables informed consumer choices with full information.

MYTH OR FACTS

PESTICIDE IMMUNITY BILLS

MYTH ONE UNPACKED



This is a health and safety and environmental protection issue for users and the communities where pesticides are used. Requiring disclosure of potential products hazards in the marketplace.

MYTH TWO UNPACKED



EPA whistleblowers¹ reported to Inspector General and Office of Science Integrity² allegations of managers revising assessments significantly to indicate no toxicity concerns, despite data to the contrary and assigning work to less experienced employees to secure sign-offs on faulty or inadequate assessments. This is just the tip of the iceberg!³

MYTH THREE UNPACKED



Federal pesticide labeling requirements do not provide full information on potential adverse effects, focusing on acute effects such as poisoning, but not longer term effects like cancer, reproductive problems, and birth defects. A landmark lawsuit⁴ found that "[t]he specter of damage actions may provide manufacturers with added dynamic incentives to continue to keep abreast of all possible injuries stemming from use of their product so as to forestall such actions through product improvement."

MYTH FOUR UNPACKED



This is a health and safety issue for the user, communities where pesticides are used, and the environment. Creating the incentive to ensure a marketplace with safe products is a longstanding principle that has governed products in the marketplace, from automobiles, drugs, medical devices, to pesticides.

1. Beyond Pesticides. 2024. Bayer/Monsanto in Roundup/Glyphosate Case Stung with Largest Multi-Billion Dollar Jury Award, Asks States to Stop Litigation.

<https://beyondpesticides.org/dailynewsblog/2024/02/bayer-monsanto-in-roundup-glyphosate-case-stung-with-largest-multi-billion-dollar-jury-award-turns-to-state-houses-to-stop-litigation/>

2. Bennett, Kyla. 2021. EPA Risk Assessments Doctored to Mask Hazards. Public Employees for Environmental Responsibility. <https://peer.org/epa-risk-assessments-doctored-to-mask-hazards/>

3. Lerner, Sharon. 2021. Whistleblowers Expose Corruption in EPA Chemical Safety Office. The Intercept. <https://theintercept.com/2021/07/02/epa-chemical-safety-corruption-whistleblowers/>

4. Bates v. Dow Agrosciences LLC, 544 U.S. 431 (2005)



**North Dakota Grain Growers Association
Testimony in Support of HB 1318
Senate Agriculture and Veterans Affairs Committee
March 14, 2025**

Chairman Luick, Members of the Senate Agriculture and Veterans Affairs Committee, for the record my name is Dan Wogsland representing the North Dakota Grain Growers Association (NDGGA). I appear today to express NDGGA's support for HB 1318 regarding pesticide labeling requirements.

HB 1318 provides crucial clarity and consistency in pesticide labeling requirements by establishing that EPA-approved labels, which undergo rigorous scientific review, serve as sufficient warning labels under North Dakota law.

This legislation will benefit our agricultural community in several important ways:

1. Regulatory Consistency

The bill aligns North Dakota's labeling requirements with federal standards, creating a clear and uniform system for pesticide manufacturers, distributors, and users. This consistency reduces confusion and improves compliance while maintaining strong safety standards through EPA oversight.

2. Protection of Agricultural Operations

Our members rely on having access to properly labeled pesticides to protect their crops and maintain productive farming operations. This legislation helps ensure continued access to these vital tools while maintaining appropriate safety standards through federal EPA oversight.

3. Scientific Basis for Labels

The bill recognizes EPA's comprehensive scientific review process, which includes thorough human health assessments and carcinogenicity classifications. These evaluations represent the gold standard in pesticide safety assessment and provide appropriate guidance for safe use.

4. Legal Clarity

By establishing that EPA-approved labels constitute sufficient warning, this legislation provides clear legal standards that protect both manufacturers and users while maintaining robust safety requirements through federal oversight.

5. Economic Benefits

Regulatory clarity and consistency help reduce compliance costs and legal uncertainty, allowing agricultural businesses to operate more efficiently while maintaining appropriate safety standards.

This legislation represents a balanced approach that maintains strong safety standards while providing regulatory clarity and consistency. It supports our agricultural community while ensuring appropriate safety measures remain in place through federal oversight.

Chairman Luick, Members of the Senate Agriculture and Veterans Affairs Committee, NDGGA respectfully urges a Do Pass recommendation on HB 1318 and we would respectfully urge the full Senate to concur.

Good Morning,

My name is Dr. Liza Lockwood. I am the Medical Affairs Lead for the Crop Science Division of Bayer, an emergency physician, a medical toxicologist & a mom. I am here today in support of HB 1318. The purpose of this bill is to ensure that the scientific safety of crop protection products are accurately reflected on the label.

Since doctors & most health practitioners do not spend a lot of time thinking about crop protection & labels, let's talk about this using an example from medicine.

Let's take penicillin. Penicillin is an antibiotic that has been on the market for over 75 years & there are thousands of studies about its safety & efficacy in the literature. These studies have been extensively reviewed and assessed by the FDA.

Imagine if one day a small group of people in Kansas City, Kansas made the claim that penicillin causes birth defects & went to the press with those claims. The ensuing media campaign became concerning for the public & then the public began pressuring their legislators to give Kansas the right to label penicillin with the claim that "This substance is known to the state of Kansas to cause birth defects." Even when we've known for over 75 years that this claim is not true. However, because of the pressure, legislators decide to put the claim on the label.

What would the impact be?

Well, manufacturers, pharmacists, and doctors would become very concerned about the liability they would incur because of the claim that they had "failed to warn" their patients even though the claim about birth defects wasn't true.

How would this impact patients?

Well patients in Kansas City, Kansas would have a much harder time getting penicillin than their neighbors right across the street in Kansas City, Missouri.

Now amplify that by 50.

As you can see, a patchwork of labeling would be very difficult to navigate across the country.

If, on the other hand, the FDA were the party responsible for the scientific accuracy of the label, the consistency across the country would make it better for patient access.

This labeling would not shield manufacturers from liability if they made a "bad batch", the pharmacists would still be liable for dispensing the wrong formulation & the doctors would still be liable for administering the wrong dose.

So let's come back to glyphosate. It is as critical to farmers as antibiotics are to medicine. Every major regulatory agency in the world has evaluated its safety for over 50 years and have come to the same conclusion. It does not cause cancer.

My family & I have personally used RoundUp branded products on our farm for decades & I have reviewed the safety studies in depth & I know that it doesn't cause cancer.

Our aim is to provide consistency on the label so there isn't a patchwork of 50 different labels that will limit farmers' access to this critically important crop protection tool.

Thank you for considering & I'm happy to take questions.



Contact:
Matt Perdue, Lobbyist
mperdue@ndfu.org | 701.641.3303

**Testimony of
Matt Perdue
North Dakota Farmers Union
Before the
Senate Agriculture and Veterans Affairs Committee
March 14, 2025**

Chairman Luick and members of the committee,

Thank you for the opportunity to testify on House Bill No. 1318. My name is Matt Perdue, and I am testifying on behalf of North Dakota Farmers Union's (NDFU) members.

For more than 50 years, glyphosate has been a trusted tool for farmers. Over half of all wheat acres, 80% of corn acres, and 92% of soybean acres rely on glyphosate-based herbicides to control invasive weeds and keep costs low.¹ We share concerns regarding frivolous lawsuits that could ultimately undermine farmers' access to critical crop protection products. We generally support efforts to protect farmers' access to these products.

We also believe it is important for farmers to have the opportunity to seek recourse through the courts if they are harmed by another's action. Since we first learned of this legislation, we have raised several questions regarding the bill's impact on farmers' right to seek legal recourse. It is our understanding this bill is aimed at limiting the potential for North Dakota to adopt unique labeling requirements for pesticides. We support that intent. However, we remain concerned about the impact of lines 16 and 17 of the bill, concerning the duty to warn.

