Portable kit may one day detect plant disease before disastrous outbreak

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This science may literally be outside the box: A briefcase-sized kit is carried to a field where thousands of tons of food are growing. The search is for microorganisms that could infect and kill the plants, wreaking havoc on the food supply and market.

If the equipment in the box finds the pathogen, experts can tell farmers how to prevent the devastation. Quick and accurate are key.

That's what scientists plan to do within three years, according to Dr. Won-Bo Shim, Texas AgriLife Research plant pathologist. He's lead investigator on a $1 million U.S. Department of Agriculture grant that takes aim at protecting the nation's food and agriculture from bacterial, fungal and viral agents on the homeland security select list.

PADLOC is what they have already named the futuristic kit - Pathogen Detection Lab-On-a-Chip.

"It's a portable system," Shim said. "The idea is to shorten the current detection process to a few hours so that a plan could be set up to minimize impact from such plant diseases."

Currently, if a new plant disease appears on a farm, it could take days to find, sample, ship to a lab and run tests to verify, Shim explained, and that time increases the chance for irreversible damage to the food supply and marketplace.

One of the novel approaches to creating a faster system, Shim explained, is collaboration between the experts in plant pathology and his co-investigator Dr. Arum Han, a Texas A&M University electrical engineer who specializes in nanotechnology where things are measured in billionths.

The two met almost accidentally at a social for professors. Shim recalls that as each asked the other about their research efforts, the notion clicked that one's skill could supplement the other to develop a better detection system.

"There's a need for a system that is not only portable but rapid, accurate and 'dummy proof' so that someone with no background in the science could use it," Shim said. "The technology we need is already available to both plant pathology and engineering. We're just putting them together."

But the nature of diseases in plants presents the challenge. Humans and other animals have an immune system, so researchers predict the strains of flu that might be present in a given year and make a vaccine against that, he explained.

Because plants do not have immune systems, breeders are constantly trying to stay ahead of disease outbreaks by breeding new varieties - a process that can take years, Shim said. If a new or foreign plant pathogen is introduced to an area, susceptible plants are not able to defend themselves. If farmers knew about the presence of such a disease early enough, the infected portion of the crop could be eradicated to prevent disease from spreading to the remaining fields.

"One thing about plant diseases is that there are so many," Shim explained. "There are bacteria, fungi and viruses that cause plant diseases, and the symptoms are also quite diverse. Even the experts when they see a disease on a plant will scratch their heads about the cause,

especially if it is a newly introduced microorganism."

In the 1980s and 90s, plant pathologists relied on visual inspections to determine diseases, he said. More recently, technology emerged to allow labs to detect pathogens at the molecular level with high precision and accuracy. However, this diagnostic process requires a lab equipped with bulky instruments.

With Han's expertise in nanotechnology, the team plans to cram this "lab" into a "box." And that means packing the sophisticated measuring devices, reagents, power supply and other features that now take up lab space into a parcel no bigger or heavier than a briefcase.

The kit, he said, would be "a library to target the plant diseases of national interest."

The first goal is to make a kit to test in the field. Shim expects that to be accomplished within the first two years of the three-year project. He and plant pathology colleague Dr. Dennis Gross will then do field testing for accuracy.

Next, a team of Texas AgriLife Extension Service agents will test the user-friendliness of the kit around the state from the rice fields in the southeast to the ornamental crops in the northeast and the field crops in the west.

Shim acknowledges that the project is high risk. The team promises USDA a prototype in three years. But he said the proposal made for the grant was already so detailed in its design that the two are confident enough to speak of PADLOC as if it is already a product.

"It's a new tool from existing technology," Shim said. "But we hope that it can make recommendations in real-time for farmers so that we would

be able to stop a local problem from becoming a regional or national one."

Source: Texas A&M AgriLife Communications