

What's Really On Your Food

A plain-language guide to common herbicides, insecticides and fungicides — what they are, why they're used, how they reach you through meat and milk as well as produce, and what the science actually says.

This guide is meant to inform, not alarm. Every chemical here is backed by a specific source — the U.S. Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC), peer-reviewed studies, or other regulatory bodies. Where scientists and regulators disagree, that disagreement is stated plainly, because pretending there's a single simple answer wouldn't be honest.

The goal is simple: know what these chemicals are, where they show up, and what's actually been documented about their effects — so you can make your own informed choices about the food you buy.

How to read this guide. "Linked to" or "associated with" means studies have found a connection — not proof of direct cause in every case. Toxicology is rarely black-and-white, and regulators in different countries sometimes reach different conclusions from the same data. Where that happens, you'll find both positions here rather than the scarier one.

This is not medical advice, and it is not a list of foods to avoid. Produce is good for you. The point is to know what you're choosing between.

Updated September 2026

Produce rankings reflect EWG's 2026 Shopper's Guide, released March 2026. This guide is refreshed as new EPA decisions and testing data come out.

HERBICIDES

Herbicides kill unwanted plants — weeds competing with crops. They're generally sprayed directly on fields before or during the growing season.

Glyphosate

Sold under brand names like Roundup. The most widely used herbicide in the world.

USED ON

Corn, soybeans, wheat and many other row crops — especially "Roundup Ready" genetically modified crops bred to tolerate it.

WHAT'S DOCUMENTED

EPA's 2017 assessment concluded glyphosate is "not likely to be carcinogenic to humans." The International Agency for Research on Cancer (IARC), part of the World Health Organization, classified it in 2015 as Group 2A — "probably carcinogenic to humans." Multiple lawsuits and some epidemiological studies have pointed to an association with non-Hodgkin's lymphoma. It's banned or restricted in several countries, while still widely used and legal in the U.S.

This is the clearest example of regulatory disagreement in this guide — two major health bodies looked at similar data and reached different conclusions, largely due to differences in how they weighted animal studies versus real-world exposure data.

Atrazine

One of the most commonly used herbicides in the U.S.

USED ON

Corn, sorghum and sugarcane. It's also the most frequently detected pesticide contaminant in U.S. ground and surface water.

WHAT'S DOCUMENTED

Atrazine is recognized as an endocrine disruptor — it interferes with hormone signaling. Laboratory studies (notably by researcher Tyrone Hayes at UC Berkeley) found atrazine caused hormonal and reproductive abnormalities in frogs at concentrations well below EPA's drinking water limit. EPA has stated the data on human developmental effects remain inconclusive, and not all follow-up studies have replicated the frog findings. Atrazine is banned in the European Union but remains legal and widely used in the U.S.

2,4-D

One of the oldest and most widely used herbicides, dating back to the 1940s.

USED ON

Lawns, wheat, corn and pasture land. Also a component of Agent Orange — though it was the other component, 2,4,5-T, and its dioxin contaminant that caused Agent Orange's worst harms.

WHAT'S DOCUMENTED

EPA classifies 2,4-D as Group D — not classifiable as to human carcinogenicity — citing insufficient data. IARC has classified the broader class of chlorophenoxy herbicides, which includes 2,4-D, as Group 2B, "possibly carcinogenic to humans." Some studies have found associations with non-Hodgkin's lymphoma, though regulators describe the evidence as inconsistent. Use has been increasing since its approval as part of the newer herbicide blend Enlist Duo.

Paraquat

A fast-acting herbicide considered one of the more acutely toxic chemicals still in agricultural use.

USED ON

Clearing fields before planting corn, soybeans and cotton.

WHAT'S DOCUMENTED

EPA itself states "one sip can kill" — there is no antidote for paraquat poisoning. Beyond acute poisoning risk, multiple peer-reviewed epidemiological studies, including research on farmworkers in Taiwan and British Columbia, have found strongly elevated risk of Parkinson's disease among people with occupational paraquat exposure. It's banned in more than 70 countries, including the UK, China and the EU, but remains legal for restricted agricultural use in the U.S.

