Four Kansas laboratories work on ending famine

November 13 2014, by Mara Rose Williams, The Kansas City Star

Can a wasp feed the world? It can help. If its larvae are nurtured near millet fields where a devastating moth steals harvests from the field, they can grow to become predators that destroy the pests and save a crop. And that might put more food in more mouths and earn money for struggling farmers in the world's poorest countries.

"In some sense, the science, how to increase crop productivity, is the easier part," said Gary Pierzynski, a Kansas State University researcher. "The challenge is how to get the people from these developing countries to do it."

His work to that end, and that of others on the Kansas State campus, has brought $100 million in federal grants to the university to explore the varied and complicated questions of how to feed the world's fast-growing population amid quickening climate change.

Kansas State has four laboratories enlisted in the U.S. government's Feed the Future innovation plan. It is an initiative to attack world hunger with better crops, smarter tactics to fight off pests and disease, more efficient distribution of harvests - all in ways that can turn profits for small-scale farmers in the poorest parts of the world.

There are 25 labs in all, including five at the University of California, Davis, and the ones at Michigan State University, the University of Georgia and Texas A&M University.

Kansas State established its labs over the past two years, winning support for each in a competitive grant process.

"We went after projects we thought we would be the best at," said Timothy Dalton, the director of the university's Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet. In agriculture, that includes wheat, sorghum, plant pathology, water management and agricultural economics.

Each lab addresses a particular food production dilemma. The researchers collaborate with foreign scientists who share the visions of those at Kansas State. Those working in Manhattan travel to Asia and Africa several times a year.

This time of year, Kansas State's wheat fields are "just mounds of dirt," said Jesse Poland, 33, director of the school's Feed the Future lab for Applied Wheat Genomics.

In greenhouses and in his lab - amid test tubes, beakers and thousands of dollars worth of the latest equipment - Poland and graduate students try to create bigger and more resilient offspring.

The super progeny they hope to create are new strains of wheat bred to yield hefty harvests in the hottest, driest and hungriest parts of the world.

Poland saw children starving in India when he first traveled there years ago as a graduate student. That motivated him to point his research toward producing a better, more nutrient-rich, more sustainable food supply. He targeted wheat, which is particularly vulnerable to climate change.

"Growing wheat is critical to addressing world hunger," he said.

About 1.2 billion poor people depend on wheat. In South Asia, where much of Poland's work is focused, wheat yields are projected to decline 20 percent to 30 percent by 2050, according to the national Feed the Future initiative.

Tiny wheat plants fill a greenhouse in the state-of-the-art Wheat Innovation Center, built across from Kansas State's football stadium by the Kansas Association of Wheat Growers.

"Since the Kansas wheat farmers have gotten behind this initiative, my program gets extra support and backing," Poland said.

That becomes clearer one floor down, where the seeds of 13,533 varieties of wheat from around the world are in cold storage. Some are shipped to farmers around the world. Others are crossed with the lab wheat to create a hardier plant.

Inside glass greenhouses, some plants are capped with small white baggies for protection against pollination from the wrong source.

Those are the ones that student researchers have already tediously - it's all done by hand - crossed with some other wheat stock. Under normal conditions, it might take nearly a decade to bring a wheat crop from the lab to the farm that's more resistant to climate change and drought.

"But we are trying to speed up the process, maybe five years," Poland said.

Five years is about how long it has been since President Barack Obama in 2009 put at least $3.5 billion in federal funds toward global food security. By 2013, private donors pledged $18.5 million more.

The annual budget for the full Feed the Future labs, including all 15

sites, is $32 million a year.

The World Food Program last month reported that about 805 million people, or about 1 in 9, do not have enough food to lead healthy, active lives. The WFP says that number is down by more than 100 million over the past decade. Food is getting to more of the world's hungry, but it's a slow process.

The U.S. government's global hunger and food security initiative reported that Feed the Future reached more than 7 million farmers in 2013. It reached more than 12.5 million children with nutrition interventions that are improving their health and development.

World hunger may seem to be a distant problem in America's breadbasket. But Dalton said accelerating global climate change could mean that solutions for small-scale Indian or Malaysian farmers could one day save the harvests of industrial-scale wheat and sorghum growers in Kansas.

Consider the threat of the white sugarcane aphid. The tiny, soft-bodied insect sucks sap from plant tissues and excretes a sticky liquid waste called honeydew that clogs harvest equipment. This crop menace multiplies rapidly and has been known to destroy whole fields.

The insect first created a farming crisis in southern Africa in the 1980s. Dalton said that because researchers had fought the bug abroad 30 years ago, they recognized it here and knew its behavior.

Years later, the white sugarcane aphid moved into Florida, then Texas and by 2013 landed in sorghum fields in Arkansas and Kansas.

"We found out that if we spray for aphids at a point before the grain begins to form," the pest is kept in check with a fairly inexpensive

insecticide, Dalton said.

Most people don't eat sorghum in the United States, where it primarily is used as cattle feed, but it is a staple on dinner tables in India and Africa.

Sorghum and millet are critical crops in some of the hottest, driest and most impoverished parts of the world. Dalton works with farmers in Ethiopia, Niger and Senegal, among the largest sorghum-producing countries in Africa.

Dalton said he wants to see these small-scale farmers become self-sufficient. That includes helping developing nations establish processes for collecting royalties on any beneficial plant offspring that come from Feed the Future research.

On a field just north of the Manhattan campus, 3,000 varieties of sorghum grow tall, hardy and in many colors - yellow, orange and rusty red. Many of the 150,000 plants come from around the world.

"We are trying to identify the genetic differences ... which gene makes a variety bad for a certain environment and which gene makes one good for a certain environment," said Geoffrey Morris, an assistant professor of crop genetics and genomics at K-State.

In one of the Kansas State labs, researchers from American and foreign universities search for ways to help poor farmers in Ghana, Ethiopia, Guatemala and Bangladesh bring more crops from the field to the market.

Farmers in those countries sometimes lose half their grain in thrashing, storage and transportation, said Venkat Reddy, who directs K-State's Post-Harvest Loss Reduction Innovation Lab.

"If you see the conditions that some of these poor farmers have, it breaks your heart," Reddy said.

For the science to take hold around the globe, "developing countries must be involved in the science and the implementation of new farming technology," Brady Deaton said. Deaton, a chancellor emeritus of the University of Missouri, is the chairman of the Board for International Food and Agricultural Development, which advises the U.S. Agency for International Development, or USAID, on food and agriculture in developing countries.

That is where Pierzynski and his lab come in.

Pierzynski's lab, which last month won a $50 million grant from USAID, identifies ways to help poor farmers in Africa and South Asia improve land, water, soil, crop and livestock management while also improving the size of the crop yields and sustaining natural resources.

Sometimes it comes down to using animals to do work that chemicals or machines might have done, like the wasps they found that are natural predators of the millet head miner moth.

In the larva stage, the wasps - which are endemic to the developing countries where these infested fields are located - are fed and their nests hung from trees near the millet fields. When the insects mature, they feast on the larvae of the miner bug, then they breed more wasp larvae, more wasps break out and eat the miner moths. And so on.