FIFRA Preemption

As you know, chemicals are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA grants EPA authority over pesticide labeling and packaging. FIFRA preempts state labeling and packaging standards. Historically, courts have strictly prohibited states from enacting labeling or packaging standards "in addition to," or "different from" federal standards. In the last 20 years, the courts have loosened that standard, instead requiring state labelings and packaging to be "equivalent to" or "consistent with" federal labels.² We support the historical standard and oppose efforts to adopt labels in North Dakota or other states that are "in addition to" or "different from" federal requirements.

¹ United States Department of Agriculture, National Agricultural Statistics Service. (2024). *Agricultural Chemical Use Program*. Retrieved from [https://www.nass.usda.gov/Surveys/Guide to NASS Surveys/Chemical Use/](https://www.nass.usda.gov/Surveys/Guide%20to%20NASS%20Surveys/Chemical%20Use/).

² Hartman, J., and Rollins, B. (2021). *Preemption under the Federal Insecticide, Fungicide and Rodenticide Act*. The National Agricultural Law Center. Retrieved from <https://nationalaglawcenter.org/wp-content/uploads/assets/articles/FIFRA-Fact-Sheet-w.pdf>.



However, this legislation's reference to duty to warn appears to go beyond labeling requirements and more broadly limits farmers' right to seek recourse if they are harmed by a failure to warn.

Duty to Warn

FIFRA prohibits misbranding products, which includes "false or misleading" statements or labels that omit necessary warnings. While FIFRA grants EPA the authority to cancel a pesticide registration for misbranding, FIFRA does not provide a private right of action. So, an individual who is harmed by the misbranding of a crop protection product may not sue for damages under FIFRA. Instead, the individual must seek a remedy under applicable state law.³

Plaintiffs filing pesticide injury lawsuits frequently allege a failure to warn.⁴ Many of these lawsuits claim the products caused negative health effects. It is likely many of these suits are what we would consider frivolous. However, failure to warn has also been alleged in suits claiming that dicamba drift caused crop damage. While other cases are still working through the judicial system, one case – Bader Farms v. Monsanto – was successful and subsequently upheld after appeal.⁵

Conclusion

NDFU supports the legislation's intent of protecting crop protection products from frivolous lawsuits. We remain concerned that the broad reference to duty to warn may prevent farmers from seeking recourse in legitimate cases. We believe the committee can mitigate that concern by:

- a. Amending the legislation to eliminate references to duty to warn and adding a clear prohibition on pesticide labels or requirements in addition to or different from those required under FIFRA;
- b. Limiting the impact of the legislation to actions alleging harm to human health caused by a failure to warn; or
- c. Amending the legislation to exempt complaints that are consistent with FIFRA mislabeling standards.

Thank you for your consideration. I will stand for any questions.

³ Rollins, B. (n.d.) *The Deal with Dicamba: Part Three*. The National Agricultural Law Center. Retrieved from <https://nationalaglawcenter.org/the-deal-with-dicamba-part-three/>.

⁴ Rollins, B. (n.d.). *Plaintiffs & Pesticides: Failure to Warn Claims in Pesticide Injury Lawsuits*. The National Agricultural Law Center. Retrieved from <https://nationalaglawcenter.org/plaintiffs-pesticides-failure-to-warn-claims-in-pesticide-injury-lawsuits/>.

⁵ Rollins B. (n.d.) *The Deal with Dicamba: Part Three*. The National Agricultural Law Center. Retrieved from <https://nationalaglawcenter.org/the-deal-with-dicamba-part-three/>.

COMMISSIONER
DOUG GOEHRING



ndda@nd.gov
www.agdepartment.com

**Testimony of Doug Goehring
Agriculture Commissioner
Senate Agriculture and Veterans Affairs
Fort Union
March 14, 2025**

Chairman Luick and members of the Senate Agriculture and Veterans Affairs Committee, I am Agriculture Commissioner Doug Goehring. I am here today in support of HB 1318 which relates to pesticide labeling and duty to warn about particular health risks.

The bill provides that pesticide labels that are approved by the United States Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), or labels that are consistent with EPA's carcinogenicity classification are considered a sufficient warning label relating to the duty to warn. This would help provide clarity and certainty about health risks concerning EPA approved products.

Chairman Luick and committee members, thank you for your consideration of HB 1318. I would be happy to answer any questions you may have.

2025 SENATE STANDING COMMITTEE MINUTES

Agriculture and Veterans Affairs Committee

Fort Union Room, State Capitol

HB 1318

3/21/2025

A bill relating to pesticide labeling.
--

10:26 a.m. Chairman Luick opened the hearing.

Members present: Chairman Luick, Vice-Chair Myrdal, Senator Weston, Senator Weber, Senator Lemm

Discussion Topics:

- Environmental Protection Agency (EPA)
- Glyphosate as a human carcinogen
- Pesticide
- Research submitted to the EPA
- Label vacations and scientific review
- Label sufficiency and label misbranding
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- Civil lawsuit ability
- Blanket immunity
- Other states statutes
- Product failures

10:28 a.m. Sarah Lovas, ND Grain Growers Association, testified in favor and referenced testimony #41420 from 3/14.

10:46 a.m. Jaclyn Hall, ND Association for Justice, testified in opposition.

10:51 a.m. Matt Perdue, ND Farmers Union, testified in neutral.

10:54 a.m. Parrell Grossman, Legislative Director, ND Soybean Growers Association, testified in favor.

10:58 a.m. Lacey Anderson, Attorney for Bayer, testified in favor.

11:02 a.m. Representative Jarod Hagert, District 20, testified in favor.

11:06 a.m. Chairman Luick closed the hearing.

Audrey Oswald, Committee Clerk

2025 SENATE STANDING COMMITTEE MINUTES

Agriculture and Veterans Affairs Committee

Fort Union Room, State Capitol

HB 1318

3/27/2025

A bill relating to pesticide labeling.
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9:00 a.m. Chairman Luick called the meeting to order.

Members present: Chairman Luick, Vice-Chair Myrdal, Senator Marcellais, Senator Weston, Senator Weber, Senator Lemm

Discussion Topics:

- Glyphosate as a human carcinogen
- Environmental Protection Agency and label registration
- Ability for lawsuits to occur
- 9th Circuit Court of Appeals
- Label vacation
- Residential use of chemical pesticides
- Additional chemicals within pesticides
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- International Agency for Research on Cancer (IARC)
- American chemical manufacturing and bankruptcy
- Risk and hazard assessments
- ND Product Liability laws
- Chemical seller liability to legal litigation
- Farmers and workers compensation
- ND punitive statutes
- Systematic reviews
- Duty to warn

9:04 a.m. Sarah Lovas, on behalf of the ND Agriculture Consultants Association, and the Director of the ND Grain Growers Association, testified in favor and submitted testimony #44263.

9:19 a.m. Mark Behrens, US Chamber of Commerce, testified in favor and submitted testimony #44234.

9:30 a.m. Dr. Sarah Eliza Lockwood, Medical Affairs Lead, Crop Science Division of Bayer, testified in favor and submitted testimony #44259.

9:34 a.m. Jaclyn Hall, Executive Director, ND Association for Justice, testified in opposition and submitted testimony #44256.

9:44 a.m. Lanny Kenner, constituent from District 7, testified in opposition and submitted testimony #44248.

9:49 a.m. Dr. Jake Schmitz, licensed health professional, practices in Fargo, ND, testified in opposition and submitted testimony #44233.

10:05 a.m. Samuel Wagner, Ag and Food Field Advisor, Dakota Resource Council, testified in opposition and submitted testimony #44180.

10:10 a.m. Elizabeth Burns-Thomas, Executive Director, Modern Agriculture Alliance, testified in favor and answered the committee's questions.

