June 2016

A mecca for wheat genetics: Kansas State University center mapping wheat genome

Tyler Sharp
Kansas State University

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Recommended Citation
Sharp, Tyler (2011) "A mecca for wheat genetics: Kansas State University center mapping wheat genome," Seek: Vol. 1: Iss. 3.

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As a top producer of wheat in the United States, Kansas is a leader in many areas of the wheat industry, particularly in innovation and research.

That’s where Kansas State University’s Wheat Genetic and Genomic Resources Center fits in. In fact, the highly integrated research center in Throckmorton Hall on campus is a world leader in wheat genetic research and development.

The center was created in 1979; the Kansas Board of Regents designated it as a center of excellence in 1984.

“This center was created to discover fundamental knowledge about wheat genetics and also develop genetic resources which can be used to make new wheat varieties,” said Bikram Gill, university distinguished professor of plant pathology and the center’s founder and project leader.

“Because of this long-term mission, this center was created so that scientists with diverse expertise and affiliation could work in one place on different aspects of wheat genetics research.”

Collaboration is paramount for one of the center’s most important tasks: mapping the wheat genome. Wheat has one of the largest genomes among crop plants and genome-sequencing methods can’t be used. To simplify the process, special genetic stocks provided by the Wheat Genetic and Genomic Resources Center were used to “divide and conquer” the wheat genome into 21 chromosomes, which were assigned to many institutes around the world. Currently, the center has responsibility for four of the 21 wheat chromosomes.

“We are the largest contributor to this effort in the world,” said Sunish Sehgal, research associate in plant pathology.

Gill is helping to lead these efforts as co-chair of the International Wheat Genome Sequencing Consortium.

The core mission of Kansas State University’s center is to maintain an extensive seed and genome bank, which currently has around 14,000 wild wheat species strains and around 100,000 genetic stocks. The collection is special because it is a one-stop shop for wild species, genetic stocks and genomic resources.

“Pretty much anyone who is doing wheat genetic research is getting their genetic stocks from us,” Gill said.

While Throckmorton Hall boasts countless laboratories to conduct research, the center has several other sites. Research is primarily conducted in the greenhouses adjacent to Throckmorton Hall. The center also has a field nursery outside of Manhattan in the Rocky Ford area near Tuttle Creek Reservoir.

Because every country can maintain individual ownership of wheat germplasm — the collection of genetic resources — it can create issues in advancing scientific research. The center’s genetic materials and improved germplasm are made freely available for promoting wheat genetics and improved wheat research. Gill has traveled extensively to promote the benefits of germplasm research.

“The strength of the center is that we have the germplasm,” Gill said. “At the same time, many Kansas State and United States Department of Agriculture scientists are working on different aspects of wheat research.”

The spirit of international exchange also extends to personnel. Since the center’s inception, it has welcomed scientists, professors, students and others from many different countries. After these people have returned to their home countries, a variety of collaborations with the center have resulted.

Current research has a diverse scope. But one project is easy to relate to stomachs worldwide. The center is working on the development of functional food.

“People as consumers are more interested in not only getting calories from food but getting health benefits as well,” Gill said.

The center’s many efforts and projects have led to its top-notch reputation.

“Our center has been described as a mecca for wheat genetics,” Gill said. “We have excellent facilities, some of the best in the country. Many scientists want to come and work here.”
A Genetix QBot is a fully automated robot used for picking and arraying bacterial colonies containing wheat DNA.

DNA sequence data is frequently analyzed by the center’s scientists.

Samples are loaded for the QBot.

Wheat field near Norton, Kan.

Bacterial colonies are kept in libraries in a freezer at -70 degrees Celsius.

The QBot picks up bacterial colonies.

Wheat under grow lights in the center’s greenhouses.

Harvesting wheat in the center’s greenhouses.