Crop infesting spores 'tricked' by new biomaterials to aid global wheat production

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New man-made materials developed by scientists have been successfully used to confuse and trick harmful spores which attack wheat crops into growing on an alternative host to help farmers protect their food

production.

Researchers at The University of Manchester have come together with international electronics partners and the minerals processing industry, to deliver networks of cheap disposable in-field biosensors, to detect in real-time the infections of crops at the earliest signs.

By working with the industry partners, these crop surveillance sensors use the latest generation of 'Internet of Things' electronics and machine-learning techniques. Previous DNA based approaches only showed the presence of specific spores, many of which are around us all the time, the new sensor can identify the exact conditions for when spores turn from benign particulates to serious diseases.

The sensors do this by literally tricking the fungal disease spores into growing within the team's novel biomaterials, in the 'belief' that they have found their specific plant host and food source. Micro-imaging detectors then constantly examine those biomaterials and use artificial intelligence to identify the characteristic and specific ways they grow with their engineered artificial hosts. Each sensor then wirelessly alerts farmers to the presence of the disease, just like a biological version of a fire-alarm, dynamically feeding into disease forecast systems and maps. Enabling 'fire-fighting' of diseases before they spread and helping scientists to understand how best to prevent future outbreaks.

The innovative new system which was trialed in Ethiopia and detailed in the journal, *Fluids*, demonstrates success in distracting the harmful spores before they have begun to grow and disrupt a wheat crop. This affords farmers extra security without needing to wait until signs of spore damage appear before reacting to save their crop.

Professor Bruce Grieve who led the research said: "This is particularly exciting as the first disease that our consortium has targeted is a major

threat to global wheat production and has not previously been reported as being capable of growing on anything but its living plant host."

Working with the Bill & Melinda Gates Foundation, African academics, NGOs and plant epidemiologists, at the University of Cambridge, the aim of the team is to deploy these 'Sentinel' sensor networks into Ethiopian wheat production to underpin future crop disease forecast modeling and control measures in East Africa, and help prevent any repeat of the major famines seen in the region in the 1980s.

The new research paper introduces a critical element of these bio-alarms, in using aeronautical engineering techniques to enable the prevailing wind and air movements to passively extract and concentrate the disease spores onto the biomimic sensor materials, so that their infection activity may be reliably signaled within hours. That compare to the weeks typically required currently to visually see the disease symptoms on the plants, thus giving farmers adequate time to act to save their crops.

More information: James L. Blackall et al. Development of a Passive Spore Sampler for Capture Enhancement of Airborne Crop Pathogens, *Fluids* (2020). DOI: 10.3390/fluids5020097

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