10:20 a.m. Chairman Luick closed the hearing and recessed the meeting.

10:31 a.m. Chairman Luick reconvened the meeting.

10:32 a.m. Senator Myrdal moved to adopt Amendment LC #25.0622.01001.

10:32 a.m. Senator Weber seconded the motion.

Senators	Vote
Senator Larry Luick	Y
Senator Janne Myrdal	Y
Senator Randy D. Lemm	Y
Senator Richard Marcellais	Y
Senator Mark F. Weber	Y
Senator Kent Weston	Y

Motion passed 6-0-0.

10:35 a.m. Senator Myrdal moved a Do Pass As Amended.

10:35 a.m. Senator Weber seconded the motion.

10:35 a.m. Senator Myrdal withdrew her motion to Do Pass As Amended.

10:39 a.m. Senator Myrdal moved a Do Pass As Amended.

10:39 a.m. Senator Weber seconded the motion.

Senators	Vote
Senator Larry Luick	Y
Senator Janne Myrdal	Y
Senator Randy D. Lemm	Y
Senator Richard Marcellais	N
Senator Mark F. Weber	Y
Senator Kent Weston	Y

Motion passed 5-1-0.

Senator Myrdal will carry the bill.

Additional written testimony:

Jon Wert, Chairman, ND Oilseed Council, submitted testimony #44252 in favor.

Denise C. Jasper-Martin, resident of Linton, ND, submitted testimony #44179 in opposition.

Kathryn L. Rutz, concerned citizen of Casselton, ND, submitted testimony #44232 in opposition.

Connie Samuelson, citizen of Minot, ND, submitted testimony #44235 in opposition.

Matt Herman, resident of Ashley, ND, submitted testimony #44261 in opposition.

Doug Sharbono, citizen of Fargo, ND, submitted testimony #44269 in opposition.

10:45 a.m. Chairman Luick closed the hearing.

Audrey Oswald, Committee Clerk

Bill further amended on 04/10/25.

PROPOSED AMENDMENTS TO

CO
3/27/25
1 of 1

HOUSE BILL NO. 1318

Introduced by

Representatives Hagert, Lefor, Beltz, Headland, Klemin, Koppelman, Weisz

Senators Hogue, Kessel, Thomas, Weber

- 1 A BILL for an Act to create and enact a new section to chapter 28-01.3 of the North Dakota
2 Century Code, relating to pesticide labeling.

3 **BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF NORTH DAKOTA:**

- 4 **SECTION 1.** A new section to chapter 28-01.3 of the North Dakota Century Code is created
5 and enacted as follows:

6 **Pesticide labeling - Duty to warn - Defenses.**

- 7 Notwithstanding any other provision of law, any pesticide registered with the agriculture
8 commissioner under chapter 4.1-33 or the United States environmental protection agency under
9 the Federal Insecticide, Fungicide, and Rodenticide Act [61 Stat. 163; 7 U.S.C. 136 et seq.]
10 which displays a label approved by the United States environmental protection agency in
11 registering the pesticide, displays a label consistent with the most recent human health
12 assessment performed under the Federal Insecticide, Fungicide, and Rodenticide Act [61 Stat.
13 163; 7 U.S.C. 136 et seq.], or displays a label consistent with the United States environmental
14 protection agency carcinogenicity classification for the pesticide under the Federal Insecticide,
15 Fungicide, and Rodenticide Act [61 Stat. 163; 7 U.S.C. 136 et seq.] is a sufficient warning label
16 for an action commenced sufficient to satisfy any requirement for warning or labeling regarding
17 health or safety under this chapter and any other provision or doctrine of state law concerning
18 the duty to warn or label, or any other common law duty to warn.

Dear ND Legislature,

My husband and I are VERY concerned about the possibility of HB1318 passing. To be honest, we are frustrated that our legislature thinks that WE THE PEOPLE would be OK with this legislation being made law.

We have so many questions.

First, WHO brought this bill? WHO does this bill mainly benefit? The answers to those questions should tell you EVERYTHING you need to know.

WHAT product could you or I manufacture & receive immunity from liability with a simple warning label on the product?

WHY shouldn't pesticide manufacturers have to work to make their products more safe like you & I would have to?

Shouldn't we (& by "we" I mean our legislature) be protecting THE PEOPLE instead of big corporations? Shouldn't they have to work to make their products more safe?

Your child, grandchild, sibling, parent, spouse could easily be affected by this. You are OK with those precious people in your life having ZERO recourse if they are damaged by these products? Your Yes vote says you are.

If you aren't receiving much pushback on this, it's because your constituents trust you. We trust you to do the right thing, by us, the PEOPLE, who elected you to protect US. Not Big Ag or any other corporation.

We can guarantee that if this was put on a ballot & voted on in the State of ND, it WOULD NOT PASS. This is unacceptable. We are PRAYING HARD that you will do the right thing here & VOTE NO.

Thank you for your time and consideration.

Sam Wagner
Ag and Food Field Organizer
Dakota Resource Council
1902 E Divide Ave
Bismarck ND 58501
Testimony in Opposition for HB1318

To the Honorable Chairman and the members of the Committee. We submit these remarks on behalf of DRC.

To the Senate Ag and Veterans Committee Regarding Amendments,

We would like to state that this bill's amendments would considerably help the bill but we would want to ask the question to the committee. What is the intent of this bill and what would happen if this bill is not passed? If this bill needs to be a housekeeping bill to keep the state law in line with the federal regulations then there should be no problems just stating that the labels have to be compliant with federal regulations. If that law exists and everything is up to date then we ask to not pass this bill.

We want everyone here to notice that the people testifying have stated that if you have a good enough lawyer you should be able to sue for damages and that this legislation is not bulletproof. We disagree. Raising the burden of proof or the standard for sufficient warning in the favor of the pesticide business coupled with the fact that federal regulators dealing with pesticides are being cut causing label reviews to be delayed. The amendments regarding FIFRA could be rendered useless as the years go by if these programs fail to exist in any meaningful way. The amendments would make this bill better, but we would still rather not have this language in our law books.

This would be the only amendment that would be considered acceptable but if it were applied it would just match existing law.

Section 2 – Pesticide Labeling - Exception Nothing in this section shall be construed to apply to any action or claim arising under state law that is equivalent to, and fully consistent with, the misbranding standards set forth in the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136(q)."

We'd also like to remind you that our Agriculture Commissioner fought against the federal government when it was trying to pass more restrictions on Dicamba. We can't simultaneously pass bills that tell us that the federal government should be given supremacy when it comes to regulating standards of chemicals then fight the federal government when they actually try to enforce regulations or try to ban substances that are proven to cause problems. We ask that

you pay attention to what our officials and members testifying in favor of this legislation do, rather than what they say.

Access to roundup and glyphosate has been brought up in most testimony, but this bill is much more wide ranging than roundup. If this bill passes this body every chemical that was made and registered and every chemical that will be made and registered when you pass this law will be essentially exempted from liability. Let's assume for the sake of argument that glyphosate is safe enough to put on your cornflakes, won't give you cancer, won't destroy crops, or cause any damages whatsoever and that California liberals are truly wrong on this one. Can you tell me with absolute certainty that every other chemical put out will be one hundred percent safe knowing the government's track record with things like DDT, Putting lead in everything, asbestos, and CFCs? Also you have to ask yourself, would you be comfortable with trusting these companies to make safe products when they also know you just raised the bar for the average North Dakotan to be able to sue them for damages? DRC's answer to this question is no.

Regardless of the amendments we still ask the committee to recommend a **DO NOT PASS** vote on this bill.

