Tecnológico de Monterrey
Escuela de Ingeniería y Ciencias

Tecnologico de Monterrey develops nutraceutical corn to address the global food crisis and improve health

- Researchers at the FEMSA Biotechnology Center of Tecnologico de Monterrey have been working for 25 years on the genetic improvement of corn to increase its nutritional value.
- This nutraceutical corn has the potential to prevent chronic degenerative diseases such as diabetes and hypertension.
- This technological development could help address the global food crisis, which is aggravated by climate change.

The FEMSA Biotechnology Center at Tecnologico de Monterrey (Mexico's number one university in engineering and technology, in LATAM according to the QS World Ranking 2024) has worked for over 25 years on the development of nutraceutical corn, a genetically improved variety that is not only nutritious but can also contribute to the prevention of chronic degenerative diseases.

This project, led by experimental biologist and researcher Silverio García-Lara, addresses the need to produce healthier and more resilient foods in the context of a food crisis aggravated by climate change.

According to García-Lara, "The global food crisis is a multifactorial reality exacerbated by climatic, political, and economic phenomena. Although corn is one of the most produced and consumed cereals in the world, its nutritional value is limited."

The research team he leads is focusing on improving the nutritional properties of corn, (a staple food cultivated on all continents and a cornerstone of diet for hundreds of millions) using traditional breeding methods to enhance its nutritional value.

Nutraceutical Corn: An Advancement in Nutrition and Health

Corn, although one of the most important crops globally with an estimated production of 1,240 million metric tons in the 2023/2024 season, has low nutritional content in its conventional form. Therefore, the FEMSA Biotechnology Center team has concentrated its research on improving corn's properties to increase its protein, fatty acid, and carbohydrate content.

The nutraceutical corn developed by Dr. García-Lara's team combines features that make it not only a more complete food but also a tool to prevent chronic degenerative diseases such as diabetes, obesity, and hypertension. This is achieved through the inclusion of antioxidant compounds and other beneficial components such as peptides and fatty acids, identified and enhanced in the new corn varieties.

"This nutraceutical corn has the potential to transform how we nourish ourselves", commented Dr. García-Lara. "In addition to providing essential nutrients, it can help prevent and combat conditions currently affecting millions of people. It is not just a matter of food security but also public health," he added.

Genetic Improvement Based on Traditional Techniques

It is important to highlight that the genetic improvement process carried out at the FEMSA Biotechnology Center does not involve the use of genetically modified organisms (GMOs). Instead, researchers employ traditional crossbreeding and enhancement techniques, an approach used in agriculture for decades. These techniques allow for selecting and combining the best genetic traits of corn, leveraging the rich diversity of native corn varieties in Mexico.

Corn originated in Mexico, and its genetic diversity is unparalleled. The country cultivates 58 native corn varieties, whose genetic wealth has been exported to other regions worldwide. The Tecnologico de Monterrey team has utilized this genetic diversity to perform traditional crossbreeding, using the world's largest corn germplasm bank located in Mexico. This genetic reserve enables the selection of desired traits, such as pest and disease resistance, to incorporate them into new corn varieties.

"Thanks to the rich genetic diversity of Mexican native corn, we have been able to make significant improvements in grain quality," explained García-Lara. By using traditional enhancement techniques, the use of GMOs is avoided, ensuring that farmers and consumers have access to a natural and healthy product.

Scientific and Sectoral Collaboration

The development of nutraceutical corn has involved the collaboration of various Mexican and international institutions and organizations. The International Maize and Wheat Improvement Center (CIMMYT), the National Institute of Forestry, Agricultural, and Livestock Research (INIFAP), and other entities have been fundamental in the crossbreeding and validation processes of the progress achieved.

Additionally, collaboration with international organizations such as the FAO and the CGIAR has enriched knowledge and technology exchange, accelerating the development of nutraceutical corn.

One of the most notable collaborations has been with the MasAgro program, an initiative of the Mexican Secretariat of Agriculture and Rural Development (SAGARPA) and CIMMYT. This program has promoted sustainability in corn production in Mexico, with Tecnologico de Monterrey playing a key role in analyzing the nutraceutical properties of the developed materials, ensuring their suitability for both farmers and consumers.

Another success story in collaboration with the private sector has been with Kellogg's Mexico, where yellow corn production was supported to replace the importation of this grain from the United States. This six-year project enabled Mexican farmers in Bajío and Pacific regions to produce high-quality corn that met the company’s standards.

Climate Change and Disease Resistance

Climate change has posed new challenges for farmers, especially in regions with extreme conditions. The improved corn developed by Tecnologico de Monterrey is not only more nutritious but also more resilient. These new corn varieties are resistant to pests, diseases, and adverse environmental conditions such as poor soils, prolonged droughts, and extreme rainfall.

Moreover, the research team has focused on combating the effects of fungi producing aflatoxins, toxic substances harmful to human and animal health. These toxins appear when corn is exposed to climatic stress, and researchers have developed corn varieties resistant to these fungi, ensuring food safety.

Enhanced Nutritional Value

One of the project's most important achievements has been developing corn with protein content exceeding 14%, compared to the 3-4% found in conventional corn. These high-quality protein maize (QPM) varieties are a significant advancement in fighting malnutrition. Additionally, fatty acid content has increased from 3% to 10%, improving the grain's energy contribution.

The increase in antioxidant compounds also directly impacts preventing chronic degenerative diseases, making this grain a functional food with additional health benefits.

In alliance with various institutions and organizations, Tecnologico de Monterrey leads sustainable agriculture and public health research, offering innovations that will transform how populations nourish and care for themselves. "Science is a community activity, and at Tec de Monterrey, we are open to collaborating with institutions sharing our commitment to improving food security and public health," concludes García-Lara.