Viewpoint: We've got 10 years to prevent 'irreversible' climate change damage. Here's how CRISPR can help

Ten years – that is the timeline scientists have given us to either address climate change or suffer irreversible damages to the environment. A massive adoption of more sustainable practices is an absolute must to meet this challenge. But in order to make adoption stick, we need to rely on technological innovations to make the shift feel seamless and the changes seem minimal.

Genetic engineering and the introduction of CRISPR are among the solutions that researchers believe can have a drastic impact on the environment, and potentially even on global warming, perhaps without forcing consumers to make drastic lifestyle changes.

The Information Technology & Innovation Foundation recently released a report, *"Gene Editing for the Climate: Biological Solutions for Curbing Greenhouse Emissions",* which asks governments across the globe to accelerate the development and deployment of gene editing technologies. Within the report, authors Val Giddings, Robert Rozansky and Peter Hart noted just how broad the potential of genome editing is:

> Gene editing is already pushing beyond the lab, ushering in dramatic innovations in medicine and manufacturing as well as agriculture. The fight against COVID-19 will accelerate this trajectory, as gene editing is contributing to the development of antiviral therapies and vaccines. It is, in short, a new platform technology that will touch many aspects of 21st century society, including climate and energy.

The report also noted that gene editing technologies like CRISPR could improve agricultural productivity upwards of 50% by 2050 if the regulatory structure was favorable.

How would this work?

So, what could gene editing and CRISPR do for agricultural productivity and the race against the climate change 'doomsday' clock? The potential is limitless, as these tools allow you to precisely reprogram a plant's own DNA sequences to create desirable traits, making it possible to eliminate the need for years of traditional plant breeding.

Without looking too far into the future, there are three key areas that gene editing can support today that are best suited for addressing climate change; the ability to enhance carbon capture, increase yield, and create biomaterials that are more sustainable.

1. Crops feed off of carbon dioxide, pulling it in and transforming it into sugars that fuel the plant and seed

growth through photosynthesis. This is nothing new; plants have done this since the dawn of time. But now agriculture is creating a new avenue for CO2 reduction.

Researchers are finding new traits that are capable of improving carbon capture and conversion within the crop. This creates a few different opportunities for supporting a sustainable future; the first being the creation of “super plants” capable of pulling in more CO2, removing it from the environment and therefore helping balance the emission levels. Agriculture generates approximately 10% of the total greenhouse gas emissions in the U.S. according to the EPA.

2. The ability to take in carbon and more effectively and convert it to sugars often has an added benefit of bolstering plant growth and seed production. In editing the existing DNA of a plant to accelerate these highly sought-after traits, such as enhanced photosynthesis, it’s possible to increase crop and seed yield, enhancing their productivity.

The possibilities don’t end there, however, as other traits can be manipulated to improve other areas of a plant’s system such as the oil biosynthesis pathway, which can help oilseed crops such as canola and camelina produce higher quantities of oil per seed, increased crop, seed and oil production within existing plants can minimize the need for additional resources, ranging from water and pesticides to invaluable and often limited land.

3. Genetic engineering is also taking its place at the table in the creation of sustainable and biodegradable plastic alternatives. For years, manufacturers have known about the potential of polyhydroxyalkanoates, better known as PHA, as a biomaterial capable of mimicking the stable feel of plastic without the same hazardous environmental impact due to its ability to disintegrate in as little as two months. This has tremendous potential for and is already being used by consumer product goods (CPG) producers to create disposable cutlery, straws and even fashion items now.

4. However, in order for them to truly take advantage of this biomaterial it needs to be scalable to be cost effective. Newly identified traits in Camelina plants could make this possible as they show potential in reprogramming crops, through CRISPR genome editing, to producePHA as a third byproduct.

To make the sustainable shift, genetic engineering and CRISPR need to be included as part of the larger solution. These tools are ready and available; now we just need the support of governments across the globe to adopt them in order to make a substantial impact.

Genetic engineering can help us reduce CO2 emissions, increase food production without taking an added toll on the environment and can create biomaterials for plastic alternatives, and that’s just the start of its potential. Without genetic engineering of crops, it will be extremely difficult, if not impossible to beat the climate change clock.

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