Good morning, honorable members of the Senate Agriculture and Veteran Affairs Committee

My name is Kathryn Rutz and I wish to express my opposition to HB1318. As a 13 + yr. cancer survivor, who ended up choosing a more natural path to her cancer healing . The knowledge that I gained after much study gave me the courage to refuse the treatments recommended at the time. I changed my diet, eating mostly organic, and by the grace of God have remained cancer free. I have continued reading much research on chemicals used on our crops as well as read many articles on regenerative farming and our declining bee population in this nation.

I realize this is a last ditch effort in trying to urge the non-passage of this bill. I truly wish I would have known about it sooner. I have read many of the testimonies , both in favor and in opposition and strongly concur with the following in opposition from 3/14 : Sam Wagner, Sara Christiansen, Charlene Nelson, Connie Samuelson and Dr. Steve Nagel. I would be remiss also not to mention Gary Emineth's editorial in the Fargo dated March 22nd, stating his opposition as well .

I have a friend whose son-in-law is a fire fighter and it was discovered that a chemical that they had been using was very hazardous to health, and they found a safer compound to use. With honesty and enough research, corporations can find better options for farmers, but until they do people who are possibly harmed by this chemicals , should have the ability to pursue legal action. Matters of health are not frivolous. As a grandmother of 8, I am very concerned about the safety of the foods we eat. I am also proud to be a ND citizen, living in a state that usually finds itself on the side of common sense and not being swayed by outside forces.

I appreciate this opportunity- PLEASE I URGE A DO NOT PASS HB1318

Dr. Jake Schmitz, DCN, MS, DC
 4233 44th Avenue South, Fargo, ND 58104
 701-770-0185
drjakedc4u@gmail.com

- Business co-owner of several entities in ND involving agriculture, minerals, water, and real estate
- Associates degree at Williston State College, BS in Chemistry at Dickinson State University, Doctor of Chiropractic at Northwestern Health Sciences University, Master's degree in Human Nutrition and Functional Medicine at University of Western States, and Doctorate in Clinical Nutrition at University of Western States
- Married with 5 children

Chairman Luick, Senators of the Agriculture and Veterans Affairs Committee,

My name is Dr. Jake Schmitz, and I am representing myself as a licensed health professional in the state of North Dakota (ND). I have a doctorate in clinical nutrition, which makes food and nutrition science a heavy focus of mine. I have been practicing in Fargo for 13 years. I STRONGLY OPPOSE the proposed bill HB 1318.

Ag Commissioner Doug Goehring made a false claim in the first hearing of this bill, on March 14th. He said that Bayer was found liable in California lawsuits without the opportunity to present a defense. This assertion is **factually incorrect**. In reality, Bayer has been afforded full legal rights to defend itself in these cases. For instance, during the *Hardeman v. Monsanto* trial in 2019, Bayer actively participated, presenting comprehensive evidence and arguments.

The jury's verdict against Bayer came after thorough consideration of evidence from both parties. Furthermore, Bayer has secured defense verdicts in several cases, indicating that the company has had ample opportunity to present its case. Therefore, the claim that Bayer was denied a defense is unfounded and should not influence legislative decisions regarding HB1318.

HB1318 **removes accountability from pesticide manufacturers** and prioritizes corporate interests over public health. It grants a **liability shield** to companies **even when scientific evidence emerges linking their products to cancer, neurological diseases, and other chronic illnesses**. I urge this committee to reject this dangerous proposal. The proponents of this bill are doing a wonderful job of obfuscating the real issue. They claim this is simply a labeling bill. You could easily argue that, even though it isn't true.

Take for example, cancer. The EPA has concluded that glyphosate is "not likely to be carcinogenic". There is plenty of research I have listed below disproving that claim. Regardless, if the EPA does not require the RoundUp label to say cancer is a risk of using the product, then even if a person gets cancer from using it, they have no recourse for suing for damages.

Why? Because this bill shields pesticide manufacturers from liability. The proponents (Modern Ag Alliance AKA Bayer) are telling you this won't protect from false labeling claims or drift. That's true, and a complete Red Herring. In the example I mentioned above, since the EPA does not require a cancer

label, then even if a person can prove they got cancer from the pesticide in question, they can't sue because Bayer was in compliance with EPA's labeling requirement.

Scientific Evidence: Pesticides Cause Cancer and Disease

Multiple peer-reviewed studies have demonstrated the **serious health risks of pesticides**, particularly for those exposed through occupation, drift, or environmental contamination.

1. Glyphosate and Carcinogenicity

- The systematic review "**Mapping the Key Characteristics of Carcinogens for Glyphosate and Its Formulations**" confirms that glyphosate, the active ingredient in Roundup, **exhibits key carcinogenic properties** linked to cancer development (Silva et al., 2022).
- This aligns with the **World Health Organization's International Agency for Research on Cancer (IARC)** classification of glyphosate as **"probably carcinogenic to humans."**

2. Cancer Rates in Agricultural Communities

- The study "**Cancer Incidence and Death Rates in Argentine Rural Towns Surrounded by Pesticide-Treated Agricultural Land**" found **significantly higher rates of cancer** in areas exposed to pesticides (Meneguzzi et al., 2022).
- This suggests a **direct correlation between pesticide exposure and increased cancer risk**, even among those not directly handling these chemicals.

3. Occupational Exposure and Health Damage

- "**Health Problems in Agricultural Workers Occupationally Exposed to Pesticides**" (Abreu-Villaça et al., 2023) reveals that farmworkers exposed to pesticides face **increased risks of cancer, neurotoxicity, and reproductive harm**.
- The review "**Health Impact of Occupational Pesticide Exposure**" (Lopez et al., 2022) highlights **chronic illnesses, immune dysfunction, and neurological disorders** in greenspace workers exposed to pesticides.

4. Long-Term Health Effects and Government Underestimation

- "**Cancer and Occupational Exposure to Pesticides: A Bibliometric Study of the Past 10 Years**" underscores the **strong link between pesticide exposure and multiple cancers**, raising concerns about underreporting by regulatory agencies.

The EPA Has Been Wrong Before

Proponents of this bill argue that **EPA approval is a sufficient safeguard**. But history shows that **the EPA has repeatedly failed to protect public health** from dangerous chemicals.

- **DDT** was once approved and widely used until **it was banned after being linked to cancer, reproductive harm, and environmental destruction**.
- **Asbestos** was approved and used for decades before being recognized as a **deadly carcinogen**.
- **PFAS chemicals ("forever chemicals")** were deemed safe by regulators, yet today they are linked to **cancer, birth defects, and immune disorders**.

The EPA does **not always require companies to list cancer risks** on pesticide labels, even when strong scientific evidence exists. If HB1318 passes, companies would be immune from lawsuits if the EPA fails to mandate label warnings indicating cancer risk.

How HB1318 Shields Companies & Hurts North Dakotans

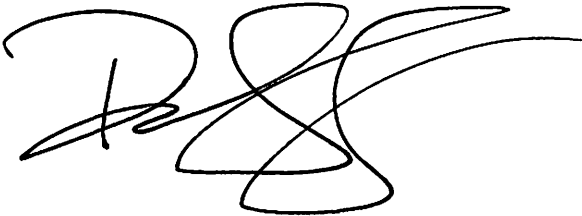
- **Manufacturers Escape Liability:** If future research confirms that a pesticide causes cancer, **but the EPA does not update the label, victims will have no legal recourse.**
- **Farmers, Workers, and Rural Families Pay the Price:** Those exposed to harmful pesticides **bear the medical and financial burden** while corporations avoid accountability.
- **North Dakota Taxpayers Foot the Bill:** If lawsuits are blocked, the cost of medical care, disability, and environmental cleanup falls on **state resources, Medicaid, and taxpayers.**

Conclusion: Vote NO on HB1318

Pesticide manufacturers should not receive a **free pass** when their products cause harm. **This bill puts corporate profits above human lives.** The scientific evidence is clear: **pesticides can and do cause serious health conditions, and regulatory agencies do not always act in time to prevent harm.**

I urge this committee to **reject HB1318** and protect the people of North Dakota from **corporate immunity at the expense of public health.**

Thank you. I welcome any questions.

