USDA: Wheat Genome Sequence Crucial For Global Food Security

WASHINGTON (USDA) — U.S. Department of Agriculture (USDA) scientists working as part of an international team have completed a shotgun sequencing of the wheat genome, a paper published in the journal Nature reported today. The achievement is expected to increase wheat yields, help feed the world and speed up development of wheat varieties with enhanced nutritional value.

"By unlocking the genetic secrets of wheat, this study and others like it give us the molecular tools necessary to improve wheat traits and allow our farmers to produce yields sufficient to feed growing populations in the United States and overseas," said Catherine Woteki, USDA's Chief Scientist and Under Secretary for Research, Education and Economics. "Genetics provides us with important methods that not only increase yields, but also address the ever-changing threats agriculture faces from natural pests, crop diseases and changing climates."

Olin Anderson and Yong Gu, scientists with USDA's Agricultural Research Service (ARS) based at the agency's Western Regional Research Center in Albany, Calif., played instrumental roles in the sequencing effort, along with Naxin Huo, a post-doctoral researcher working in Gu's laboratory. All three are co-authors of the Nature paper.

ARS is USDA's principal intramural scientific research agency, and the work supports the USDA goal of ensuring global food security.

As the world's largest agricultural research institute, USDA is focused on reducing global hunger by increasing global cooperation and collaboration on research strategies and their implementation. For example, through the U.S. government's Feed the Future initiative, USDA and the U.S. Agency for International Development (USAID) are coordinating their research portfolio [1] with ongoing work of other donors, multilateral institutions, and government and non-government entities at the country level to effectively improve agricultural productivity, reduce food insecurity and generate economic opportunity.

Grown on more land area than any other commercial crop, wheat is the world's most important staple food, and its improvement has vast implications for global food security. The work to complete the shotgun sequencing of the wheat genome will help to improve programs on breeding and adaptation in Asia and Sub-Saharan Africa for wheat crops that could be drought tolerant and resistant to weeds, pests and diseases.

ARS is one of nine institutions with researchers who contributed to the study. The lead authors are based in the United Kingdom and were funded by the British-based Biotechnology and Biological Sciences Research Council. Funding also was provided

by USDA's National Institute of Food and Agriculture, or NIFA. NIFA focuses on investing in research, education and extension programs to help solve critical issues impacting people's daily lives.

The study represents the most detailed examination to date of the DNA that makes up the wheat genome, a crop domesticated thousands of years ago. The wheat genome is five times the size of the human genome, giving it a complexity that makes it difficult to study. The researchers used the whole genome shotgun sequencing approach, which essentially breaks up the genome into smaller, more workable segments for analysis and then pieces them together.

Another international team of scientists is working on a long-term project expected to result in more detailed sequencing results of the wheat genome in the years ahead. But the results published today shed light on wheat's DNA in a way that will help breeders develop hardier varieties by linking genes to key traits, such as disease resistance and drought tolerance.

Wheat evolved from three ancient grasses, and the ARS team, working closely with partners at University of California, Davis, sequenced the genome of one of those three parents, Aegilops tauschii. That sequencing, funded in part by the National Science Foundation, was instrumental in the study. It allowed researchers to identify the origins of many of the genes found in modern-day wheat, a key step in linking genes to traits and developing markers for use in breeding new varieties.

Wheat growers face numerous challenges each year. Acidity in the soil can make wheat difficult to grow in some areas. Stem rust, a fungal disease, can wipe out entire crops, and a particularly aggressive form of stem rust has developed the ability to knock out genetic resistance in many popular wheat varieties and is causing major losses overseas.

USDA scientists have conducted similar genomic studies that have helped to increase the productivity of dairy operations, enhance cattle breeding and improve on varieties of a number of other crops, including tomatoes, corn and soybean. In 2010, another ARS team published a paper in Nature detailing the sequencing of Brachypodium distachyon, a model plant used to study wheat, barley and biofuel crops.

Recent international research collaborations have been critical to meet challenges such as combating wheat rust and increasing wheat productivity, fighting aflatoxin contamination in food, and sequencing genomes of important crops.

The Nature paper can be found at:
www.nature.com/nature/journal/v491/n7426/full/nature11650.html *[2]*

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http://www.foodmanufacturing.com/news/2012/11/usda-wheat-genome-sequence-crucial-global-food-security

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