Greatest thing since sliced bread: New data offer important clues toward improving wheat yields

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Breed a better crop of wheat? That's exactly what a team of researchers from Kansas State University and the U.S. Department of Agriculture hope their research will lead to. In their study, appearing in the March 2009 issue of the journal *Genetics* they analyzed the type of wheat commonly used to make bread in an effort to understand why it is versatile enough to be used around the world and across different climates. This analysis provides important insights into why its genetic structure gives it a tremendous advantage over other competing species. Further, their analysis provides an important first step toward improving wheat crop yields to levels that can support ever-growing populations of people.

Unlike people who have only two copies of each gene—one from each parent—plants used for bread wheat have six copies of each gene—three copies are inherited from each "parent." Just as is the case with people, these gene copies work in concert to produce characteristics and traits that allow the plant to survive and thrive. Understanding gene expression in wheat is complex, not only because there are so many variants of each gene which could be active at different times, but as the study shows, combinations of different genes may be active to produce entirely different plant characteristics than what each individual gene could on its own.

The researchers found that more than 1 in every 10 genes may be

affected by the phenomenon, and that this is likely to be the cause of why the wheat used for bread is remarkably hearty. Furthermore, they found that a relatively high percentage (1.7 percent) of genes may be candidates for further study and selective breeding when trying to develop new strains of wheat with higher yields or more resistant to the environmental strain brought about by global warming.

"With the human population predicted to reach 9 billion by 2050, we must increase wheat yield at the rate of 2 percent per year per unit area," said Bikram S. Gill of Kansas State University, and the senior scientist involved in the study. "Wheat is a human staple that holds the key for better quality of life for billions."

To conduct this analysis, the authors attempted to recreate the evolutionary events leading to the spontaneous origin of bread wheat in nature. To do this, they crossed a diploid and tetraploid progenitor species and formed a synthetic strain of wheat in the laboratory. Then they simultaneously measured genetic expression of thousands of genes in the parent strains and the synthetic wheat offspring using a gene chip. The data then was used to test the commonly held notion that all wheat characteristics are simply different genes expressing themselves rather than some characteristics coming from a complex series of gene interactions.

"This paper is a beautiful example of yet another source of genetic variation that has led to the astounding diversity of life," said Mark Johnston, Editor-in-Chief of the journal *GENETICS*. "The authors show that our ancestors, in their quest to feed themselves, exploited variation in the expression of genes in hybrid wheat. The need to foster sustainable agriculture remains unabated, and the authors here make an important contribution toward understanding a crop critical to our existence. This research gives entirely new meaning to 'wonder bread.'"

More information: http://www.genetics.org

Source: Federation of American Societies for Experimental Biology