A handwritten signature in black ink, appearing to be 'Dr. Jake Schmitz', with a stylized, cursive script.

Dr. Jake Schmitz

EPA-EVALUATED AND APPROVED LABELS SHOULD SUFFICE IN CIVIL LITIGATION RELATED TO PESTICIDE LABELING

Pesticides are among the most highly-regulated products on the market. Before any pesticide can be sold, its manufacturer must obtain pre-market approval from the U.S. Environmental Protection Agency (EPA) as part of a robust registration process that confirms human health and safety and includes approval of the labeling in accordance with strict federal requirements. The pesticide also must be registered with the North Dakota Department of Agriculture prior to sale.

Despite adhering to these strict requirements and regulatory approvals, pesticide manufacturers and sellers are often subject to lawsuits challenging the adequacy of EPA-approved labels. Companies typically win the cases, but the cost of defending such claims is substantial. And there is extreme unpredictability in the courts, even as to claims that are essentially identical. Some plaintiffs have obtained “nuclear verdicts” totaling hundreds of millions of dollars in recent cases.

Case-by-case outcomes undermine the decision-making of expert regulators charged with protecting the public. Further, tort lawsuits involving EPA-approved labels can negatively impact the availability of pesticides, both as to products on the market now and with respect to the development of next-generation products. To offset high litigation costs, pesticide manufacturers may be forced to raise the price of their products, hitting farmers in the pocketbook. Consumers, in turn, have to pay more for farm products, hitting their pocketbooks too.

EPA experts have specialized knowledge, access to broad information, and the time and resources to carefully study the relevant science and literature in-depth; this allow them to reach the most informed decisions. A manufacturer or seller of a pesticide should not be subject to liability for using a label that has been approved by EPA or that is consistent with the EPA’s most recent human health assessment or carcinogenicity classification for the pesticide.

Pesticide Regulation

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) establishes a comprehensive statutory scheme that governs the use, sale, and labeling of pesticides.¹ Pesticides are “any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest; or intended for use as a plant regulator, defoliant, or desiccant.”² Thus, pesticide products include insecticides to kill bugs; rodenticides to kill rodents; fungicides to protect against fungus, mold or mildew; and herbicides for weeds.

FIFRA prohibits pesticides that pose unreasonable risks to humans, animals, or the environment.³ Before a new pesticide can enter the market, EPA conducts both a human health risk assessment and an ecological risk assessment. During this process, EPA requires manufacturers to submit extensive test data and the agency evaluates scientific literature, such as epidemiological studies. EPA also evaluates carcinogenicity potential when a pesticide is proposed for registration.⁴ It is illegal for a pesticide manufacturer to knowingly falsify an application for registration,⁵ falsify testing information,⁶ or knowingly submit false data in support of registration.⁷

FIFRA also requires EPA to determine that the pesticide’s “labeling ... compl[ies] with the requirements of [FIFRA].”⁸ According to EPA, “The label on a pesticide package or container and

¹ 7 U.S.C. § 136 et seq.

² 40 C.F.R. § 152.3.

³ EPA, *About Pesticide Registration*, <https://www.epa.gov/pesticide-registration/about-pesticide-registration>.

⁴ EPA, *Evaluating Pesticides for Carcinogenic Potential*, <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/evaluating-pesticides-carcinogenic-potential>.

⁵ 7 U.S.C. § 136j(a)(2)(M).

⁶ 7 U.S.C. § 136j(a)(2)(Q).

⁷ 7 U.S.C. § 136j(a)(2)(R).

⁸ 7 U.S.C. § 136a(c)(5)(B).

the accompanying instructions are a key part of pesticide regulation. The label provides critical information about how to handle and safely use the pesticide product and avoid harm to human health and the environment.”⁹

Federal regulations provide specific requirements for pesticide labels.¹⁰ Registrants must submit both a proposed and final label to the EPA. EPA must review and approve the labeling.¹¹ Based on its safety assessment, EPA may require a product’s labeling to feature specific health and safety statements or personal protective equipment requirements.¹²

EPA’s Office of Pesticide Programs includes experts who are specifically trained to review labels based on science to ensure that pesticide labels adequately communicate directions and precautions. EPA explains:

We [EPA] review pesticide product labels as part of the licensing/registration process and must approve all label language before a pesticide can be sold or distributed in the United States. The overall intent of the label is to provide clear directions for effective product performance while minimizing risks to human health and the environment.¹³

EPA oversight does not end when a label is approved and a pesticide is registered for sale. After a pesticide is registered, EPA regulations require pesticide registrants to report any new adverse effects within 30 days,¹⁴ including harmful effects and scientific studies such as an epidemiological study showing “that a correlation may exist between exposure to a pesticide and observed adverse effects in humans.”¹⁵ EPA can immediately suspend or can cancel registration of a pesticide when serious risks are identified.¹⁶

Finally, FIFRA requires EPA to complete a full reassessment of each registered pesticide at least every 15 years to determine whether the pesticide continues to meet FIFRA’s registration requirements.¹⁷

In addition to federal regulation, North Dakota requires every pesticide sold in the state to be registered with the Commissioner of Agriculture.¹⁸ Before approval, a registrant must submit the “current label of each product to be registered.”¹⁹

The Legislation

The bill provides that the warning label on a pesticide that is registered with the Commissioner of Agriculture or EPA is sufficient to satisfy any state-law duty to warn if the label is (1) approved by EPA; (2) consistent with the most recent human health assessment performed by EPA under FIFRA, or (3) consistent with the EPA’s carcinogenicity classification for the pesticide under FIFRA.

⁹ EPA, *Pesticide Registration, Labeling Requirements*, <https://www.epa.gov/pesticide-registration/labeling-requirements>.

¹⁰ 40 C.F.R. Part 156.

¹¹ 7 U.S.C. §136a(c)(5)(B).

¹² 40 C.F.R. §§156.60-156.70; 156.10(i)(1), (2).

¹³ EPA, *About Pesticide Registration*, <https://www.epa.gov/pesticide-registration/about-pesticide-registration#label>.

¹⁴ 40 C.F.R. § 152.125; 40 C.F.R. § 159.155; EPA, *Incident Reporting by Pesticide Manufacturers/ Registrants*, <https://www.epa.gov/pesticide-incidents/incident-reporting-pesticide-manufacturers-registrants>.

¹⁵ 40 C.F.R. § 159.170.

¹⁶ 7 U.S.C. §§ 136d(c)(3), 136d(b).

¹⁷ 7 U.S.C. § 136a(g)(1)(A).

¹⁸ N.D. Cent. Code § 4.1-34-03.

¹⁹ *Id.* at § 4.1-34-03(1)(c).

Legal Analysis

The bill provides narrow liability protection that will apply only to lawsuits challenging the adequacy of the warning label on government-approved pesticides, such as product liability actions claiming that the product's label should have warned of a particular health risk.

The bill would not apply to any claim that is unrelated to the pesticide's label. For example, the bill would not preclude a lawsuit alleging that a different formulation may have been as effective but less risky (i.e., a design defect claim). A manufacturer could be sued if a contaminant in a bad batch of its product causes crop losses (i.e., a manufacturing defect claim). Claims that a pesticide did not work as advertised are not precluded either. The bill would also not impact a negligence claim alleging that a pesticide was misapplied by an applicator and caused harm to a neighboring farmer's crops.

The Public Policy Need

The legislation will prevent unfounded lawsuits involving pesticides that bear a label that has been evaluated and approved by EPA or that is consistent with the EPA's most recent human health assessment or carcinogenicity classification for the pesticide under FIFRA. The bill respects the decision-making of experts based on sound science.²⁰

Given the extensive use of and critical role of pesticides in modern agriculture, these products must remain available and affordable to farmers and others who utilize them, such as in agricultural operations. Pesticides increase agricultural efficiencies in a market faced with rising demand for food products.

