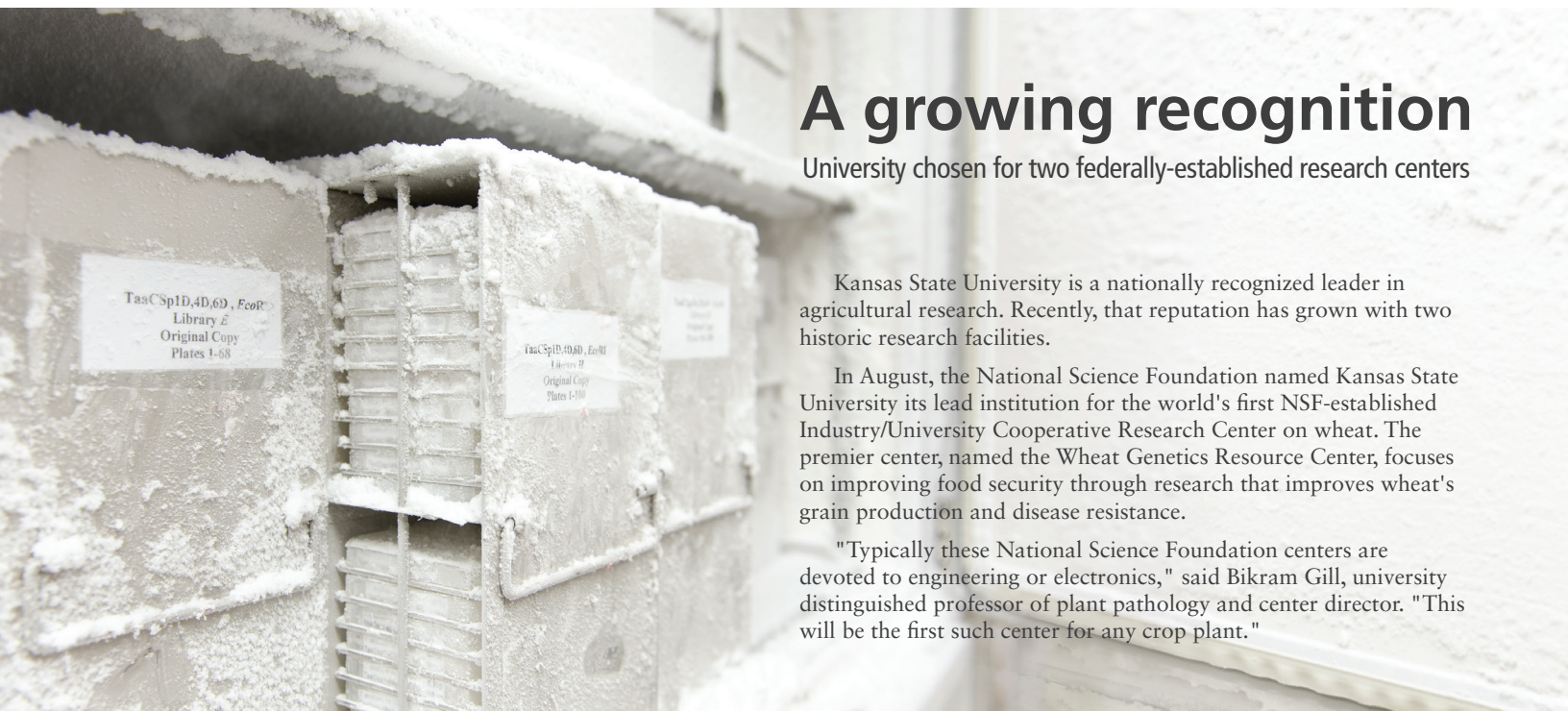


Perspectives

Fall 2013



A growing recognition

University chosen for two federally-established research centers

Kansas State University is a nationally recognized leader in agricultural research. Recently, that reputation has grown with two historic research facilities.

