'Cyber breeder' improves wheat varieties

Zhiwu Zhang sorts through field, molecular data to help breeding

By MATTHEW WEAVER
Capital Press

PULLMAN, Wash. — Zhiwu Zhang rarely actually touches wheat, but his work helps put better varieties of the popular grain into growers' hands.

As a statistical geneticist — he calls himself a "cyber breeder" — at Washington State University in Pullman, Zhang combines information from wheat breeders and researchers who identify molecular markers.

Wheat farmers are most concerned with yield, quality and production cost, all traits determined by how genetics and the environment interact, Zhang said.

"There are hundreds and even thousands of genes associated with yield," he said. "Gathering favorite genes together takes time. Fortunately, DNA sequencing technologies provide the opportunity to pinpoint where those genes are on the genome."

Zhiwu Zhang

Title: Assistant professor, Washington State University; Washington Wheat Distinguished Professorship for Statistical Genetics

Age: 55

Current location: Pullman, Wash.

Hometown: Shulan, China

Education: Bachelor's degree in animal science and master's degree in animal breeding and genetics, Jilin Agriculture University, Changchun, China; Ph.D. in animal breeding and genetics, Northeast Agricultural University, Harbin, China; Ph.D. in statistical genetics, Michigan State University

Family: Married; son James, 26; daughter Joia, 14

Website: http://css.wsu.edu/zhiwu-zhang/

Matthew Weaver/Capital Press

Washington State University assistant professor Zhiwu Zhang stands in the middle of his lab in Pullman. As a statistical geneticist, Zhang compiles information from field breeders and molecular DNA sequencing to enable wheat breeders to improve the varieties they develop.

Deoxyribonucleic acid — called DNA — is a molecule that carries the genetic instructions within most living organisms. Attributes such as drought tolerance are located at specific spots on the lattice-like structure of DNA.
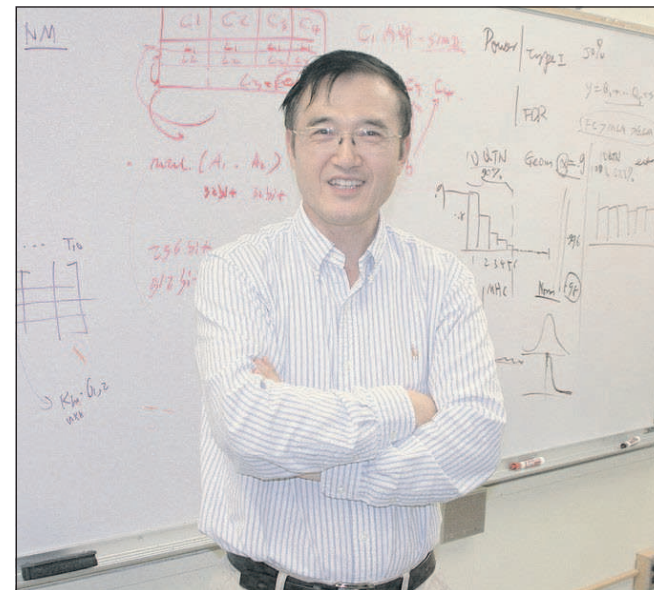
"We're trying to get them together, turn this big data into some knowledge," he said. "Then field breeders can turn it into a variety that can really increase the income of the farmer."

Zhang is developing the computer programs and databases necessary for wheat breeders to sort through millions of data points associated with genetic markers and gene sequences, said Rich Koenig, associate dean of the College of Agricultural, Human and Natural Resource Sciences, director of WSU Extension and interim chairman of the crop and soil sciences department.

"The explosion of data has created a need for 'genetic software engineers' to enable breeders to sort through all of these data and make good breeding and selection decisions," Koenig said.

Zhang's work should help breeders better select lines that have the potential to outperform other cultivars in the field, WSU winter wheat breeder Arron Carter said.

"Effectively, we are testing better material under field conditions, which should have higher yield potential, better disease resistance and better end-use quality," Carter said. "It will speed up the process a little bit, but mainly helps us get the best material out to the field as a starting point."

Breeders will still have to do years of field testing to ensure stability across locations and years, Carter said. Zhang's work helps identify the best wheat lines early in the process, allowing breeders to begin making crosses sooner.

Zhang has an agricultural background. He raised animals and worked in the field from childhood in China, and got his bachelor's degree in animal science. He went on to study genetics, statistics and computer science in getting his master's degree and Ph.D.s and postdoctoral training.

His first job was predicting breeding values, helping beef breeders select bulls for better yield, carcass quality and less calving difficulty.

Zhang's second job was to develop statistical methods and computing tools to dissect the genetic architecture of key complex traits in maize. Zhang developed a compressed model that reduced computing time from weeks to hours.

Jobs such as Zhang's did not exist a decade ago, Koenig said. Now, they are in high demand among modern breeding programs.

"Zhiwu has an international reputation and is recognized for developing leading platforms to process and screen genetic information," Koenig said.

Zhang hopes his work will increase farmers' net income and be environmentally friendly and sustainable.

Sequencing wheat varieties is currently limited by cost. The wheat genome is five times bigger than the human genome, with many gaps, Zhang said.

"Mathematically and accurately filling those gaps is critical to transform DNA sequencing into a useful tool for wheat breeding," he said.

The story first appeared Jan. 1, 2016.