Metolachlor

A widely used soil-applied herbicide.

USED ON

Corn, soybeans and sorghum.

WHAT'S DOCUMENTED

EPA classifies metolachlor as a Group C "possible human carcinogen" based on animal studies. Reported effects from higher exposure levels include respiratory irritation and nausea. It's one of the more frequently detected agricultural chemicals in U.S. groundwater.

INSECTICIDES

Insecticides target insects that damage crops. Generally speaking, the World Health Organization notes insecticides tend to be more acutely toxic to humans than herbicides.

Chlorpyrifos

An organophosphate insecticide developed in the 1960s.

USED ON

Cotton, almonds, oranges, apples and corn. Previously used widely in homes and gardens until that use was phased out.

WHAT'S DOCUMENTED

EPA's 2020 human health risk assessment found that food residue exposure alone was not of concern, but combined food, water and residential exposure exceeded the agency's own safety thresholds. Multiple studies have linked chlorpyrifos exposure in children to lower IQ and increased attention difficulties, including ADHD-like symptoms. At higher doses it's a nervous system toxicant capable of causing headaches, nausea, and in severe poisoning, respiratory failure.

Bifenthrin

A pyrethroid — a manmade version of pyrethrins, the insecticidal compounds found in chrysanthemum flowers.

USED ON

A wide range of agricultural crops, plus lawn, garden and structural pest products. More than 600 products containing bifenthrin are registered in the United States.

WHAT'S DOCUMENTED

EPA classifies bifenthrin as a possible human carcinogen, a rating based on studies in mice; studies in rats did not show the same effect. Skin contact commonly causes tingling, itching, burning or numbness at the contact site, usually resolving within 48 hours. Inhalation can irritate the nose, throat and lungs, and ingesting large amounts causes sore throat, nausea, abdominal pain and vomiting. Bifenthrin is also one of three fluorinated pesticides highlighted in EWG's 2026 produce testing — see the PFAS section on the next page.

FUNGICIDES

Fungicides prevent or treat fungal disease on crops — mold, blight, mildew — which can otherwise destroy a harvest. Some are applied in the field; others are applied after harvest, to keep produce from molding in transit and on the shelf.

Chlorothalonil

Sold under names like Daconil and Bravo. One of the most widely used fungicides in the world.

USED ON

Potatoes, tomatoes, peanuts, and turf and lawns.

WHAT'S DOCUMENTED

EPA rates it a severe eye irritant and moderately toxic if inhaled, though it's considered "practically nontoxic" for oral and skin exposure at typical residue levels. A related concern: hexachlorobenzene, a contaminant sometimes found in chlorothalonil products, is classified as a B2 probable human carcinogen. The EU banned chlorothalonil in 2019 over concerns about groundwater contamination and its breakdown products; it remains approved for use in the U.S.

Captan

A fungicide in use since the 1950s.

USED ON

Apples, strawberries, grapes and other fruit crops, as well as ornamentals.

WHAT'S DOCUMENTED

EPA's own hazard summary notes captan was found to be carcinogenic in animal studies, specifically linked to tumors in high-dose lab tests, though it's currently classified as "not likely to be carcinogenic to humans" at expected dietary exposure levels. Acute exposure can cause skin and eye irritation; ingesting large amounts has caused vomiting and diarrhea in reported cases.

Fludioxonil

A phenylpyrrole fungicide introduced in 1994. Applied after harvest, to stop mold during shipping and on store shelves.

USED ON

A broad range of fruits and vegetables as a post-harvest treatment. In EWG's 2026 analysis of USDA testing data it was the most frequently detected fluorinated pesticide — found in 14% of all produce samples and in nearly 90% of peaches and plums.

WHAT'S DOCUMENTED

A peer-reviewed review in *Food and Chemical Toxicology* reported that fludioxonil's mechanism of action is not firmly established, and cited studies indicating it can disrupt liver, endocrine and neurological function. The authors concluded that in the absence of a clear, safe mechanism of action it should be re-evaluated for potential human health impact. It remains EPA-registered and legal in the U.S.