In August, the National Science Foundation named Kansas State University its lead institution for the world's first NSF-established Industry/University Cooperative Research Center on wheat. The premier center, named the Wheat Genetics Resource Center, focuses on improving food security through research that improves wheat's grain production and disease resistance.

"Typically these National Science Foundation centers are devoted to engineering or electronics," said Bikram Gill, university distinguished professor of plant pathology and center director. "This will be the first such center for any crop plant."

The center will be a collaborative effort between academia, industry and government. Members include Colorado State University and 10 business partners that will contribute \$50,000 annually toward funding the center.

Gill was crucial to the foundation's choice of Kansas State University. An internationally decorated wheat scientist, he directs the university's wheat research center that contains a wheat gene bank comprised of about 14,000 wild wheat species strains and about 10,000 genetic stocks. The databank and its research lab are being incorporated into the NSF center.

The center also offers unprecedented opportunities for graduate students and young researchers to work alongside some of the nation's top wheat scientists, Gill said.

Kansas is the leading wheat producing state in the U.S., contributing about \$20.6 billion to the America economy.

In July, the U.S. Agency for International Development, or USAID, awarded Kansas State University a \$13.7 million competitive

grant to establish the Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet. The lab is part of the federal government's Feed the Future initiative, which seeks to end poverty and increase food supplies in semiarid Africa.

Timothy Dalton, associate professor of agricultural economics and the lab's director, helped secure the funding against other national land-grant universities.

"With its selection, USAID has strongly validated Kansas State University's preeminence in sorghum and millet research and agricultural science," Dalton said.

As the initiative's lead institution, Kansas State University is coordinating the research efforts of partnering U.S. universities and research centers that specialize in sorghum and millet science with universities, research centers and nongovernmental organizations in the African countries of Ethiopia, Senegal and Niger.

Ethiopia is the most important sorghum-producing nation in East Africa and is one

of the centers of genetic origin for sorghum, which may lead to new germplasm for farmers. Senegal grows large amounts of pearl millet — the most grown subspecies of millet — that has adapted to semiarid environment in West Africa. Niger is one of the largest sorghum- and pearl millet-producing nations in West Africa, and neighbors several other key producing countries that are expected to economically benefit from Niger's advancements.

Scientists are developing technologies such as climate-resilient crop varieties and more profitable market approaches for farmers in these three nations.

"The overall goal with those three key producing nations is to improve farmers' productivity with sorghum and millet, which will reduce poverty and hunger," Dalton said. "Additionally, we want to help the farmers with value-added product development to increase benefits to consumers, the private sector and farmers."

— Greg Tammen



Michael Robinson, left, and John Leslie.

Safety in numbers

University researchers partner with Australian center to make biosecurity a priority

An Australian research center is the latest to recognize Kansas State University's potential in agricultural security. As the only U.S. university partner in the Australian Plant Biosecurity Cooperative Research Centre, or CRC, the university is in an unparalleled position to add depth to international biosecurity research.

The center is a consortium of Australian and international governmental research institutions and universities. Researchers develop new defensive strategies for emerging plant diseases and insect pests that threaten agricultural systems, according to Michael Robinson, the center's chief executive officer and director.

"The center drives research and makes meaningful differences," Robinson said. "The Australian research environment is well-suited to study plant biosecurity. Kansas State University

Biosecurity Research Institute, grain science facilities and the site for the federal National Bio and Agro-Defense Facility. Since Australian policy prohibits many foreign pathogens and organisms from entering the country — even for research — the university is able to further aid the center.

"We can do work at Kansas State University that cannot be done in Australia," Robinson said. "The university's facilities are a great opportunity for the center. The depth of their expertise in agriculture is something we don't have with any other organization."

Producers must double food production in the next 40 years to feed the anticipated global population, said Randall Tosh, university liaison to Australia. Kansas State University resources can be shared to more efficiently address global security issues.

has strong ties in agricultural research, and there is much we can collaborate on."

