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THE FUTURE OF AGRICULTURE

Seeds in the Arctic

By Gerald Traufetter

The world's largest seed collection is being developed under the permafrost on the Arctic Sea island of Spitzbergen. The tens of thousands of varieties of wheat, corn and beans stored there could even survive a nuclear war. The survival of many crop plant could depend on it.

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While millions is spent to preserve monuments and architectural gems, not much is done to protect our agricultural heritage.

Cary Fowler encounters a blast of cold air when he opens the creaking wooden door into the underground vault. It smells of stone. "There is a treasure hidden behind this door," whispers the American agricultural expert, dressed in a blue miner's suit. "The existential part of mankind's heritage is stored in this tunnel," he says, adjusting his miner's light. "What I'm talking about is a ten thousand-year-old heritage that has given us food and prosperity."

At first, Fowler is enveloped by the inky darkness as he enters the mine shaft. But soon the glow of his flashlight reveals glittering crystals on the blasted rock face, which is striated with thin layers of black coal.

After walking another 400 meters and through two additional wooden doors, Fowler reaches his destination: an unassuming container resting on wooden beams. In a project funded by the United Nations Food and Agriculture Organization (FAO), this inhospitable place is gradually becoming a repository for the seeds of the world's most important food crop plants. When finished, the site -- located on the Arctic Sea island of Spitzbergen -- will contain up to three million samples from tens of thousands of different varieties from around the world. Whether wheat, sorghum, peas or feed corn, the project's sponsors hope that the seeds being stored in this tunnel 400 meters below the surface in Spitzbergen's permafrost will remain preserved for centuries to come -- possibly even surviving mankind itself.

"Could even survive a nuclear war"

"The facility is designed so that it could even survive nuclear war," says Fowler. Experts jokingly call it the "doomsday vault."

Fowler spent years searching the Arctic for the ideal storage site for this gene pool of the world's plants. The biggest challenge to storing the seeds poses is that they must never be allowed to reach temperatures above three to four degrees Celsius (37 to 39 degree Fahrenheit). Although they are packaged in aluminum shells, the storage environment must be dry. More than 6 percent relative humidity would trigger the germination process and "the seeds would be ruined," says Fowler -- an immeasurable loss for future generations.

Because of its dry cold climate, the Arctic is the ideal storage site. Even a breakdown in the artificial cooling system would not pose any risk to the vault's valuable contents. Both climate and relative accessibility made Spitzbergen the ideal storage site. The abandoned mine housing the facility lies not far from Longyearbyen airport, to which new samples can be flown on scheduled flights.

Accessibility by air is especially important, because each sample must be sown in a test laboratory after a few decades of storage. The fresh seeds obtained from the new plants will then be taken back to Spitzbergen for storage.

The project -- costing millions of euros -- is being sponsored by a number of industrialized countries, including Germany. Although seed archives already exist in various parts of the world, most specialize in certain plant species. There is a rice archive in the Philippines, for example, one for beans in Colombia and one for corn in Mexico. But none of these institutions has an all-encompassing collection, nor are any of the storage facilities as safe as the new one on Spitzbergen. "We take care of books in old libraries and we invest billions to preserve historic buildings and works of art," says Fowler, "but hardly anyone has paid any attention so far to our agricultural heritage." The consequences of this omission have been devastating. Of the 7,100 apple varieties that existed in the United States in the 19th century, for example, 6,800 are already extinct.

Tracking down Iraq's treasure of seeds

A nuclear war isn't the only thing that poses a threat to these scattered collections of agricultural heritage. In 1998, Hurricane Mitch destroyed the national seed bank of Honduras. More recently, when the Taliban were withdrawing from Afghanistan, they emptied the plastic seed containers in that country's seed bank because they felt the containers could be put to better use.

The situation in Iraq is even worse. The country's seed bank used to be located in Abu Ghraib, a Baghdad suburb that gained notoriety through the American prisoner torture scandal. "It was particularly important, because agriculture was first developed in Mesopotamia (modern-day Iraq) more than 10,000 years ago," says Fowler. When looters raided the Abu Ghraib facility after the American invasion in 2003, they made off with the items they considered valuable: the glass containers. "They just poured the seeds onto the ground," says Fowler.

Botanists from all over the world are now involved in a painstaking effort to track down the Iraqi facility's several hundred varieties in other seed banks. But Fowler is convinced that "we will only manage to bring back a small percentage."

Fortunately, astute employees were able to send what they called a black box to Syria long before the Iraq war. The sealed box, kept at a chilly minus 10 degrees Celsius (14 degrees Fahrenheit), was sent to that country's International Center for Agricultural Research in the Dry Areas (ICARDA). The box contained samples of 200 varieties of 28 of the country's most important crop plants. "The black box contains Iraq's agricultural heritage," says William Erskine, a scientist working at ICARDA.

Breeding better plants

Saving such seeds is vitally important -- having as many different varieties of each crop species as possible is a key factor in securing the world's future food supply. Both seed manufacturers and government organizations are constantly developing new varieties, if only to keep pace in a constant race against pests. Botanists are also developing more drought-resistant plants through interbreeding -- a way of helping plants adapt to global climate change.

A Swiss botanist recently succeeded in breeding a new, more drought-resistant corn plant by crossing a high-yield variety with a wild relative of corn. Unlike corn, the wild plant, a type of grass, produces ears containing only a few grains. But because of its resistance to dry conditions, crossing the wild grass with the cultivated corn plant resulted in a high-yield plant that can continue to thrive despite

drought in the fields.

A few years ago, Fowler embarked on a search for a drought-resistant variety of another grain plant, sorghum. His team analyzed more than 20,000 samples before finding the right variety.

Gerald Traufetter / DER SPIEGEL

Cary Fowler, left, in the mine shaft where millions of seed samples are being stored for eternity.

"Nowadays we are constantly in defensive mode," says the American researcher. Genetic engineering, according to Fowler, is only one way to introduce new characteristics into cultivated plants. Even in modern agriculture, he says, there is no getting around classic cultivation methods using well-sorted seed banks. "Luckily evolution is in our own hands -- at least with the right gene banks."

Plant breeders are always running into new enemies. In Uganda, where bananas are a staple of the local diet, a pathogen is currently infesting banana trees and is spreading to other countries -- especially dangerous given the important role bananas play in the diet of many people in Africa. To fend off pathogens, banana trees already have to be sprayed up to 50 times with toxic pesticides.

But the problem Ugandan banana growers face is that conventional pesticides are no longer effective against the new pests. Their only hope is a new variety cultivated using FAO's plant pool. The Ugandan example shows how gene banks are now being systematically scrutinized for characteristics crucial to plants' survival.

Fowler has completed his inspection of Spitzbergen's seed repository, shed his dust-covered miner's suit and left the small mine. He gazes at the austere brown cliffs, almost devoid of plant life, that frame the fjord. "Perhaps this isn't such a bad place to imagine what life would be like if we didn't care for our crop plants," the scientist says, thoughtfully.

Once valuable genetic material is destroyed, it can never be reconstructed. "It's as if one were to burn down a library filled with books that no one has read yet," says Fowler.

Translated from the German by Christopher Sultan