

Putting forensics to work in the field

By WILLIE VOGT

A plant pathologist leans over a microscope looking at a tissue sample, looks up in distress, then swings around to review a DNA readout only to blurt "we've got a match." Cue the Who music it's time for CSI: Soybean Field. While the truth may not be that dramatic, plant pathologists, the FBI and the Department of Homeland Security are in fact working on ways to track plant diseases and determine if an outbreak that hits the United States is natural, or a crime.

And that work now centers on the National Institute for Microbial Forensics and Food and Agricultural Biosecurity that's headquartered at Oklahoma State University. The institute is a dream, and idea, of Dr. Jacqueline Fletcher who is the Sarkeys Distinguished Professor at OSU's Division of Agricultural Sciences and Natural Resources. She acts as the institute's director.

"If you determine that a crime has been committed in the field, then how do you determine who did it?" Fletcher asks rhetorically. Turns out the answer isn't quite so easy since the idea of microbial forensics is relatively new.

Fletcher, who was president-elect of the American Phytopathological Society when 9/11 occurred, got a first-hand look into the area of crop biosecurity when she teamed with major crime-fighting agencies to look into the issue. "Of course, the microbial forensics case everyone talks about was the anthrax outbreak that occurred in the same timeframe," she recalls. "It was determined that it was the Ames strain of anthrax from the Ames Laboratory in Iowa that was used, but that strain is so common and so widely distributed in labs that it was difficult to determine who might have caused it."

That wasn't a failure, instead it was a wake-up call that the idea of microbial forensics might be important. Fletcher, who was part of a multidisciplinary team that included members from the FBI, CIA, and DHS, worked on the issue. Later some of those colleagues, also in Oklahoma, would become part of the Institute, which officially formed in January. And there's a lot of work to do.

Building a process

Fletcher talks in great detail about the challenges of forensics - which is the science of solving a crime using evidence. In the microbial world it's not as easy as dusting for finger prints. "If an apparent crime has been committed, what are the processes that need to be in place?" she asks.

The list of tactics that have to be undertaken is pretty extensive. Take for example a potential contrived outbreak of Asian Soybean Rust. First, you would have to determine that the disease didn't just pop up naturally. Fletcher notes that if the disease has been progressing in a specific way across the country, but it was to pop up in an unlikely place, that might signal a crime had been committed. Then the challenge begins.

"A law enforcement officer will be called to that scene first, and they have to decide what evidence to collect," Fletcher notes. That's what the institute will work to determine. Should the criminalist

collect leaf samples, soil samples, roots, stems? How should the samples be preserved? Should they go in a plastic bag or a paper bag?

"All these issues are important and can impact that evidence," Fletcher says. "And you have to figure that the trial for such a crime could be two years away? How do you preserve that evidence for such a long time?" She also offers up the reverse challenge: what if a crime is determined two years after the fact? How would you collect evidence from that field and what would be the best way to have to prosecute the offender.

Work ahead

Fletcher acknowledges that she and her colleagues have a lot of work ahead of them, but her enthusiasm for the topic shines through in a conversation. "We have grad students working with us now determining some of these processes and we're even working to get one hired on as an intern at an FBI lab," she notes. "There is a lot of work to do here, but it's important both from a crop safety and a food safety standpoint."

From learning more about microbial signatures to match location to a crime, to evidence collection techniques, the work of crop security continues. Fletcher notes that she's still hiring staff and hopes to bring on more by year end. The work ahead will yield new ways to track disease outbreaks in crops and help assure the nation's food supply.