Failure-to-warn claims negatively impact the agricultural community as they can make needed products unavailable or result in redirection of funds that could be used for researching and developing next-generation products to cover unwarranted litigation costs.

Finally, the legislation would help reduce costs for farmers and consumers.

²⁰ One federal appellate court has held that once EPA approves a pesticide's label, federal law bars any civil action alleging that the product should have had a different label. *Schaffner v. Monsanto Corp.*, 113 F.4th 364 (3d Cir. 2024); *but see Carson v. Monsanto Corp.*, 92 F.4th 980 (11th Cir. 2024); *Hardeman v. Monsanto Corp.*, 997 F.3d 941 (9th Cir. 2021), *cert. denied*, 142 S. Ct. 2834 (2022).

In Opposition of HB1318

Chairman and Members of Senate Agricultural and Veteran Affairs.

There is a reason a Georgia Jury ordered the recent \$2.1B lawsuit against Monsanto parent company Bayer. A lawsuit which has been going on since 2021. It is no coincidence that Monsanto/Bayer are now on a mission throughout the states to change the labeling thereby protecting themselves from future liabilities.

Ask yourselves:

What is “a sufficient warning label”? Who determines what is “a sufficient warning label”?

What is “a label consistent with the most recent human health”? Any label with the possibility of linkage to a carcinogenic should be placed under deep scrutiny, bring pause and fear to all that have make decisions on its usage. The last one is you.

Be better and smarter than the House. DO NOT PASS on HB1318.

Connie Samuelson (D-3)
226 Souris Drive
Minot, ND 58701

Lanny Kenner
District 7

Chairman Luick and committee members,
I am opposed to HB 1318 for these reasons:

1. This bill mainly deals with pesticide labeling regulations and the impact on potential lawsuits.
2. This bill tries to say that if a pesticides labeling is approved by the EPA that it serves as a defense against lawsuits.
3. The intent of this bill is to provide a legal defense when they adhere to EPA approved labeling.
4. It could affect lawsuits that claim the warnings and labelings on pesticide products were inadequate. Don't let these manufacturers hide behind labeling!
5. In other words this is a bad Bill only trying to be put in place to protect manufacturers much like the pharmaceutical companies vaccine programs are protected against lawsuits.
6. Anytime a company cannot be held liable for a bad product because of some law, what is stopping that company from putting out bad products over and over again?

For the safety of everyone please vote NO on HB 1318.

Thank you, Lanny Kenner



North Dakota Oilseed Council

Canola, Crambe, Flax, Safflower, Sunflower

Testimony of Jon Wert Chairman ND Oilseed Council

HB 1318 March 26, 2025

Chairman Luick and members of the Senate Agriculture and Veterans Affairs Committee, my name is Jon Wert and I am a farmer from New England. I serve as the Chairman of the ND Oilseed Council. On behalf of the ND Oilseed Council we support HB 1318. This bill protects a valuable resource which enables our farmers to be profitable and sustainable, while ensuring appropriate safety measures remain in place through federal oversight. The ND Oilseed Council respectfully urges a Do Pass recommendation on HB 1318.



North Dakota Association for Justice
 PO Box 365
 Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
 jaclyn@ndaj.org

Chairman Luick and members of the Senate Agriculture and Veterans Affairs Committee. My name is Jaci Hall, Executive Director of the North Dakota Association for Justice. Today, I am here to answer some questions that have come up regarding HB1318 and the amendment provided by NDAJ.

Under current North Dakota law, when a pesticide is misbranded, liability clearly rests with the manufacturer who violated federal law. Product sellers are protected by North Dakota product liability law and employers can rely on labels of the products they give to employees. Manufacturers have the primary responsibility to accurately test, label, and warn of potential risks. HB 1318 would fundamentally alter this established accountability.

HB 1318, as drafted, grants manufacturers total immunity for merely complying with EPA labeling—even if they know the label is misrepresented. If adopted, responsibility could shift toward other parties depending on the facts, potentially affecting local chemical sellers and farm employers.

Sellers are currently shielded by North Dakota's product liability statute, could face liability if they possess actual knowledge of undisclosed defects or risks. Specifically, under N.D.C.C. § 28-01.3-04, sellers who are aware of risks not disclosed on EPA labels could find themselves liable. Now N.D.C.C § 28-01.3-05 says a manufacturer ordinarily would need to indemnify a seller--pay for their legal costs and liability--but HB 1318 wipes that out too because it applies "notwithstanding any other provision of law."

This means a chemical seller who becomes aware of a product's danger could bear liability currently assigned to manufacturers, and the manufacturer wouldn't have an obligation to indemnify them either.

Under HB1318 employers who hire farm workers could also face increased liability. If they don't have workers' compensation coverage, farm employers have duties to maintain safe working environments, provide safe equipment, and adequately warn employees about potential dangers. **If pesticide manufacturers are immune, then employers may**



North Dakota Association for Justice
PO Box 365
Mandan, ND 58554
The Trial Lawyers of North Dakota

Jaclyn Hall, Executive Director
jaclyn@ndaj.org

bear the liability for risks that should have been disclosed by the manufacturers.

By giving manufacturers immunity, HB 1318 places additional burdens on chemical sellers and farm employers to protect their customers and employees. If a customer or employee gets cancer, and they can't hold the manufacturer accountable, there really isn't anyone else who has a duty to keep them safe than the seller and the employer. I think we all agree the manufacturer *should* be responsible for the safety of the products they sell and ensure it isn't misbranded.

And that is what our amendment is designed to do. Our amendment says that if a company violates federal misbranding law, then you can hold them accountable for causing cancer, or Parkinson's or losing your acreage. However, It is still a high bar. The plaintiff will still have to prove that the product caused their cancer--for example, under this amendment the plaintiff would have to prove that glyphosate **actually** caused their cancer in order to recover--but the amendment will give them the opportunity to hold the manufacturer accountable in those circumstances, which is much more straightforward and clear for everyone, and fair.

When someone is injured, it is common practice to hold the entity or person who is liable for the injury accountable. This amendment will allow farmers and the public to hold the correct person liable for their losses.

Now, let's talk about the recent case in Georgia. In this case, Home Depot was the first defendant in the case, and they were dismissed because the manufacturer was ultimately the entity potentially liable for Mr. Barnes' cancer diagnosis. At the end of the trial, Mr. Barnes was awarded \$65 million in compensatory damages and \$2 billion in punitive damages. The question I was asked was whether a verdict like this could be awarded in North Dakota. The answer is simply No. North Dakota's punitive statute says the cap of punitives awarded in North Dakota is either two times the compensatory damages or \$250,000 – whichever is larger.

