Crop Protection Primer

Why do farmers use pesticides?

Almost all the crops we grow today are the result of 1000s of years of selective breeding that transformed wild, often barely edible plants into abundant sources of food and nutrition.

That process spurred the growth of civilizations and allows us to feed the 7.9 billion people alive today, but it also made these plants more vulnerable to the 90,000-plus pests that can stunt growth, leave crops diseased and inedible, or wipe out a whole year's harvest. The first recorded use of pesticides was in 2,500 BC by the Ancient Sumerians, who dusted crops with sulfur — still used by farmers today — to control insects. The three main classes of pesticides farmers rely on today are:

- **Herbicides —** to control the **30,000 weed species** that rob food crops of space, water, sunlight and soil nutrients
- **Insecticides —** to mitigate damage from **10,000-plus** species of **plant-eating insects**
- **Fungicides —** to kill **toxin-generating fungi** and prevent more than **50,000 plant diseases**

What would happen without pesticides?

Even with modern pesticides, farmers lose 30 to 40 percent of their crops to pests and disease.[1] Without pesticides, agricultural production would collapse. Estimated total losses by crop[1] include:

- **Wheat - 50%** loss
- **Rice - 77%** loss
- **Corn - 68%** loss
- **Potatoes - 75%** loss
- **Soybeans - 60%** loss
- **Apples - 86%** loss
- **Oranges - 77%** loss
- **Carrots - 48%** loss
- **Cucumbers - 66%**[2]

Without pesticides it would be impossible to feed today's population of 7.9 billion, let alone the 9.8 billion projected for 2050.

Is it true that organic farmers grow crops without pesticides?

No, organic farmers use pesticides, too. Almost all farmers who grow to scale use them. The list of organic pesticides, which can be found on the USDA website,[3] includes both naturally-derived and factory-produced, synthetic chemicals such as Copper Sulfate.

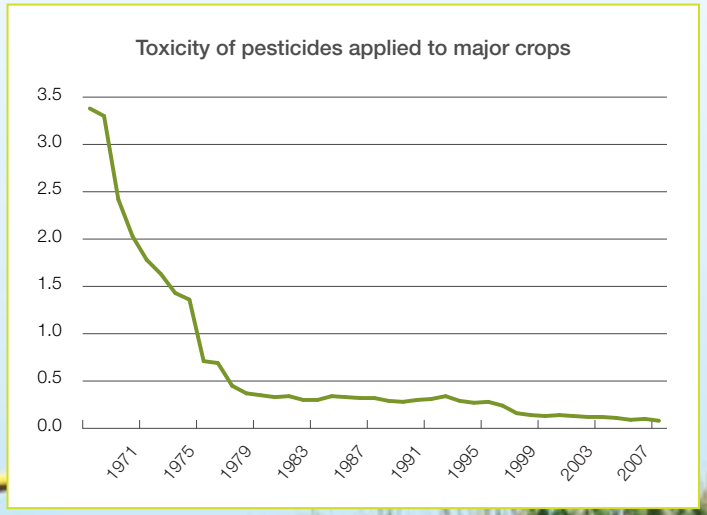
Like all farmers, organic farmers are careful to use pesticides safely and responsibly, but organic's preference for pre-modern chemistries means that the chemicals they use are less targeted and often need to be used in greater volume. Copper sulfate — the second most heavily used organic pesticide — is broadly toxic, highly persistent, and must be applied at 2 to 3 times the rate of modern pesticides.

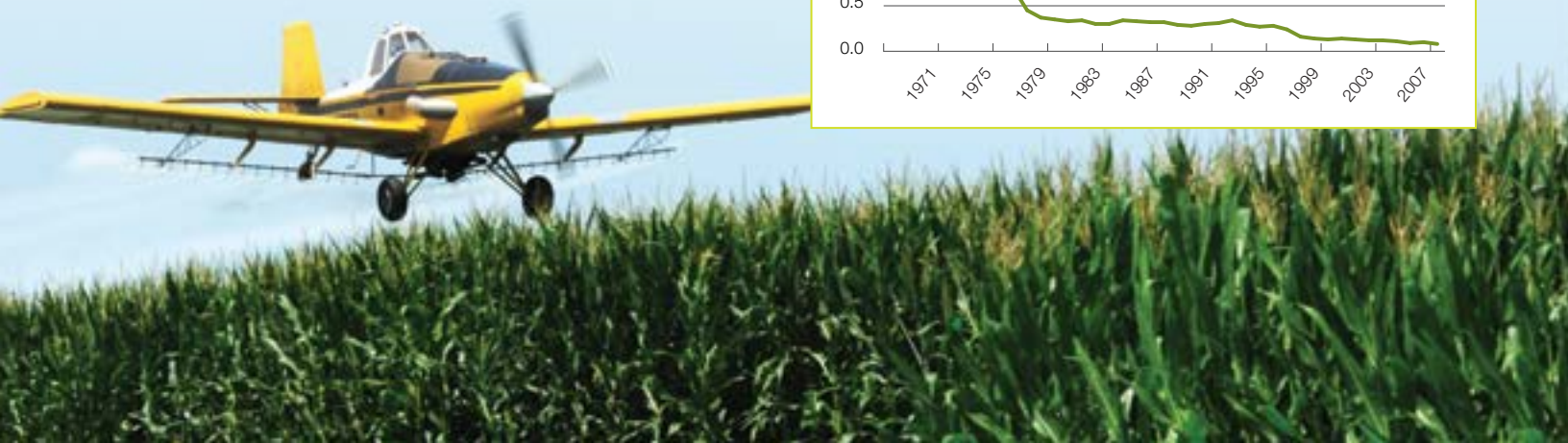
Are pesticides safe?