Because it's applied after harvest rather than in the field, washing does less than people assume — USDA residue testing is done on produce after it has been washed or peeled.

Fluopyram

An SDHI fungicide — it works by blocking energy production inside fungal cells.

USED ON

Potatoes and sugarbeets, plus apples, wine grapes, strawberries and dried beans. No residential uses.

WHAT'S DOCUMENTED

EPA classifies fluopyram as "likely to be carcinogenic to humans," while concluding that the dietary exposure limits it set are low enough to be protective against long-term effects including cancer risk. Separately, it is highly persistent and moderately mobile in soil — measured half-lives run from roughly 160 to 750 days — and EPA states it can be expected to reach groundwater.

THE NEWER QUESTION: PFAS PESTICIDES

You'll increasingly see agricultural chemicals described as "forever chemical pesticides." This is a real issue, but it hinges on a definition fight that's worth understanding before you repeat the claim — because the answer to "is this a PFAS?" is currently *yes and no, depending on who you ask*.

The two definitions

THE BROAD ONE (OECD, 2021)

A substance counts as PFAS if it contains at least one saturated, fully fluorinated carbon — a single CF_2 or CF_3 group. The European Union uses a definition close to this one. Environmental and health advocacy groups generally use it.

THE NARROW ONE (EPA'S PESTICIDE OFFICE)

A substance counts as PFAS only if it has two or more fully fluorinated carbons in specific arrangements. In 2023 EPA formally adopted a definition that excludes single-fluorinated-carbon compounds, reasoning that they are less likely to persist in the environment or to bioaccumulate than molecules with two or more.

Same molecule, two answers. Under the OECD definition many common pesticides — including fludioxonil, fluopyram and bifenthrin — are PFAS. Under EPA's definition, a number of them are not. Neither side is inventing data; they're drawing the boundary in different places.

What the testing found

Using the broad definition, EWG's 2026 Shopper's Guide reported that fluorinated "PFAS pesticides" appeared on 63% of Dirty Dozen samples. Fludioxonil was the most frequently detected, followed by fluopyram and bifenthrin. EWG notes that early research suggests potential reproductive and developmental risks, and that significant data gaps remain.

What's actually worth arguing about

The label matters less than the underlying question: how long do these compounds last, and what do they break down into? That part is measurable. Fluopyram's soil half-life runs into years. Some fluorinated pesticides degrade into trifluoroacetic acid, which environmental scientists say persists for a century or more. Whether you call the parent compound a PFAS or not, persistence and breakdown products are the substance of the debate — and they're where the research is still thin.

Practical takeaway: if someone tells you a pesticide "is PFAS," ask which definition. If they tell you it "isn't PFAS," ask the same question. Both can be technically true statements made to sound like the whole story.

HOW IT REACHES YOU THROUGH MEAT, MILK AND EGGS

Most of what gets sprayed in this country is never eaten by a person. It's eaten by an animal first. About 40% of domestic corn use goes to livestock feed, and much of the corn sent to ethanol comes back to cattle as distillers grains. Most U.S. soybean meal goes to feed as well. So the chemicals on row crops reach the table mainly through a second door — the one marked beef, pork, milk and eggs.

The rulebook already assumes this

This isn't a fringe theory. It's written into federal regulation. Under 40 CFR 180.6, when EPA sets residue limits it must give "consideration...to possible residues of those pesticide chemicals or their conversion products entering the diet of man through the ingestion of milk, eggs, meat, and/or poultry."

EPA sorts every chemical into three buckets: residues in animal products are *definite, reasonably expected*, or *unlikely*. If it lands in either of the first two, EPA must set a separate tolerance for the meat, milk or eggs — not just for the crop. There are tolerances on muscle, fat, liver, kidney, milk and eggs because the agency already knows the pathway works.

But it depends entirely on the chemistry

This is where most of what you'll read online falls apart, and where being precise protects you.

