Peanut Blog

An ounce of information



ICRISAT Co-Leads World's Largest Peanut Diversity Study, Revealing Hidden Genetic Potential

A comprehensive study on groundnut diversity covering 2,320 accessions from 87 countries identifies genes for flowering-time regulation and dwarfing, laying the groundwork for breeding climate resilient varieties

Researchers from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), in collaboration with leading agricultural research institutions in China and Australia, have conducted the most comprehensive genomic investigation of cultivated peanut. Published in Nature Genetics, the study analyzed 2,320 accessions from 87 countries, uncovering previously hidden genetic diversity and identifying new opportunities to accelerate groundnut improvement.

Titled "Pan-genome-based resequencing of 2,320 accessions reveals structural variations and accelerates breeding advances in cultivated peanut," the study was co-led by Dr Manish K. Pandey, Principal Scientist – Genebank and Trait Discovery, Centre for Pre-breeding Research (CPBR), ICRISAT, alongside researchers from the Institute of Crop Germplasm Resources, Shandong Academy of Agricultural Sciences (SAAS), Jinan, China; the State Agricultural Biotechnology Centre (SABC), Murdoch University, Australia; and the Henan Academy of Agricultural Sciences, Zhengzhou, China.

The research drew on the rich genetic diversity conserved in ICRISAT's Genebank. The 2,320 accessions analyzed represent 88.03% of ICRISAT's core collection and 59.21% of the United States Department of Agriculture (USDA) peanut collection, making this a significant resource for global groundnut research and breeding.

"Pan-genome studies are important for advancing global agricultural research. ICRISAT's genomics research and Genebank have made significant contributions to pan-genome studies in important pulses, including chickpea and pigeonpea. This latest publication in Nature Genetics on the peanut pan-genome is another key milestone towards delivering improved crops for smallholder farmers in the drylands," said Dr Himanshu Pathak, Director General, ICRISAT.

"Pan-genome assemblies require strong international cooperation. I congratulate the collaborating institutions in China and Murdoch University, alongside ICRISAT's Centre for Pre-breeding Research, on this remarkable achievement. Such partnerships are essential to advancing crop science and translating genomic discoveries into practical breeding outcomes," said Dr Stanford Blade, Deputy Director General – Research and Innovation, ICRISAT.

The study catalogued several previously undetected structural variations (SVs) and homoeologous exchanges across the peanut genome, providing new insights into the crop's genetic architecture. Researchers identified genes associated with important agronomic traits, including AhTFL1, linked to flowering-time regulation, and Ah12g032500, identified as a dwarfing gene in cultivated peanut that valuable targets for groundnut improvement programmes worldwide. Dwarf plant architecture can support mechanized harvesting and higher planting densities, potentially contributing to more efficient production systems and climate-resilient agriculture. The study also provides a foundation for identifying superior genetic variants associated with traits such as seed size and pod number.

"ICRISAT's Genebank is at the heart of this discovery. Identifying genes associated with traits such as flowering-time regulation and dwarfing provides valuable resources for breeding climate-resilient groundnut varieties. This study demonstrates how conserved genetic diversity can be leveraged for breeding better varieties that benefit the farmers," said Dr Raman Babu, Global Research Program Director – Accelerated Crop Improvement, ICRISAT.

Dr Manish K. Pandey highlighted the broader implications of the research for global breeding efforts: "For decades, groundnut breeding has faced challenges associated with a narrow genetic base. This graph-based pan-genome captures structural variations that are important for crop improvement. This public resource can help accelerate the development of high-yielding, nutritionally superior and climate-resilient groundnut varieties across the globe."

By providing an unprecedented genomic resource for cultivated peanut, the study establishes a stronger foundation for future research and breeding. It demonstrates the value of international collaboration and long-term investment in germplasm conservation, while opening new pathways to develop productive, resilient and farmer-preferred groundnut varieties for agricultural systems worldwide.

Source: https://www.cgiar.org/news-events/news/icrisat-co-leads-worlds-largest-peanut-diversity-study-revealing-hidden-genetic