

Climate change is launching a mutant seed space race

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Hurting around the Earth at more than 20 times the speed of sound, some of the tiniest life forms aboard the International Space Station are on a mission to feed people on a warming planet.

Seeds of sorghum and cress launched into orbit by the International Atomic Energy Agency are tethered to the capsule via a thin metal box. That's exposing them to more-intense solar radiation in a trial to induce [genetic mutations](#) so they can survive hotter temperatures, drier soils, spreading pestilence and rising sea levels.

"Most astrobotany until now has been to test how plants can be grown to feed astronauts for eventual space colonies," Shoba Sivasankar, the IAEA's head of genetics and plant breeding, said at her lab outside Vienna. "This experiment is different because it is designed to help people on Earth adapt to [climate change](#)."

Farmers from Argentina to California, France and India are struggling to maintain yields amid global warming, with rising prices for the key crops used to bake bread weighing on political stability. Drought gripping North Africa is curbing local wheat harvests, potentially boosting demand in one of the world's top import regions.

Warming temperatures and weather disruptions reduced food productivity worldwide by almost 13% since 1961, according to recent United Nations estimates. NASA expects fundamental changes to the way food is grown over the [next decade](#).

Enter China, with almost a fifth of the world's population but just 7% of its arable land. For decades, the second-biggest economy has been sending seeds into space aboard rockets and high-altitude balloons.

Scientists said the space seeds produce higher-yielding harvests of wheat, barley, corn, cucumber and tomato. The country is still testing samples from a 2006 mission carrying 130-plus species, and a joint mission with Pakistan last year returned medicinal-plant seeds to the University of Karachi.

"We hope they can grow better with stronger resistance, survival rate and efficacy," Wang Yan, a university researcher, told China Economic Net. "All can be achieved via genetic mutation in space."

This is the first time IAEA is using [cosmic radiation](#) to mutate seeds. However, it's been administering controlled radiation doses using a cobalt-60 source at its lab in Seibersdorf for more than a half-century.

The sorghum and arabidopsis (a cousin of cress used widely in genetic experiments) seeds shot 400 kilometers (249 miles) into orbit atop a Northrop Grumman Corp. rocket in November are expected to land back at the IAEA's labs in April, after which they'll be put through trials that may take years.

Unlike newer techniques that genetically engineer DNA with tools like CRISPR, inducing mutations with radiation is considered natural. Therefore, the seeds aren't subject to the same market restrictions as genetically modified organisms, or GMOs.

"The lab is truly changing the way we fight disease, the way we fight hunger," said Cindy McCain, the U.S. ambassador to the U.N. food agencies in Rome, one of which supports the labs. "Food security is a national-security issue."

Rice is the crop most-frequently exposed to radiation, with 870 new varieties under cultivation. Increasingly parched conditions have diminished production of the staple food for half the world's people. Tweaked varieties in Vietnam and Indonesia increased yields by more than 40%.

Sivasankar researches in a humid greenhouse, filled with banana and coffee plants, about an hour's drive south of Vienna. Countries send her scores of seeds every year to be bombarded with gamma rays and then

cultivated for arid conditions.

It can take about a decade to develop a new variety through controlled mutation—and business is booming.

"Food production is going to be affected by climate change," she said. "Helping plants adapt to these changes through genetic diversity is the most sustainable solution."

The IAEA labs are one of the final frontiers of diplomacy, generating collaboration between China, Russia and the U.S. amid a resurgence in superpower jockeying. Countries have invested almost \$100 million in recent years to upgrade the Cold War-era facility, which helps satisfy a non-proliferation treaty obligation by the five official nuclear powers.

"We're making sure that the beneficial uses of nuclear technologies and materials can be made available," said Laura Holgate, the U.S. ambassador to the IAEA.

Rich countries also benefit from research. A sterile-insect program helped North American farmers save tens of billions of dollars by eradicating fly strains that attack fruit and livestock. A program in Italy eliminated about 80% of disease-carrying mosquito populations in targeted regions.

The agency site includes eight nuclear-application labs ringed by razor wire and pastures. One windowless building houses a machine to detect uranium traces in environmental samples from countries such as Iran. Another was used to develop tests for COVID-19, the Ebola and Zika viruses, and African swine fever.

One more contains swarms of insects buzzing around in boxes covered with white-mesh cloth. Inside rooms heated to tropical climes, the air

hangs heavy with the scent of bug food: animal blood, liver powder, tuna meal and yeast.

The specimens cause billions of dollars in damages annually in sub-Saharan Africa, where tsetse flies propagate sleeping sickness in people and render cattle herds weak. Irradiating the pests helps scientists raise infertile males to help curb hatching rates.

For many people, the IAEA is synonymous with being the U.N.'s nuclear watchdog, guarding against the illicit trafficking of materials that could wind up in atomic weapons. But, increasingly, it's another threat to humanity—climate change—that's driving new investment, said Chantel de Beer, a South African entomologist.

"Our old labs were way too small for the kind of growth we're experiencing," she said. "It's our responsibility to manage environmental problems with respect."

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