

# OSU scientists bolster wheat's defense against disease

By Candace Krebs  
OKGenetics.com

PHOTO CAPTION: Meriem Aoun, shown here at the USDA-ARS Western Wheat Quality Laboratory at Washington State University, took over as OSU's new wheat pathologist in January. She received a bachelor's degree in her native Tunisia, a master's degree in Greece and a PhD at North Dakota State University before conducting post-doc research at Cornell and Washington State. [Photo courtesy Meriem Aoun]

As a child growing up in a village in rural Tunisia, Meriem Aoun would stop and study the heads of wheat in the fields surrounding her primary school.

That early fascination led to a career in agricultural science. Since January, she's been the wheat pathologist at Oklahoma State University and a key member of OSU's wheat improvement team.

"My grandfather was a farmer, and he grew wheat every year," she recalls. "Still to this day, it would be unthinkable to him not to plant a wheat crop."

His fierce dedication to one of the world's most important food sources is something he holds in common with many Oklahoma farmers. The disease threats they encounter are similar too.

Within the wheat breeding program, it's the plant pathologist's job to screen wheat lines for resistance to a wide range of diseases, sometimes well known, other times just beginning to emerge on the world stage.

Incorporating genetic resistance reduces the need for chemical inputs, which benefits growers, flour millers and food processors, but also consumers, by keeping food abundant, affordable and safe.

Aoun was hired to replace Bob Hunger, who formally retired last June after nearly four decades in the position.

The two scientists have different backgrounds and skills but share the same commitment to developing productive, high quality wheat lines for the Southern Plains.

Hunger grew up near Denver, where his parents ran a dairy located on the grounds of a residential facility. He helped with feeding the cows, milking twice a day, processing the milk and delivering it to other institutions in the area.

He too was drawn to the biological sciences from an early age. When he graduated high school in the early 1970s, wildlife biology and forestry were popular career paths in Colorado, but he wanted to pursue something different. At Colorado State University, he started out in botany but later gravitated to plant pathology because it seemed to have more practical application.

"I worked on potatoes in Colorado and hops in Oregon," he recalls. "Then I was hired here in Oklahoma to work on wheat. It gave me the opportunity to interact with people I really admire and respect, people who reminded me a lot of my parents."

In his long career, Hunger watched disease threats change over time.

New farming practices that leave more crop residue on the soil surface, such as minimum tillage and cover cropping, have increased fungal diseases like tan spot and Septoria leaf blotch in recent years, he said.

The popularity of certain varieties also influenced which diseases took hold. One example is Jagger, a Kansas State University release from the mid-1990s.

“One of the reasons powdery mildew became more prevalent is that variety was really susceptible, and it was planted on so many acres,” he notes.

Sometimes the contributing factors are difficult to tease out, with stripe rust providing a prime example.

“Prior to the early 2000s, it was a disease we would rarely see,” Hunger recalls. “Now it’s almost as common as leaf rust. There is speculation the pathogen changed a little bit so it could function at a higher temperature than it normally would.”

Throughout his career, Hunger focused on being flexible, responsive and proactive. Within the industry, he was widely praised for helping establish a critical testing program to satisfy trade partners and keep markets open when Karnal bunt, a fungus, was detected in north Texas two decades ago. The disease has never been found in Oklahoma.

Wheat blast is a more recent development. The devastating fungal disease is primarily seen in South America and Southeast Asia and is more likely to infect high humidity regions like the southeastern U.S., but it still bears monitoring, Hunger said.

Stem rust, a pathogen Aoun studied in her previous position, is also spreading in many parts of the world.

“With globalization and the exchange of so many different materials, it’s getting more difficult to keep foreign diseases out,” Hunger said.

### **Adopting new approaches**

While Hunger spent much of his time studying the physical manifestation of diseases in wheat, genome sequencing and related tools are now being used to speed up the selection of disease resistant lines.

That’s a strength Aoun brings to the program.

She first studied biotechnology while working on her master’s degree in Greece, where she developed molecular markers to distinguish between different olive varieties grown in the Mediterranean basin for the purpose of detecting labeling fraud in extra virgin olive oils.

After arriving at North Dakota State University in 2013, she used her skills in molecular marker development to target rust resistant genes in wheat. In subsequent post-doc research at Washington State University, she used a similar approach to identify wheat with superior milling and baking traits.

That emphasis on quality is relevant to her new role with OSU’s wheat improvement team, she said.

“We need wheat with good levels of disease resistance, but it also needs to have good grain quality,” she said.

She is looking forward to some planned upgrades of OSU’s greenhouses, but having already worked in excellent research facilities around the country is all part of an opportunity she doesn’t take for granted.

“In Africa we have really talented and ambitious scientists, but sometimes the resources are just not available to do the advanced work we can do here,” she said. “Most of the time it has to all be done in a very traditional way.”

Being a woman on the frontier of science is also meaningful to her.

In 2018, she received the Jeanie Borlaug Laube Women in Triticum Early Career Award, which allowed her to spend a month at the International Maize and Wheat Improvement Center in Mexico City and attend the Borlaug Global Rust Initiative workshop.

“The award encourages and supports women researchers in wheat science in order to fight global hunger,” she said.

Aoun intends to capitalize on her extensive international connections. As it happens, Tunisia is a hot spot for Septoria leaf blotch, an increasingly prevalent foliar disease in Oklahoma.

“In recent years, we saw higher disease pressure in our fields here, mainly related to cultural practices,” she said.

She plans to study the pathogen at OSU but will also reach out to colleagues in her home country for their expertise.

“If we have other people in other parts of the world who are working on the same diseases, why not collaborate with them?” she said. “I think it will be really beneficial for our program.”