Pesticides are among the most rigorously studied and regulated products on the market, with typically more data affirming their safety than common household chemicals and cosmetics. **It takes an average of 11 years and $286 million to bring a new pesticide to market.**

Continuing innovation is making pesticides even safer and reducing their impact on the environment. According to USDA, **pesticide toxicity has declined 98% since 1968,** the amount applied per acre declined 60%, and pesticide persistence in the environment declined 40%.[4]

Pesticides today are 98% less toxic than in the 1960s.[5]





Most pesticides are less toxic than your daily coffee and vitamins.[6] An analysis of California data found:

- **97% of pesticides were less toxic than coffee**
- 89% were less toxic than ibuprofen (Advil)
- 64% were less toxic than vitamin A
- 55% were less toxic than vitamin C

What about the environment?

Modern pesticides, which came on line in the mid-1940s, powered a revolution in productivity that allowed farmers to more than triple the yield of many crops on each acre of land. Corn yields in the US rose a miraculous six-fold. Growing more food per acre saves forests, grassland and wetland from being converted to agricultural uses — by far the most important factor in protecting wildlife habitat, promoting biodiversity, and avoiding a major source of greenhouse gas emissions.

- US farmers today produce 300% more food than in 1950 on 10% less land — sparing 120 million acres for wilderness or other uses. That's more than the entire land area of California. It's twice the area of all 423 national parks, rivers, seashores, other designations in the US national park system.

- Researchers at Stanford University calculate that since 1961, the improved yields of modern agriculture avoided the release of 590 gigatons of CO2 equivalent emissions — equal to one-third of all the greenhouse gases emitted from all sources over the course of a century and a half.[11]

Modern pesticides have also reduced the environmental impact on land under cultivation. For instance, no-till farming uses herbicides to control weeds rather than plowing, which is destructive to soil health and wildlife and releases greenhouse gasses into the atmosphere. Due to such innovations, US corn farmers between 1980 and 2015:

- Lowered water use per acre by 26%
- Reduced soil loss per acre 58%
- Cut greenhouse gas emissions per acre 26%
- Achieved energy savings per bushel of 41%

END NOTES

[1] OERKE, E. (2006). Crop losses to pests. The Journal of Agricultural Science, 144(1), 31-43. doi:10.1017/S0021859605005708 https://www.cambridge.org/core/journals/journal-of-agricultural-science/article/abs/crop-losses-to-pests/AD61661AD6D503577B3E73F2787FE7B2

[2] Without crop protection products we could lose out on, CropLife, accessed April 30, 2021 https://croplife.org/wp-content/uploads/pdf_files/Fruit-infographic.pdf

[3] The National List of Allowed and Prohibited Substances: https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=9874504b6f1025eb0e6b67cadf9d3b40&rgn=div6&view=text&node=7:3.1.1.9.32.7&idno=7

[4] Fernandez-Cornejo, Jorge, Richard Nehring, Craig Osteen, Seth Wechsler, Andrew Martin, and Alex Vialou. Pesticide Use in U.S. Agriculture: 21 Selected Crops, 1960-2008, EIB-124, U.S. Department of Agriculture, Economic Research Service, May 2014 https://www.ers.usda.gov/webdocs/publications/43854/46734_eib124.pdf

[5] Fernandez-Cornejo, Jorge, Richard Nehring, Craig Osteen, Seth Wechsler, Andrew Martin, and Alex Vialou. Pesticide Use in U.S. Agriculture: 21 Selected Crops, 1960-2008, EIB-124, U.S. Department of Agriculture, Economic Research Service, May 2014 https://www.ers.usda.gov/webdocs/publications/43854/46734_eib124.pdf

[6] "Pesticides: Probably Less Scary Than You Imagine," Steve Savage, Science2.0, September 21, 2012. https://www.science20.com/agricultural_realism/pesticides_probably_less_scary_you_imagine-94343

[7] Agricultural area over the long-term. (n.d.)., from https://ourworldindata.org/grapher/total-agricultural-area-over-the-long-term, Table 1. Indicies of farm output, input, and total factor productivity for the United States, 1948-2017. From https://ers.usda.gov/data-products/agricultural-productivity-in-the-us

[8] Agricultural area over the long-term. (n.d.)., from https://ourworldindata.org/grapher/total-agricultural-area-over-the-long-term, Table 1. Indicies of farm output, input, and total factor productivity for the United States, 1948-2017. From https://ers.usda.gov/data-products/agricultural-productivity-in-the-us

[9] LOWER, R., & WATSON, R. (2021, January 22). How many national parks are there? Retrieved April 12, 2021, from https://www.nationalparks.org/connect/blog/how-many-national-parks-are-there

[10] Greenhouse gas mitigation by agricultural intensification, PNAS June 29, 2010 107 (26) 12052-12057; https://doi.org/10.1073/pnas.0914216107

[11] 2016 National Indicators Report, Field to Market, 2016, http://fieldtomarket.org/media/2016/12/CORN-FOR-GRAIN_Field-to-Market_2016-National-Indicators-Report_Fact-Sheet.pdf