Wheat gene may boost foods' nutrient content

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Researchers at the University of California, Davis; the U.S. Department of Agriculture; and the University of Haifa in Israel have cloned a gene from wild wheat that increases the protein, zinc and iron content in the grain, potentially offering a solution to nutritional deficiencies affecting hundreds of millions of children around the world. Results from the study will be reported in the Nov. 24 issue of the journal Science.

"Wheat is one of the world's major crops, providing approximately one-fifth of all calories consumed by humans, therefore, even small increases in wheat's nutritional value may help decrease deficiencies in protein and key micronutrients," said Professor Jorge Dubcovsky, a wheat breeder and leader of this research group. He noted that the World Health Organization estimates that more than 2 billion people are deficient in zinc and iron, and more than 160 million children under the age of five lack an adequate protein supply.

The cloned gene, designated GPC-B1 for its effect on Grain Protein Content, accelerates grain maturity and increases grain protein and micronutrient content by 10 to 15 percent in the wheat varieties studied so far. To prove that all these effects were produced by this gene, the researchers created genetically modified wheat lines with reduced levels of the GPC gene by a technique called RNA interference. These lines were developed by research geneticist Ann Blechl of USDA's Agricultural Research Service in Albany, Calif.

"The results were spectacular," Dubcovsky said. "The grains from the

genetically modified plants matured several weeks later than the control plants and showed 30 percent less grain protein, zinc and iron, without differences in grain size. This experiment confirmed that this single gene was responsible for all these changes."

Dubcovsky said the research team was surprised to find that all cultivated pasta and bread wheat varieties analyzed so far have a nonfunctional copy of GPC-B1, suggesting that this gene was lost during the domestication of wheat.

Therefore, the reintroduction of the functional gene from the wild species into commercial wheat varieties has the potential to increase the nutritional value of a large proportion of our current cultivated wheat varieties," he said. "Furthermore, this discovery provides a clear example of the value and importance of conserving the wild germplasm -- the source of genetic diversity -- of our crop species."

Dubcovsky leads a consortium of 20 public wheat-breeding programs known as the Wheat Coordinated Agricultural Project, which is rapidly introducing GPC-B1 and other valuable genes into U.S. wheat varieties using a rapid-breeding technique called Marker Assisted Selection. The resulting varieties are not genetically modified organisms, which will likely speed their commercial adoption. More information about the Wheat Coordinated Agricultural Project is available online at http://maswheat.ucdavis.edu/.

Several breeding programs have already used the GPC-B1 gene to develop elite breeding lines, which are close to being released as new wheat varieties. Breeders are currently testing the new lines in multiple environments to determine if the introduction of GPC-B1 has any negative impacts on yield or quality. The researchers hope that these efforts will soon translate into food products with enhanced nutritional value.

Source: University of California - Davis