

Study finds PHS gene that prevents wheat from sprouting

A new study about the common problem of preharvest sprouting, or PHS, in wheat is nipping the crop-killing issue in the bud.

Researchers at Kansas State University and the U.S. Department of Agriculture-Agricultural Research Service, or USDA-ARS, found and cloned a gene in wheat named PHS that prevents the plant from preharvest sprouting. Preharvest sprouting happens when significant rain causes the wheat grain to germinate before harvest and results in significant crop losses.

"This is great news because preharvest sprouting is a very difficult trait for wheat breeders to handle through breeding alone," said Bikram Gill, university distinguished professor of plant pathology and director of the Wheat Genetics Resource Center. "With this study, they will have a gene marker to expedite the breeding of wheat that will not have this problem."

Gill conducted the study with Guihau Bai, a researcher with the Hard Winter Wheat Genetics Research Unit of the USDA-ARS, adjunct professor of agronomy at Kansas State University and the study's lead author. Also involved were Harold Trick, professor of plant pathology; Shubing Liu, research associate in agronomy; Sunish Sehgal, senior scientist in plant pathology; Jiarui Li, research assistant professor; and Meng Lin, doctoral student in agronomy, all from Kansas State University; and Jianming Yu, Iowa State University.

Their study, "Cloning and Characterization of a Critical Regulator for Pre-Harvest Sprouting in Wheat," appears in a recent issue of the scientific journal *Genetics*. The finding will be most beneficial to white wheat production, which loses \$1 billion annually to preharvest sprouting, according to Gill.

He said consumers prefer white wheat to the predominant red wheat because white wheat lacks the more bitter flavor associated with red wheat. Millers also prefer white wheat to red because it produces more flour when ground. The problem is that white wheat is very susceptible to preharvest sprouting.

"There has been demand for white wheat in Kansas for more than 30 years," Gill said. "The very first year white wheat was grown in the state, though, there was rain in June and then there was preharvest sprouting and a significant loss. The white wheat industry has not recovered since and has been hesitant to try again. I think that this gene is a big step toward establishing a white wheat industry in Kansas."

Gill said identifying the PHS gene creates a greater assurance before planting a crop that it will be resistant to preharvest sprouting once it grows a year later. Wheat breeders can now bring a small tissue sample of a wheat plant into a lab and test whether it has the preharvest sprouting resistance gene rather than finding out once the crop grows.

Much of the work to isolate the PHS gene came from Gill and his colleagues' efforts to fully sequence the genome -- think genetic blueprint -- of common wheat. Wheat is the only major food plant not to have its genome sequenced. The genome of wheat is nearly three times the size of the

human genome.

Researchers were able to study sequenced segments of the common wheat genome and look for a naturally occurring resistance gene. Gill said without the sequenced segments, finding the PHS gene would have been impossible.