MERCOLA
Take Control of Your Health

Can Gene-Editing Pesticides Pose Risk to Humans?

Analysis by Dr. Joseph Mercola September 14, 2024

STORY AT-A-GLANCE

- Scientists warn about new gene-editing pesticides that could unintentionally affect nontarget organisms, including pollinators, soil organisms and even humans
- Their study reveals that CRISPR-edited pesticides could disrupt up to 155 metabolic pathways across 12 species, with the majority of effects observed in human genes
- The rapid development of gene-editing technology outpaces our understanding of its long-term health impacts
- Gene-editing pesticides could have far-reaching ecological impacts, affecting keystone species like earthworms and potentially altering the genetic makeup of entire ecosystems
- Regenerative agriculture offers a sustainable alternative to both chemical and gene-editing pesticides, focusing on soil health, biodiversity and natural pest control methods

The biotech industry has been tinkering with the genetic material of living organisms and crops using CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) gene-editing technology, resulting in changes to taste profiles, extended shelf life and enhanced resistance to specific pathogens, but with unknown health consequences.[1]

These genetic modifications have, so far, been conducted within the confines of controlled laboratory environments. However, a disturbing new development is on the horizon — new pesticides designed to edit genes may soon be available, touted to be "more environmentally friendly" than chemical pesticides.[2]

A team of scientists recently raised concerns about the possible consequences of unleashing this product in an open environment, where it can affect not just its intended targets but also a wide range of nontarget organisms, possibly causing far-reaching ecological destruction. And leading the list of potential collateral damage are us humans.[3]

How Does CRISPR Gene-Editing Work?

The principle behind CRISPR gene-editing technology, touted as a revolutionary tool in biotechnology, comes from nature itself. At its core, CRISPR is a defense mechanism found in bacteria and archaea, which helps protect these microorganisms from viral pathogens. Scientists adapted it for use in other organisms, turning it into a gene-editing tool.[4]

The CRISPR system relies on two main components — the Cas9 protein and a guide RNA (gRNA). The Cas9 protein acts like molecular scissors that can cut DNA at specific locations, while the gRNA is designed to match and bind to a particular DNA sequence, directing the Cas9 protein to the precise location where the cut is needed.[5]

Once the Cas9 protein reaches the target site, it makes a double-strand break in the DNA. The cell's natural repair mechanisms then kick in to fix the break. This repair process can be harnessed to introduce new genetic material or make edits, such as inserting new genes, deleting existing ones or modifying genes to achieve desired traits or correct genetic defects. However, multiple studies have shown that this technology comes with numerous potential risks.[6]

Recent Study Reveals Unintended Side Effects of CRISPR-Edited Pesticides

The group of scientists who sounded the alarm about gene-editing pesticides presented their findings in a study published in the journal Ecotoxicology and Environmental Safety.[7] Using a combination of computational tools and in silico modeling, they simulated the potential impact of CRISPR-edited pesticides on a variety of nontarget organisms (NTOs).

> *"CRISPR/Cas9, a potent genetic engineering tool widely adopted in agriculture, is capable of introducing new characteristics into plants on a large scale and without conventional breeding methods … Our aim was to assess potential activity in organisms that could be exposed to genome editing in uncontrolled environments,"* the authors wrote.

They began by simulating three plausible scenarios for the application of these pesticides — irrigation, fumigation and fertilization. To identify potential unintended consequences, they focused on gRNAs that they designed to target particular genes in pests. They investigated whether they could also interact with unintended genes in nontarget species.

The study involved 18 species commonly found in agricultural environments, including crops like maize and soybeans, livestock such as cattle and chickens, pollinators like bees, and soil organisms like earthworms and fungi. They also identified three pests that are likely to be targets for the use of these new pesticides — the Western corn rootworm, the Red Flour Beetle and the fungus Sclerotinia sclerotium. According to their findings:[8]

> *"Whether the NTOs are desired or not, the consequences of modifying them remain unpredictable because of the large number of unintended modifications. gRNAs activity was observed in 12 out of the 18 species of NTOs investigated in this study.*
>
> *These hybridization sites revealed genes with functions in several annotated metabolism, from central nervous system morphogenesis in honeybee to several pathways related to cancer and hormone metabolism in humans. In total, 155 metabolic pathways were enriched for the three gRNA scenarios in the 12 species with the majority of hits in the human genome."*

Unknown Consequences Could Affect the Environment and Human Health

To put it simply, the researchers discovered that gRNAs from gene-editing pesticides affected 12 out of 18 NTOs, causing potentially unpredictable health consequences due to unintended genetic changes. These off-target effects were observed in human genes involved in metabolic processes, including cancer and hormone regulation. In total, 155 metabolic pathways were disrupted across these 12 species, with the majority of these effects occurring in human genes.[9]

Aside from the potential risks to human health, the authors warned that even small changes caused by gene-editing pesticides in the behavior of keystone species in the ecosystem can have big ripple effects on the environment.

