Spotting tar spot disease sooner

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Photo by Martin Chilvers, MSU

Dispatching drones equipped with remote sensing technology in the air and taking smartphone images on the ground, a Michigan State University researcher is helping farmers more quickly predict and quantify tar spot, a disease found in maize crops.

"The fungus that causes tar spot likes cool temperatures and wet leaves," said Addie Thompson, assistant professor in the Department of Plant, Soil and Microbial Sciences within the College of Agriculture and Natural Resources. "It can spread quickly, causing up to a 50% decrease in crop yields," said Thompson who was recently awarded a Bayer Grants4Ag $10,000 award to support her research.

While Phyllachora maydis, the fungal pathogen that causes tar spot disease, has been invading crops in Central America and South America for decades, it was found for the first time in Midwest maize crops in 2015.

Thompson, a plant geneticist, started by looking for maize crops that could be resistant to tar spot and screened 800 different varieties in the summer of 2019. Promising types were fast-tracked into a winter nursery to begin crossing potentially resistant varieties into more elite maize varieties.

Thompson and colleagues Martin Chilvers, an associate professor in the Department of Plant, Soil and Microbial Sciences, and Erin Bunting, an assistant professor in the Department of Geography, Environment and Spatial Science also conducted their first remote sensing tests using drones equipped with spectral sensors to identify signs of tar spot disease over an entire field of maize crops. These images reveal changes within the maize plants from a bird's-eye view.

Tar spot causes black lesions to form on the plants' leaves, but before that happens, the fungus may cause biochemical changes within the crop that could be used to identify the problem before symptoms are widespread. If left too long, severe tar spot can also weaken the strength of the corn stalks, causing them to fall over. Thompson's goal is to identify tar spot disease early, thereby alerting farmers sooner so they can examine specific areas before there is damage to crop yields.

Currently, Thompson and her team have been taking smartphone images of leaves in more than 1,000 plots, along with disease severity ratings. With that data, the team is training computer models to automatically identify and quantify spots on the leaves.

"I'd like to see this be transferable so that any farmer in any field using any phone can identify and quantify tar spot severity. This technology will also be helpful for breeders to precisely assess experimental varieties in the field," Thompson said. "In the future, we hope to use drone imagery from hyperspectral sensors to identify areas in the field with tar spot, potentially even before the black lesions are widely visible on the leaves."

Aspects of this work have also been supported by the USDA National Institute of Food and Agriculture's Agriculture and Food Research Initiative to further screen and incorporate disease

resistance into new varieties, MSU's Plant Resilience Institute-Generating Research and Extension to meet Economic and Environmental Needs to initiate resistance screening and an MSU Strategic Partnership Grant on plant phenomics to acquire the hyperspectral drone unit and bring together experts across campus in plant and computational sciences.

Provided by Michigan State University