Finally, I wanted to talk a bit about products liability cases. These cases in general are very costly and time consuming to bring forward because of the



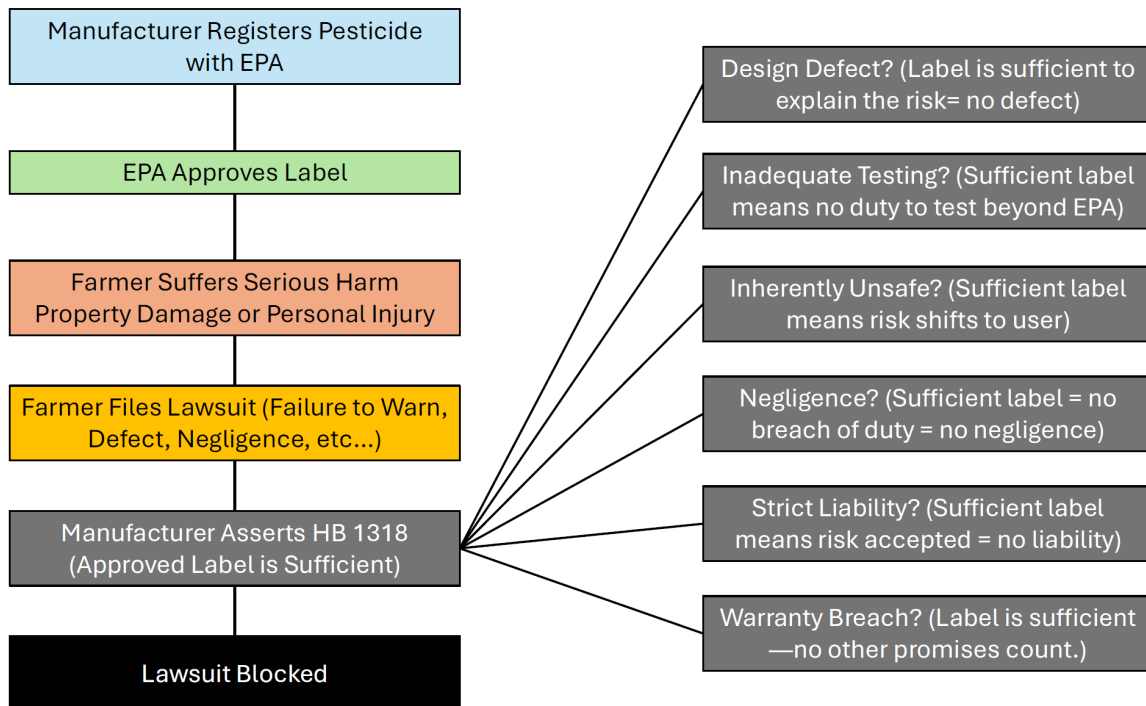
North Dakota Association for Justice
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Jaclyn Hall, Executive Director
jaclyn@ndaj.org

technical nature of the case. There are many different options to bring a products case forward, but under HB1318, the normal path would be superseded by this statute for farmers and those injured by misbranded chemicals.

This legislation is simply not needed. If the committee chooses to bring the case forward with a Do Pass, I ask you to consider utilizing both amendments presented last week. This way, the health and safety of the individual is considered and the pathway for misbranding is clear for farmers and those impacted by misbranded chemicals.

Below is a table on how HB1318 can be used to block claims.



Good Morning,

My name is Dr. Liza Lockwood. I am the Medical Affairs Lead for the Crop Science Division of Bayer, an emergency physician, a medical toxicologist & a mom. I am here today in support of HB 1318. The purpose of this bill is to ensure that the scientific safety of crop protection products are accurately reflected on the label.

I am here to answer any questions related to toxicity and health protocols related to pesticide label submissions.

Testimony in Opposition to HB 1318

Matt Herman

Ashley ND

Chairman Luick and members of the committee, my name is Matt Herman. I'm a retired high school principal currently ranching in western Dickey County. I testify on behalf of myself and stand in opposition to HB 1318.

I oppose HB 1318 because pesticide producers should be held liable for damages their products cause.

This bill needs a DO NOT PASS.

Thank you.

HB1318**Senate Agriculture and Veteran Affairs Committee****3/27/25****Sarah E Hall Lovas, Hillsboro, ND Agronomist****Director, North Dakota Grain Growers Association****North Dakota Agriculture Consultants Association**

My name is Sarah Hall Lovas. I am an agronomist from Hillsboro, ND. I'm representing the North Dakota Agriculture Consultants Association (Independent Crop Consultants) and also as a Director with the North Dakota Grain Growers Association. We ask you to Support HB 1318.

What is HB1318 and why do we need it?

HB 1318 is a pesticide labeling bill which would affirm that the EPA-granted pesticide label has sufficiently warned the public about potential hazards of using a pesticide. The reason this legislation is so important is to protect North Dakota's agriculture industry from frivolous lawsuits which result in pesticide label vacations and leave North Dakota's farmers and ranchers with limited pesticide options. This happened on June 17, 2022 when the 9th circuit court of appeals had a decision that vacated portions of the glyphosate label, which would have left the USA without this pesticide that is critical to agriculture production. However, the EPA on September 21, 2022 withdrew the vacation decision on glyphosate because its findings did not determine that glyphosate was carcinogenic.

<https://www.epa.gov/pesticides/epa-withdraws-glyphosate-interim-decision>

<https://www.regulations.gov/document/EPA-HQ-OPP-2009-0361-14447>

This frivolous lawsuit is just one example where environmental activism in combination with trial lawyers had the opportunity to greatly impact US Agriculture and North Dakota Agriculture. As a matter of fact, the greatest opposition to this proposed legislation, nationally, is the trial lawyers across the US including here in North Dakota.

EPA Label Vetting and Current interpretation by Farmers, Agronomists, Applicators:

The EPA has a rigorous comment period for every single active ingredient it considers for label registration. As an example, here is a closed docket from the EPA on glyphosate.

<https://www.regulations.gov/docket/EPA-HQ-OPP-2009-0361> You can see the EPA had to

consider over 14,000 comments dealing with this active ingredient. Some of these comments are from the agriculture industry, some are from environmental groups, some are scientific reviews, and some are from other sources.

When a label is vetted by the EPA, it has been done so thoroughly. Further, all agronomists, applicators, and farmers are trained to know that the label is the law. Not to follow the label is breaking the law. The safety requirements on the label are there to protect us. The label does an accurate job of warning of safety concerns.

Does HB1318 prevent someone suing a large corporation?

Lastly, there is concern that HB1318 would prohibit farmers and others from suing large companies who produce pesticides if there is a problem with a pesticide. As it was noted by different lawyers during committee work on March 21, 2025 in front of the Senate Agriculture and Veterans Affairs Committee, HB1318 does not prohibit lawsuits dealing with pesticides from occurring so lawsuits can occur. In other words, if HB1318 were to pass, lawsuits against chemical manufacturers could still occur. However, the label in our state would be protected from being vacated without sufficient review from the EPA.

Please Support HB1318.

Sincerely,

Sarah Hall Lovas
Agronomist
701-866-1704
Director, North Dakota Grain Growers Association
North Dakota Agriculture Consultants

**Do Not Pass Testimony
of Doug Sharbono, citizen of North Dakota
on HB1318
in the Sixty-ninth Legislative Assembly of North Dakota**

Dear Chairman Luick and members of the Senate Agriculture and Veterans Affairs Committee,

I am writing as a citizen and believe HB1318 is undesirable legislation shifting more product liability from the chemical manufacturer to the applicator, farmer, and General Public. This legislation includes a "Duty to warn" provision in the last paragraph. This is legal terminology which will substantially limit product liability for the manufacturer if damages result from its usage.

Additional comment from previous testimony is this liability release will allow the multi-national chemical companies to perhaps produce great new chemicals that increase crop yields and control weeds and disease, but obligation towards product safety towards humans and animals will no longer be a necessary consideration. More dangerous chemicals will be on the horizon.

This bill needs to be outright killed. The farmers and General Public need to maintain the protections we currently have, not dismantle them.

Please give HB1318 a Do Not Pass.

Thank you,

Doug Sharbono
1708 9th St S
Fargo, ND 58103

2025 SENATE STANDING COMMITTEE MINUTES

Agriculture and Veterans Affairs Committee

Fort Union Room, State Capitol

HB 1318

4/3/2025

A bill relating to pesticide labeling.
--

9:27 a.m. Chairman Luick opened the hearing.

Members present: Chairman Luick, Vice-Chair Myrdal, Senator Marcellais, Senator Weston, Senator Weber, Senator Lemm

Discussion Topics:

- Environmental Protection Agency (EPA)
- Trial lawyers and class action lawsuits
- Public protection
- Frivolous lawsuits
- Sunset clause
- Delayed implementation

9:27 a.m. Chairman Luick led the committee discussion on if they need to reconsider this bill regarding legal issues.