WHAT GETS FLUSHED OUT

Water-soluble compounds are absorbed poorly and excreted fast. Glyphosate is the clearest case. A review in the *Journal of Animal Science* concluded that glyphosate does not accumulate in animal tissue or milk, was not detected in cow's milk or in eggs using validated testing, and that its meat tolerance is set at the limit of detection. Feed surveys found residues in corn and soybean samples, but within legal limits and orders of magnitude below safety thresholds.

Say plainly what this means: "glyphosate in your steak" is the weakest form of this argument. The evidence does not support it, and leading with it hands critics an easy win. There's a much better argument below.

WHAT BUILDS UP

Compounds that resist breakdown and bind to fat behave the opposite way. They move from soil into forage, from forage into the animal, and they concentrate rather than clear. That's the category where residues in meat and milk are real, measurable, and have already triggered government action in this country.

The documented case is PFAS — and it happened in Michigan

In February 2022, Michigan issued the first beef consumption advisory in state history, for a cattle operation in Livingston County. The chain was traced end to end: a chrome plating facility discharged PFOS into a municipal wastewater plant; the sludge that came out the other side — biosolids measured at 2,150 parts per billion of PFOS — was land-applied to farm fields as fertilizer; the crops took it up; the crops were fed to the cattle; the PFOS ended up in the beef.

The state helped the farmer notify his customers and provided financial assistance to pull the cattle from commerce. Michigan now prohibits land-applying biosolids above 150 ppb PFOS and requires testing first. The plating facility installed carbon filtration and cut its discharge by 99%.

Worth knowing: the beef did not meet USDA's criteria for a recall. The advisory was a state public health action, not a federal one. A product can be contaminated enough for a state to tell people to stop eating it and still not trigger a recall.

EPA's own modeling says it isn't isolated

In January 2025 EPA released a draft risk assessment for PFOA and PFOS in sewage sludge. It modeled biosolids containing just **1 part per billion** — near the detection limit, and far below what the Michigan fields received — and still found that in some scenarios, human health risks exceeded EPA's acceptable thresholds.

The pathways modeled were ordinary: milk from pasture-raised dairy cows, eggs from pasture-raised hens, beef from cattle on affected pasture, and drinking water from farm wells. EPA found risk highest for pasture-raised livestock operations and lower for grain, fuel and fiber crops — and acknowledged real data gaps on farm practices and uptake rates.

So ask a different question

Most people who care about this ask a producer what they spray. That's a fine question, but it's not the one that catches the problem above — because the contamination in the Michigan case didn't come from a pesticide at all. It came from what was spread on the ground as fertilizer.

WORTH ASKING ANY PRODUCER

Has sewage sludge or biosolids ever been applied to this ground, by you or by whoever farmed it before? Where does the water come from, and has it been tested? Where does your feed come from, and do you grow it yourself? What do you spray, and when?

A farmer standing in front of you can answer all four in about a minute. A package in a cooler cannot answer any of them, and neither can the people who stocked it. That gap — not a scary chemical name — is the real case for buying from someone you can talk to.

THE HONEST BOTTOM LINE

The feed-to-food pathway is real, and federal regulators build their entire tolerance system around it. But not every chemical travels that road. The ones that get excreted mostly don't reach you through meat. The ones that persist and bind to fat absolutely do, and PFAS is the documented example with a state advisory, a traced source and a federal risk assessment behind it. Make the strong version of the argument and it holds up to anyone who checks.

WHERE TO FOCUS: THE 2026 LISTS

Each year the Environmental Working Group (EWG) analyzes USDA pesticide residue testing — done on produce *after* it's been washed or peeled — and ranks fruits and vegetables by pesticide load. These are the 2026 lists, released in March 2026.

