ROTHAMSTED RESEARCH

Growing Health

Detecting pathogens using biosensor technology: Sentinel Crop Protection Surveillance, A Novel Tool for Integrated Pest Management

CAPABILITY

What's the issue?

Current pathogen management programmes are based on weather prediction models and year-to-year variations. Early detection of pathogen infections in cropping systems could lead to better management and action before symptoms appear. Having a targeted approach that clearly identifies when a pathogen appears would allow better use of crop protection resources and targeted fungicide usage when needed. This reduction in spraying could reduce costs to farmers, improve the yield outputs for farmers, and reduce the negative impact of fungicides on the environment.

What did we do?

Our consortium (Sony, BASF, NIAB, RRes, G's Fresh, Manchester University, One-Nine Design) has developed and validated a biosensor system (Sentinel) that enables early detection of pathogen infection in crops. The Sentinel system comprises a cartridge linked to a camera that monitors germination. The Sentinel biosensor can discriminate between viable and non-viable spores enabling detection of only active pathogens. Once detected users are notified enabling preventative actions e.g. crop spraying. Recent UK field trials were carried out to monitor arrival of yellow rust, Puccinia striiformis f. sp. tritici (Pst)), in wheat crops, comparing crop (yellow rust incidence and crop yield) following fungicide application based on either Sentinel spore detection or standard farm practice, or no fungicide application.

There was a significant reduced incidence of yellow rust infection of wheat in the Sentinel lead application regime and an improvement in yield over the other treatments. Field trials are currently underway to test the Sentinel system in monitoring the arrival of Downy Mildew in lettuce/spinach crops. The work to date has been supported through leveraged funding from the Farming Innovations Pathway scheme.

What else will we do to increase outcomes?

The consortium has attended KE events to showcase the prototype Sentinel technology e.g. to the UK arable industry at Cereals 2024 for example and will continue with similar stakeholder engagement activities (Key-note presentation by Dr John Caulfield at NewIPM conference). Peer-reviewed publications have raised awareness of the science underpinning the technology e.g. Camila et al. Yellow rust infection of wheat: How the quantify of light received by wheat seedlings before inoculation affects infection efficiency (https://doi.org/10.1111/ppa.13977).

Further leveraged funding will be sought to continue technology development i.e. collection of field data for yellow rust and downy mildew. To further enhance the impact and enable adoption of these technologies this research is being commercialised through a joint effort between the project partners and led by Manchester University Innovation Factory.

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HOW ARE WE GOING TO MONITOR THE OUTCOMES?

We will monitor progress with Sentinel technology development through continued spore collection of field data for yellow rust and downy mildew. This will allow year-upon-year variations and implementations to be visually described, and comprehensive field validation datasets to be generated. Future activity will expand the pathogen detection capabilities, Stem Rust/Leaf Rust/Stripe Rust and Downy Mildew, and develop the technology for additional pathogenic spores.