9:41 am. Chairman Luick adjourned the meeting.

Audrey Oswald, Committee Clerk

2025 SENATE STANDING COMMITTEE MINUTES

Agriculture and Veterans Affairs Committee

Fort Union Room, State Capitol

HB 1318

4/4/2025

A bill relating to pesticide labeling.
--

9:08 a.m. Chairman Luick called the meeting to order.

Members present: Chairman Luick, Vice-Chair Myrdal, Senator Marcellais, Senator Weston, Senator Weber, Senator Lemm

Discussion Topics:

- Legitimate emails
- Retailer and seller protection
- Environmental Protection Agency (EPA) and conservancy
- Legality of "not withstanding" language
- Manufacturer liability and immunity
- Residential cases of misuse
- Sufficient warning label and frivolous lawsuits

9:08 a.m. Senator Weber led committee discussion on EPA.

9:22 a.m. Chairman Luick closed the hearing.

Audrey Oswald, Committee Clerk

2025 SENATE STANDING COMMITTEE MINUTES

Agriculture and Veterans Affairs Committee

Fort Union Room, State Capitol

HB 1318

4/4/2025

A bill relating to pesticide labeling.
--

2:46 p.m. Chairman Luick opened the hearing.

Members present: Chairman Luick, Vice-Chair Myrdal, Senator Marcellais, Senator Weston, Senator Weber, Senator Lemm

Discussion Topics:

- Unconstitutional language strikes
- Amendment drafted
- Sunset clause
- Reconsideration

2:46 p.m. Chairman Luick updated the committee and submitted proposed amendment testimony #44696.

2:48 p.m. Chairman Luick adjourned the meeting.

Audrey Oswald, Committee Clerk

25.0622.01004
Title.

Prepared by the Legislative Council
staff for Senator Luick
April 4, 2025

Sixty-ninth
Legislative Assembly
of North Dakota

PROPOSED AMENDMENTS TO

HOUSE BILL NO. 1318

Introduced by

Representatives Hagert, Lefor, Beltz, Headland, Klemin, Koppelman, Weisz

Senators Hogue, Kessel, Thomas, Weber

- 1 A BILL for an Act to create and enact a new section to chapter 28-01.3 of the North Dakota
- 2 Century Code, relating to pesticide labeling.

3 BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF NORTH DAKOTA:

- 4 **SECTION 1.** A new section to chapter 28-01.3 of the North Dakota Century Code is created
- 5 and enacted as follows:

6 **Pesticide labeling - Duty to warn - Defenses.**

- 7 ~~Notwithstanding any other provision of law, any~~Any pesticide registered with the agriculture
- 8 commissioner under chapter 4.1-33 or the United States environmental protection agency under
- 9 the Federal Insecticide, Fungicide, and Rodenticide Act [61 Stat. 163; 7 U.S.C. 136 et seq.]
- 10 which displays a label approved by the United States environmental protection agency in
- 11 registering the pesticide, displays a label consistent with the most recent human health
- 12 assessment performed under the Federal Insecticide, Fungicide, and Rodenticide Act [61 Stat.
- 13 163; 7 U.S.C. 136 et seq.], or displays a label consistent with the United States environmental
- 14 protection agency carcinogenicity classification for the pesticide under the Federal Insecticide,
- 15 Fungicide, and Rodenticide Act [61 Stat. 163; 7 U.S.C. 136 et seq.] is ~~a sufficient warning label~~
- 16 ~~for an action commenced~~sufficient to satisfy any requirement for warning or labeling regarding
- 17 health or safety under this chapter and any other provision or doctrine of state law concerning
- 18 the duty to warn or label, or any other common law duty to warn.

2025 SENATE STANDING COMMITTEE MINUTES

Agriculture and Veterans Affairs Committee

Fort Union Room, State Capitol

HB 1318
4/10/2025

A bill relating to pesticide labeling.
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9:00 a.m. Chairman Luick called the meeting to order.

Members present: Chairman Luick, Vice-Chair Myrdal, Senator Marcellais, Senator Weston, Senator Weber, Senator Lemm

Discussion Topics:

- Reasons for interest
- Pesticide necessity in crop production
- Health and nutrition concerns
- National efforts and base level protection
- Previous proposed amendments
- Language strikes and replacements
- Original intent
- Pesticide code sections and regulations

9:00 a.m. Chairman Luick led the discussion and proposed Amendment LC# 25.0622.01006.

9:07 a.m. Senator Myrdal moved to reconsider.

9:09 a.m. Senator Weber seconded the motion.

9:09 a.m. Voice vote to Reconsider - Motion passed.

9:09 a.m. Senator Myrdal moved to adopt Amendment LC# 25.0622.01006.

9:09 a.m. Senator Weston seconded the motion.

Senators	Vote
Senator Larry Luick	Y
Senator Janne Myrdal	Y
Senator Randy D. Lemm	Y
Senator Richard Marcellais	Y
Senator Mark F. Weber	Y
Senator Kent Weston	Y

Motion passed 6-0-0.

9:11 a.m. Senator Myrdal moved a Do Pass As Amended.

9:11 a.m. Senator Weber seconded the motion.

Senators	Vote
Senator Larry Luick	Y
Senator Janne Myrdal	Y
Senator Randy D. Lemm	Y
Senator Richard Marcellais	N
Senator Mark F. Weber	Y
Senator Kent Weston	N

Motion passed 4-2-0.

Senator Myrdal will carry the bill.

9:15 a.m. Senator Luick adjourned the meeting.

Audrey Oswald, Committee Clerk

April 9, 2025

Sixty-ninth
Legislative Assembly
of North Dakota

PROPOSED AMENDMENTS TO

CO
4/10/25
10F1

HOUSE BILL NO. 1318

Introduced by

Representatives Hagert, Lefor, Beltz, Headland, Klemin, Koppelman, Weisz

Senators Hogue, Kessel, Thomas, Weber

- 1 A BILL for an Act to create and enact a new section to chapter 28-01.3 of the North Dakota
2 Century Code, relating to pesticide labeling.

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- 4 **SECTION 1.** A new section to chapter 28-01.3 of the North Dakota Century Code is created
5 and enacted as follows:

6 **Pesticide labeling - Duty to warn - Defenses.**

- 7 Notwithstanding any other provision of law in this title, any pesticide registered with the
8 agriculture commissioner under chapter 4.1-33 or the United States environmental protection
9 agency under the Federal Insecticide, Fungicide, and Rodenticide Act [61 Stat. 163; 7 U.S.C.
10 136 et seq.] which displays a label approved by the United States environmental protection
11 agency in registering the pesticide, displays a label consistent with the most recent human
12 health assessment performed under the Federal Insecticide, Fungicide, and Rodenticide Act [61
13 Stat. 163; 7 U.S.C. 136 et seq.], or displays a label consistent with the United States
14 environmental protection agency carcinogenicity classification for the pesticide under the
15 Federal Insecticide, Fungicide, and Rodenticide Act [61 Stat. 163; 7 U.S.C. 136 et seq.] is a
16 sufficient warning label for an action commenced sufficient to satisfy any requirement for
17 warning or labeling regarding health or safety under this chapter and any other provision or
18 doctrine of state law concerning the duty to warn or label, or any other common law duty to
19 warn.

**REPORT OF STANDING COMMITTEE
HB 1318**

Agriculture and Veterans Affairs Committee (Sen. Luick, Chairman) recommends **AMENDMENTS** ([25.0622.01006](#)) and when so amended, recommends **DO PASS** (4 YEAS, 2 NAYS, 0 ABSENT OR EXCUSED AND NOT VOTING). HB 1318 was placed on the Sixth order on the calendar. This bill does not affect workforce development.