2026 Dirty Dozen

Highest pesticide residue

1. Spinach
2. Kale, collard & mustard greens
3. Strawberries
4. Grapes
5. Nectarines
6. Peaches
7. Cherries
8. Apples
9. Blackberries
10. Pears
11. Potatoes
12. Blueberries **BACK ON**

2026 Clean Fifteen

Lowest pesticide residue

1. Pineapple
2. Sweet corn
3. Avocados
4. Papaya
5. Onions
6. Sweet peas (frozen)
7. Asparagus
8. Cabbage
9. Cauliflower **NEW**
10. Watermelon
11. Mangoes **NEW**
12. Bananas **NEW**
13. Carrots **NEW**
14. Mushrooms
15. Kiwi

WHAT CHANGED FROM 2025

Blueberries returned to the Dirty Dozen and bell and hot peppers came off it. Cauliflower, mangoes, bananas and carrots joined the Clean Fifteen; honeydew melon dropped off. Blackberries stayed on the Dirty Dozen after USDA tested the fruit for the first time in 2023. Potatoes remain listed — they're the most-consumed vegetable in the U.S. and often carry chlorpropham, a sprout inhibitor banned in the EU.

BE HONEST ABOUT WHAT THIS LIST IS

This is not a government list, and it's not without critics. EWG ranks by how many residues are detected, not by dose. Scientists including immunologist Andrea Love argue that detection is not the same as risk, and a 2024 peer-reviewed analysis estimated that daily exposures from conventional produce fall well below EPA safety thresholds. EWG's counter is that those thresholds are set chemical by chemical and don't account for combined exposure across many residues at once.

Use it for what it's actually good for: deciding where your organic dollars go furthest when you can't buy everything organic. Do not use it as a list of foods to avoid. Every major health body agrees that eating conventional produce beats not eating produce — and that is not a close call.

SOURCES

- U.S. Environmental Protection Agency — pesticide registration decisions, human health risk assessments, carcinogenicity classifications, and "Pesticides Containing a Single Fluorinated Carbon."
- International Agency for Research on Cancer (IARC), World Health Organization — monograph classifications for glyphosate and chlorophenoxy herbicides.
- Environmental Working Group — 2026 Shopper's Guide to Pesticides in Produce, based on USDA Pesticide Data Program testing.
- National Pesticide Information Center (Oregon State University / EPA) — bifenthrin fact sheet.
- 40 CFR 180.6 — EPA statement of policy on pesticide tolerances regarding milk, eggs, meat and poultry.
- Michigan Department of Environment, Great Lakes and Energy, via the Environmental Council of the States — February 2022 Livingston County beef consumption advisory and the biosolids PFOS investigation.
- U.S. EPA — Draft Sewage Sludge Risk Assessment for PFOA and PFOS, January 2025, and its fact sheet for farmers.
- *Journal of Animal Science* — review of glyphosate in livestock: feed residues and animal health.
- USDA Economic Research Service — Feed Grains Sector at a Glance, for the share of the corn crop used as livestock feed.
- Minnesota Department of Agriculture — fluopyram new active ingredient review.
- *Food and Chemical Toxicology* — peer-reviewed review of the mechanism and safety of post-harvest fludioxonil.
- *Chemical & Engineering News* (American Chemical Society) — reporting on the OECD vs. EPA PFAS definition dispute in pesticide registration.
- *Food Safety Magazine* — coverage of scientific criticism of EWG's Dirty Dozen methodology.
- Peer-reviewed epidemiological literature on paraquat and Parkinson's disease, chlorpyrifos and childhood neurodevelopment, and atrazine endocrine effects, as cited by the bodies above.

Now find food that isn't on this list.

Real Food Outreach is a free directory of local farmers, butchers, bakeries and growers — built by going and finding them, one town at a time. Nobody pays for placement and there are no ads.

realfoodoutreach.com

Raise, grow, bake or cut something honest? Getting listed is free. Email realfoodoutreach@gmail.com with your name, your town, what you sell and how people should reach you.

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With love and light.

This guide is for general education. It does not replace medical, legal or agricultural advice. Regulatory classifications change; chemicals are reassessed and lists are revised. Check the current EPA and EWG sources for the latest before relying on any single entry. Compiled and published by Real Food Outreach, September 2026.