Recently, Robinson visited Kansas State University's Manhattan, Kan., campus to meet with researchers and tour area facilities, including the

"Threats to global food security and to producing enough food for the world's population is too big of a challenge for one or two countries," Tosh said. "Kansas State University is fortunate to have a highly trained global workforce. It's critical that we leverage these resources — that's the overarching idea behind the partnership with the CRC."

The university's research focus is aligned with the Cooperative Research Centre's, allowing for a mutually beneficial partnership. John Leslie, university distinguished professor and head of the department of plant pathology, said biosecurity is a university research priority in line with its goal of becoming a Top 50 public research university by 2025.

"Australia and Kansas both rely heavily on wheat and livestock," Leslie said. "We share similar problems and concerns in our agriculture. The science that comes out of this endeavor will be broadly applicable."

Since the university began its collaboration with the Plant Biosecurity Cooperative Research Centre, Kansas State University President Kirk Schulz has created in-depth Australian partnerships with three leading Australian universities. Tosh said this is a direct result of the university's high regard for the depth of scientific research in Australia.

— Megan Saunders

IT'S ALL IN THE GENES

Kansas State University is quickly becoming synonymous with breakthroughs in wheat genetics.

Eduard Akhunov, associate professor of plant pathology, co-led a research project that identified a gene named Sr35. The gene gives wheat plants resistance to one of the most deadly races of the wheat stem rust pathogen, called Ug99.

"This gene, Sr35, functions as a key component of plants' immune system," Akhunov said. "It recognizes the invading pathogen and triggers a response in the plant to fight the disease."

The discovery may help scientists develop new wheat varieties and strategies that protect the world's food crops against the Ug99 wheat stem rust pathogen, Akhunov said.

Harold Trick, professor of plant pathology, and Andres Salcedo, doctoral candidate in genetics, also were involved.

Along with the U.S. Department of Agriculture-Agricultural Research Service, Kansas State University scientists also recently nipped a common crop-killing issue in the bud.

They 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.

The finding will be most beneficial to white wheat production, which loses \$1 billion annually to preharvest sprouting, said Bikram Gill, university distinguished professor of plant pathology.

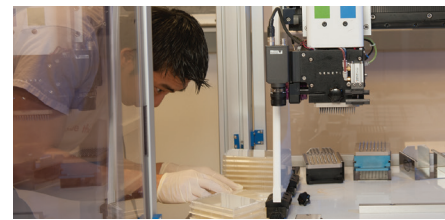
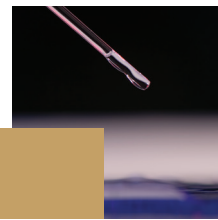
"This is great news because preharvest sprouting is a very difficult trait for wheat breeders to handle through breeding alone," Gill said. "With this study, they will have a gene marker to expedite the breeding of wheat that will not have this problem."

Other Kansas State University researchers in the project include Trick; 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.

According to Gill, these advancements have been possible because of scientists' efforts to fully sequence the genome of wheat. The genome, similar to a blueprint, provides a map of an organism's genes. With it, scientists can focus on improving genes that may help meet the world's growing demands for food and feed.

In November 2012, Gill and Sehgal were part of an international collaboration that successfully sequenced most of the genes of common wheat, also known as bread wheat. Common wheat is grown in more than 95 percent of the world's wheat fields and is the only major food crop not to have its genome fully sequenced. The reason: common wheat has one of the largest genomes among crops — nearly three times the size of the human genome, Gill said.

— Greg Tammen



Taking control

Researchers think proactively about crop safety

Kansas State University researchers are being trusted with the safety of the nation's food supply. The U.S. Department of Agriculture's National Institute of Food and Agriculture recently awarded a \$5.5 million research grant to the university to keep potential crop threats at bay.

Barbara Valent, university distinguished professor of plant pathology, is leading a research team in efforts to study, control and eliminate the wheat and rice blast fungus, *Magnaporthe oryzae*, which has the ability to devastate wheat and rice crops across the United States and around the world.