For instance, earthworms play a crucial role in pastures by helping with nutrient cycling, improving soil structure and regulating water. Even a minor decline in earthworm activity due to repeated exposure to gene-editing chemicals can significantly impact soil health and, consequently, the productivity of the land.

The authors assert that these technologies should be considered as potential emerging environmental contaminants, given their ability to impact a range of organisms when released into the environment. They also call for a more comprehensive risk assessment on gene-editing technologies used outside contained controlled laboratory settings.[10]

Unexpected Effects Are Not New with CRISPR-Edited Organisms

There have been many instances where a genetically engineered (GE) crop exhibited unexpectedly toxic or allergenic properties that were absent from their conventional counterparts. The reality is that researchers have a limited understanding of the potential side effects that DNA tampering can produce, as its outcomes are highly unpredictable.

As shown in the featured study, even CRISPR, despite being touted as more precise than other genetic engineering techniques, causes off-target effects. A study published in The CRISPR Journal[11] corroborated these concerns, revealing that when the CRISPR tool makes a double-strand break in DNA at the targeted site, it can trigger a range of genetic outcomes, including small insertions or deletions of DNA bases and large-scale rearrangements of the genome.

CRISPR technology has also been explored for modifying T-cells in adoptive T-lymphocyte therapy. However, a study published in Nucleic Acids Research[12] notes that while it aims to target specific genes, it also inadvertently generates unintended structural variations (SV) in the genome. These include chromosomal translocations, where segments of chromosomes are rearranged, as well as large deletions. The authors concluded:

> *"Our findings raise concerns about the safety of CRISPR/Cas9-edited T cells mediated immunotherapy. Persistent SVs might be a problem for CRISPR/Cas9-edited TCR [T-cell receptor] T cells or similar CAR [Chimeric Antigen Receptor] T cells, as these SV-containing cells may gain more mutations during further clonal expansion."*[13]

Moreover, researchers from Boston Children's Hospital have found that using CRISPR in human cell lines can lead to significant DNA rearrangements, potentially increasing cancer risk. These disruptions were observed in up to 6% of cases.[14]

In my previous articles, I've also discussed the implications of CRISPR-edited **salad greens**,[15] **insects**[16] and even **babies**.[17] I encourage you to dive deeper into these topics to understand the profound and potentially dangerous consequences of this technology for our environment and future.

What Does a Future with Gene-Editing Pesticides Hold?

As if conventional pesticides weren't already a significant concern for human health and the environment, we could soon be facing the challenges posed by gene-editing pesticides, too. While this technology promises benefits like reduced environmental impact, the reality presented by the featured study reveals a more troubling reality.

We could be looking at a future where the very genetic makeup of our ecosystem could be inadvertently altered, from soil microorganisms and pollinators to crops, livestock and humans. The rapid development of this technology outpaces our understanding of its long-term effects, essentially turning our environment and food supply into a vast, uncontrolled experiment.

The future of agriculture doesn't have to be a choice between harmful chemical pesticides and unpredictable gene-editing technologies. Instead, we should be investing in truly sustainable, regenerative agriculture practices that work with nature, not against it.

Regenerative agriculture eliminates pesticide use by focusing on soil health and biodiversity. It employs techniques like crop rotation and integrated pest management to create balanced ecosystems where natural predators naturally control pests. Incorporating animals into the system further enhances this approach.

Grazing animals not only control weeds and pests by consuming them but also enrich the soil with their manure. This, in turn, creates healthy soils, which produce stronger, pest-resistant plants, eliminating the need for chemical interventions while improving crop yields and quality naturally.

Sources and References

- [1] Cell. 2024 February 29;187(5):1076-1100
- [2] Children's Health Defense, July 23, 2024
- [3, 7, 9, 10] Ecotoxicology and Environmental Safety Volume 282, 1 September 2024, 116707
- [4] Biomolecules 2023, 13(1), 114
- [5, 6] Journal of Diabetes and its Complications Volume 37, Issue 8, August 2023, 108524
- [8] Ecotoxicology and Environmental Safety Volume 282, 1 September 2024, 116707. Conclusions
- [11] CRISPR J. 2022 Feb;5(1):19-30
- [12] Nucleic Acids Research, Volume 50, Issue 19, 28 October 2022, Pages 11128–11137
- [13] Nucleic Acids Research, Volume 50, Issue 19, 28 October 2022, Pages 11128–11137. Discussion
- [14] Boston Children's Hospital July 14, 2022

- [15] Wired, May 16, 2023
- [16] Plants (Basel). 2023 Dec; 12(23): 3961
- [17] The Guardian, April 1, 2024