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USDA Scientists, Colleagues Complete Most Comprehensive Genetic Analysis of Corn to Date

WASHINGTON, June 4, 2012 – U.S. Department of Agriculture (USDA) scientists and their colleagues have published the most comprehensive analysis to date of the corn genome, an achievement expected to speed up development of improved varieties of one of the world's most important agricultural commodities.

The work was organized by USDA scientists and funded in the United States by USDA and the National Science Foundation. The research was a collaborative effort by an international team of scientists at 17 institutions including Cold Spring Harbor Laboratory, the University of California at Davis, Cornell University, the International Maize and Wheat Improvement Center (CIMMYT) in El Batan, Mexico, and BGI, a genomic research center based in Shenzhen, China.

The results are expected to boost international efforts to increase yields, expand areas where corn can be cultivated, and produce varieties that are better equipped to resist pests and disease.

"This work represents a major step forward and an important tool in the arsenal available to scientists and breeders for improving a vital source of nutrition, as well as a source of fuel, in the face of changing climates, growing populations and a diminishing supply of arable land," said Edward B. Knipling, administrator of the Agricultural Research Service (ARS), USDA's principal intramural scientific research agency. The research supports the USDA goals of promoting agricultural sustainability, international food security, and developing new sources of bioenergy.

The researchers published two separate reports in *Nature Genetics* that shed light on corn's remarkable genetic diversity, reveal its evolution, and outline how corn, known as maize among scientists, continues to diversify as it adapts to changing climates and habitats.

One report, published by a team led by ARS scientist Doreen Ware in collaboration with ARS colleagues Ed Buckler, Peter Bradbury, Jim Holland and Michael McMullen, examined the genetic structure and the relationships and sequential ordering of individual genes in more than 100 varieties of wild and domesticated corn.

Lead author Jer Ming Chia described how the structures of genomes can vary tremendously from one corn variety to the next, how structural variations within a genome can have major effects on traits, and how the corn genome is essentially still in flux. The researchers also discovered significant variations in the physical size of genomes of different varieties.

The research expands on a study published by Ware and another international team in 2009 that provided a genetic blueprint of the corn genome and identified roughly 1 million genetic markers. Using a sophisticated, population-genetics scoring model, Chia and his colleagues were able to identify 55 million markers. The achievement is expected to vastly enhance the ability of scientists and breeders to track and select for valuable regions of the genome to enhance targeted traits.

A second report, published by a group led by Jeff Ross-Ibarra from the University of California at Davis, gives an unprecedented glimpse into how corn evolved from a wild, scrubby plant into today's ubiquitous international commodity.

Lead author Matthew Hufford and his colleagues compared wild varieties with traditional corn varieties from across the Americas and with modern improved breeding lines. The researchers identified hundreds of genes that played a role in the transformation of corn from its wild roots to today's cultivated crop and show how that transition was largely achieved by ancient farmers who first domesticated the crop thousands of years ago.

They also found that since corn was first domesticated, many of the changes in patterns of gene expression by modern day breeding efforts have been centered on genes selected for hybrid vigor.

The economic value of the U.S. corn crop was $76 billion last year, with U.S. growers producing an estimated 12 billion bushels, more than a third of the world's supply. It is the largest production crop worldwide, providing food for billions of people and livestock and critical feedstock for production of biofuels.

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