Gene-edited crops and animals: Best-kept secrets in the fight against climate change

David Hart, Robert Rozansky, Val Giddings | October 26, 2020

Credit: Eniola Odetunde/Axios

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Advances in gene editing over the past decade have given scientists new tools to tailor the biochemistry of nearly any living thing with great precision. Because the biosphere—including trees, crops, livestock, and every other organisms—is a major source and sink for greenhouse gases (GHGs), these tools have profound implications for climate change. Gene editing is unlocking new ways to enhance natural and agricultural carbon sinks, limit emissions from agriculture and other major GHG-emitting sectors, and improve biofuels. Congress should act now to open this new frontier for climate innovation.

Gene editing uses enzymes—CRISPR Cas9 is the most well-known—to identify, remove, and replace segments of an organism's DNA, much like using a word processor to edit a document. These tools originated as defense mechanisms so that bacteria could remove foreign DNA inserted by predatory viruses. Researchers have adapted this cellular

machinery to introduce beneficial traits into plants and animals. The techniques are new, but they build on nearly a half century of experience with conventional genetic engineering and hundreds of millions of years of evolution.

Zooming out from the microscopic level, gene editing offers novel solutions to a diverse set of emissions-related problems.

The Trillion Trees initiative recognizes plants' unique ability: using photosynthesis to capture carbon. Yet the process is surprisingly inefficient. Scientists have moved swiftly to use their new toolkit to try to improve it, and several breakthroughs have already been reported. Further progress might enable productivity gains of 50 percent in major crops, slashing emissions radically, raising output per acre, and bolstering farmers' incomes.

The decomposition and transport of wasted food accounts for the single largest portion of agricultural GHG emissions. Companies are already selling gene-edited soybean oil with a longer shelf life and potatoes that resist bruising, both of which reduce waste.

Next-generation biofuels from switchgrass, which grows easily on otherwise non-arable land, could power sustainable, low-carbon transport. The hitch has been that this plant's key ingredient, cellulose, is hard to break down. Gene editing may open up this abundant resource by optimizing microbes that can efficiently process cellulose, yielding low-cost biofuels and spurring rural development.

The world's 1.4 billion cattle account for about 6 percent of global agriculture GHG emissions, in large part because of methane in their burps. Some cattle emit far less methane than others because of specific microbial populations in their digestive tracts. Gene editing could allow this trait to spread across herds, reducing emissions.

Related article: What's stopping us from using CRISPR to gene edit humans to fight disease?
Gene editing's enormous promise for solving societal problems, including climate change, has been slowed by concerns that it is neither natural nor safe. These concerns are misplaced. Humans have used breeding to shape the genomes of crops and livestock since

the dawn of agriculture. Our new gene editing toolkit has been used by nature for hundreds of millions of years. Most important, in eleven major studies over the past four decades, the U.S. National Academy of Sciences has found no new hazards in gene edited or genetically engineered products. Other authoritative bodies around the world have drawn the same conclusion, which has been confirmed by vast experience.

The urgency of the climate challenge is becoming clearer with each passing season as severe storms, droughts, fires, and other disasters become more frequent at home and around the world. Congress should take action today to accelerate gene-edited climate solutions. First, legislators should eliminate regulatory burdens that disincentivize innovation in gene-edited technologies and contribute little to human or environmental safety. Current regulations on gene-edited products have added tens of millions of dollars and multiple years to their development without delivering commensurate benefits for health, safety, or the environment.

Second, Congress should create a new agency to support agricultural research into high-reward biological technologies including gene editing. The ARPA-Terra Act of 2019 (S.2732) introduced by Sen. Michael Bennet would do so, emulating the highly successful models of the Defense Advanced Research Projects Agency (DARPA) and the Advanced Research Projects Agency-Energy (ARPA-E).

Finally, Congress should encourage innovative farmers to adopt new gene-edited crops and livestock to demonstrate their value and speed wider deployment. Existing tax credits for carbon capture could be expanded as these nascent products come to market.

Although gene editing is less than a decade old, it is already abundantly clear that it will be a powerful tool to address climate change. The science is ready and waiting for Congressional action.

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