



Profitable move

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Sunflowers, pumpkins and peppers grown from seeds bred in space. Shaanxi province is transforming its traditional farming techniques with this agricultural project. PHOTOS PROVIDED TO CHINA DAILY

Amazing seeds from space

Researchers make important strides toward ensuring food supplies on Earth by crossbreeding mutated plants

By QIN FENG in Xi'an and ZHOU HUYIYING

Guo Rui and his agricultural research team have made the breeding of seeds in space a new starting point for the transformation of traditional farming and brought a modern circular economy to Shaanxi province.

Space breeding is a process in which plant seeds are exposed to cosmic radiation and microgravity during a space mission, causing genetic mutations. Then the seeds are returned to Earth, where scientists evaluate the mutations, some of which confer properties favored by farmers, such as greater yields, shorter growth periods and better resistance to disease.

So far, Guo's team has successfully sent Shaanxi varieties of buckwheat, sesame, kiwi, Sichuan pepper, orchids and millet into space. The experimental process of optimizing and improving them is ongoing. So far, they say they have filled the domestic technological gap and enabled space agriculture to move from Shaanxi to the world.

"China is the world leader in the space breeding industry, and Shaanxi is at the forefront nationwide," said Guo, director of the Shaanxi Engineering Research Center for Plant Space Breeding. "Grain is the foundation of a country, and seeds are the priority of agriculture, as they play an irreplaceable role in increasing crop yields and improving crop quality. All these are closely related to the vital interests of farmers."

Integrating field breeding with experimental cultivation, industrial promotion and popular science education, the center focuses on developing new technologies, cultivates

professional talent and promotes the growth of space agriculture.

So far, the center has crossbred a batch of high-yield and high-quality plant varieties using seeds that were modified in space. It has obtained independent intellectual property rights for these in China, obtaining 11 agriculture-related patents and providing strong technical support for the rapid application of China's space-induced breeding achievements on the ground.

The modified crops have shown improved quality, strong resistance to disease and a longer stable period, with a general increase in yields of around 20 percent.

In August 1987, China's ninth retrievable satellite experiment satellite carried a batch of seeds on its first space journey. Upon returning to the ground, scientists found significant genetic changes and initiated a series of further experiments involving crossbreeding.

"Space is a super laboratory that simultaneously possesses extreme conditions such as microgravity, weak magnetic fields, strong radiation, a vacuum, extreme cleanliness and ultra low temperatures," Guo said. "The harsh environment stimulates the seeds."

So far, Chinese scientists have cumulatively created more than 40,000 space-induced germplasm materials and developed more than 400 new varieties of rice, wheat, corn, soybeans, cotton, oil crops and vegetables, significantly improving crop yields and quality and generating economic benefits of over 360 billion yuan (\$49.8 billion), Guo said.

While breeding a variety of flowers and vegetables, the team also focuses on promoting locally advantageous varieties to support agricul-



Top Above: Professor Guo Rui, director of the Shaanxi Engineering Research Center for Plant Space Breeding, introduces seeds from space to visitors. Above: Red rice seeds bred in space. PHOTOS PROVIDED TO CHINA DAILY

tural and rural development.

Mizhi county in Yulin is well known as a center for millet in Chi-

na. However, for a long time, the cultivation of Mizhi millet had to rely on introduced seeds because of a

lack of independent varieties.

In 2018, Guo's team started the Mizhi millet space breeding project, and in May 2020 they sent some of the millet seeds into orbit aboard a Long March 5B rocket.

They got the seeds back after three days in space and have completed five generations of crossbreeding on Earth, which will help fill the gap in local independent brands.

Last year, the county planted modified seeds on 20 hectares to demonstrate integrated planting of regular millet with ground-bred seed varieties using the space mutations, according to Ren Shuangang, head of the county's agriculture and rural comprehensive technology promotion station.

"The base can also issue a call for the integrated, high-quality fields and varieties, good methods, machinery and technologies for the millet growers, guiding more farmers to participate," he said.

In recent years, Guo's research team gradually shifted their focus to the breeding of ecological grass and forage grass in high-altitude and arid regions. "For a long time, 75 percent of our country's forage grass and all the grass for ecological preservation relied on imports," he said. "The production gap of forage grass and ecological grass is restricting the development of China's animal husbandry and the restoration of the environment."

In 2019, the team began research and development on high-quality forage grass varieties in temperate regions.

"Now we have achieved phased research results, which can provide us with more advanced and more various technological support for large-scale promotion and applica-

tion," Guo said. "We hope to cultivate high-quality forage grass with space-modified seeds that will not only improve the ecological environment but also provide increased income for farmers."

In Guo's view, telling an accurate, vivid and interesting story of this high-tech field is just as important as the scientific research itself.

To attract more attention from the public to the space-modification industry, Guo has written a series of popular science books to popularize the technology.

"Space breeding is not mysterious. Actually, the achievements of space breeding can be seen everywhere in our daily lives," he said. "Flowers, tomatoes, peppers, pumpkins and more plants using genetic modifications from space can be found in many markets."

Space-breeding science not only ensures our food security but can also change the future lives of humanity and the Earth, he said. "Therefore, it is necessary for everyone to know about these emerging technologies."

In addition to research and development in the seed industry, the team has been actively participating in the Belt and Road Initiative, seeking cooperation in the agricultural industry and academia to promote the development of strong seeds, smart technology and the development of healthy animal husbandry.

"We will adhere to innovation-driven development, continuously strengthen international exchanges and cooperation and make greater contributions to the development and strengthening of the aerospace agriculture industry," he said.

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