Researchers fight world hunger by mapping the soybean genome

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In 2009, soybeans represented an almost $30 billion industry in the U.S. alone, making soybeans the second-most profitable crop next to corn. Worldwide, soybeans have been used in human foods and livestock feed for centuries and have been a key component in industrial products, such as plastics and soy biodiesel, an environmentally friendly fuel. A team of researchers, including University of Missouri researchers, recently completed a study identifying 1.1 million base pairs of DNA in the soybean genome, including more than 90 distinct traits that affect plant development, productive characteristics, disease resistance, seed quality and nutrition, which could lead to extensive crop improvements.

"The genome sequence will be a new tool for plant breeders, industrial engineers, geneticists, biochemists, technologists, nutritionists and anyone else who uses soybeans worldwide," said Henry Nguyen, director of the National Center for Soybean Biotechnology at the MU College of Agriculture, Food and Natural Resources. "With knowledge of which genes control which soybean traits, scientists may be able to better adapt the plant to drought conditions, bringing a new cash crop and food product to poor areas of the Earth."

Funded by the U.S. Department of Energy, MU scientists, in collaboration with researchers at other institutions, mapped the soybean genome to make crop improvements and provide a key reference for more than 20,000 different species of plants. Nguyen already has begun collaborating with animal science and nutrition experts to modify soybeans added to animal feeds that could increase the health value of

meat. Specifically, he is looking at ways to impart certain antioxidants that are known to decrease the frequency of cancer, and proteins from soybeans into the meat. Nguyen also is studying the root system of soybeans and how they respond to drought. He's pinpointing which proteins or genes contribute to drought tolerance.

"Perhaps the most exciting thing that we have found for the soybean community is the gene that confirms resistance to the devastating Asian Soybean Rust disease," Nguyen said. "In countries where this rust is well established, soybean losses can range from 10 to 80 percent. Improved soybean strains resistant to the disease will greatly benefit production and increase foodstuffs around the world."

In addition to mapping the soybean genome, MU scientists have created a database of soybean transcription factors, which regulate the expression of genes and can turn genes on or off. The database, SoybeanDB, can be accessed through a web server and contains information such as protein sequences, protein family classifications and web links to other protein databases.

The genome research has been published in the January issue of *Nature* magazine, and Nguyen's research on soybean drought-tolerance has been published in *Plant*, *Cell* and *Environment*. Faculty members from the MU College of Agriculture Food and Natural Resources, College of Engineering and the Christopher S. Bond Life Sciences Center contributed to the study. Nguyen was recently elected as a Fellow of the American Association for the Advancement of Science (AAAS) for his research contributions in plant genetics and genomics and the national and international recognition of his research and leadership in plant abiotic stress, most notably in drought tolerance.

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