"Under the right environmental conditions, the fungus can lead to huge crop loss," Valent said. "We need to know what crop varieties can best resist it, as well as how to spot and control the fungus."

Although the rice blast fungus is well-established in the U.S., the wheat fungus has only shown up in a single head of wheat in the U.S. in 2011. However, when the wheat fungus has hit crops in South America, the effects have been disastrous. Wheat blast accounted for 30 percent of Brazil's wheat crop loss in 2009, and the fungus has the potential to cause 100 percent crop loss, Valent said.

"Wheat farmers already have many diseases they have to deal with," she said. "If this new one comes in on top of everything else, it would be bad news. In wheat, this disease looks like others we commonly encounter, so we need to pay attention and know how to spot it."

With the new funding, Valent and her team plan to continue their research on the fungus in both wheat and rice through several methods:

- Develop faster ways to move known resistance genes into new rice varieties, and develop new resistance genes based on knowledge gained from recent research on how the fungus causes disease.
- Determine if rice resistance genes also will protect wheat. Many resistance genes exist for rice varieties, but not currently for wheat varieties.
- Compare genome sequences, or genetic blueprints, for the fungus in South America and in the U.S., and develop diagnostic testing to know if the South American wheat blast fungus has moved into the U.S.
- Develop treatments that will kill the fungus in the seed to keep it from spreading.
- Develop disease forecasting methods to allow farmers to grow resistant crop varieties when needed and to only apply fungicides when needed. The fungus is heavily dependent on rain, so weather predictions will be used.

Valent said she and a team of experts from all over the country and South America are focused on controlling this disease both in the U.S. and abroad.

"This research can be applied to crops everywhere the fungus already exists," Valent said. "Identifying new tools will help us protect crops around the world."

— Megan Saunders

Chumley laid foundation for Wheat Genetics Resource Center

If you look behind the scenes at the Wheat Genetics Resource Center, or WGRC, you're likely to find Forrest Chumley. The Kansas State University adjunct professor played a key role in bringing the center to Kansas.

Chumley retired from Kansas State University's College of Agriculture in 2008, but if anything, he has only worked harder. Today, he serves as president and chief executive officer of Heartland Plant Innovations, which is in the Kansas Wheat Innovation Center, the same building as the Wheat Genetics Resource Center.

Heartland Plant Innovations partners with the university to develop new

technology for farmers and their crops. Chumley helped jump-start efforts to find new funding for the Wheat Genetics Resource Center, serving as one of the grant writers for the first funding proposal to the National Science Foundation.

"After that, it took on a life of its own and I was just one of many trying to make this happen," he said.

Two years later, Chumley looks forward to continued involvement in the Wheat Genetics Resource Center through membership in the center.

"We'll be working the way we always have — to mobilize wheat genetic diversity and to help speed up the development of new wheat varieties that solve problems,"

Chumley said. "The WGRC is meant to be a place where industry and academia come together to create valuable new technology and commercialize it in a way that benefits farmers and others."

Chumley said the goal of Heartland Plant Innovations will be helping bridge the gap from wild wheat relatives to modern wheat varieties that farmers can work with.

"We're creating real-world commercial opportunities, and Kansas State University is essential to the success of our efforts," Chumley said. "This new center gives us a forum to bring organizations together and make new things happen."

— Megan Saunders

Rising in the ranks

As Kansas State University works to become a Top 50 public research university by 2025, it's picking up other rankings along the way. Kansas State University programs are recognized nationally in fields from physiology to agricultural economics to engineering.

U.S. News & World Report

No. 13 in atomic/molecular/optical/ physics

No. 17 in biological and agricultural engineering graduate programs

National Research Council

No. 1 in U.S. for plant pathology

No. 4 in U.S. for agricultural economics

No. 8 in U.S. for entomology

No. 9 in U.S. for food science

No. 13 in U.S. for physiology