

What new in-field pest and disease tech can offer



Cutting-edge surveillance and monitoring techniques that will help the industry meet pesticide reduction targets are on their way. **Louise Impey** finds out more

The development of “smart” spore-trapping systems that combine on-site analysis and real-time reporting to track the spread of diseases mean that the same-day detection of more than one pathogen will soon be possible.

Sometimes referred to as a “lab in a box”, an in-field spore sampler system which collects airborne spores before analysing and interpreting them on-site has been designed by Agri Samplers with funding from Innovate UK and the AHDB.

The prototype new system’s wireless reporting capability means an alert can be sent to a website or mobile phone, so the need for site-specific treatment can be assessed by the agronomist before any resulting sprays are used. The aim is to both improve detection and response, leading to better decision-making and healthier, more sustainable crops – produced using less pesticide.

Warning network

In an ideal world, there would be a number of units that are geolocated and operating as a network, while testing in real time, doing their own analytics and communicating wirelessly, summarises Prof Jon West, a plant pathologist

at Rothamsted Research. “Of course, they will also have to be affordable and reliable. And we still need more information on how many units would be needed in a certain area to give the most accurate results.”

High-value crops and very destructive, fast-moving diseases are obvious target markets, as are crops such as vineyards where spray frequency could be reduced from closer monitoring, he believes.

Identifying resistance

Looking further ahead, it is possible to find out whether the pathogen carries any specific genetic mutation to a certain mode of action. This will enable the most appropriate fungicides to be selected and avoid the use of products affected by resistance, Jon adds.

“When combined with weather forecasts, this development means preventative strategies based on a better understanding of the



The DNA auto spore sampler being developed by Agri Samplers and Rothamsted Research

MONITORING INSECTS

Both low-tech and high-tech methods are relevant for tracking insect pests, says Dr Dion Garrett, a molecular entomologist at Rothamsted Research, who highlights the *Rothamsted Insect Survey* as one of the former.

A network of 65 light traps and 15 suction traps has provided data since the 1960s and been a key contributor to the understanding of insect declines, as well as being used to alert growers to aphid migration.

"Increasingly, the use of artificial intelligence and machine learning is doing the identification work, which was very time consuming before, so it continues to evolve," notes Dion.

Other low-tech methods include sticky and water traps, as well as field walking and host plant knocking, so that the pests fall onto the ground. "The high-tech category consists of measures such as pest forecasting models, bucket traps and mini suction trap networks. They all have a place, depending on the crop and the pest."

infection risk can be adopted – that should reduce fungicide use."

In its current form, up to four different diseases can be reported on, and the units can be customised to the farm's cropping. The following DNA assays have currently been developed for use with the DNA auto spore sampler:

- Potato late blight
- Sclerotinia spores, which affect oilseed rape and a range of vegetables
- Yellow rust
- Brown rust
- Septoria.

Preventative approaches

Innovation in monitoring is coming thick and fast, confirms Jon, who explains that techniques which show when symptoms have already developed in crops are being replaced by those that can detect the presence of pathogens before they infect the plant.

"There's a whole range of techniques out there," he says. "Growers will be familiar with the use of satellite imagery and what it offers them, but we now have in-field monitoring and DNA-based assessment methods which have really expanded the possibilities." Spore counts aren't new, he acknowledges, but used to be done by microscope. "That took time, so the results could be anything from three to

New techniques which are being tested include bioacoustics, which uses contact microphones to "hear" pest activity. Relevant to pests such as cabbage stem flea beetle, which bury into plant stems and aren't always visible, this work is in its early stages.

Cameras

Slow-motion cameras are another tool, and are used to look at insect locomotion and the implications for both short- and long-distance migration, while camera trapping has a role in improving the understanding of insect behaviour. "We've used it to look at the movement of ground predators and the effects of this on predation and parasitisation of pests."

Otherwise, multispectral imaging allows researchers to identify which aphids are carrying barley yellow dwarf virus and will be likely to transmit the virus. "It's a non-invasive way of detecting them and knowing whether it's going to be a high-risk year."

10 days old. Now we can offer much faster detection from tests you do in the field."

Other advances

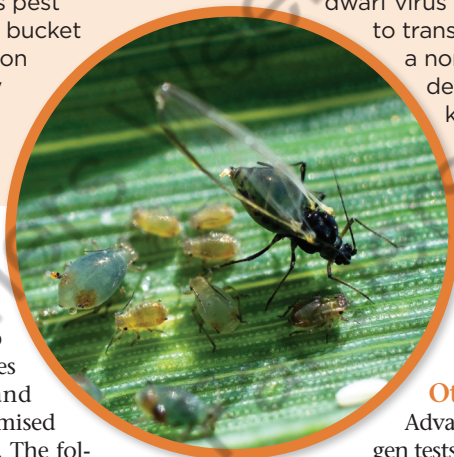
Advancements in rapid antigen tests – such as those used for Covid – are also relevant for pathogens, as the strength of the infection line can be read for a same-day result.

"If we look at what DNA sequencing has to offer, we will be able to see what's been found in a certain location and the abundance. So this means that it's theoretically possible to get an indicator of biodiversity."

Real-time, optical-based methods are also promising, he notes, with the Australian BioScout system coming to Europe next year.

In the field, air gets drawn into the BioScout unit and any particles adhere to a sticky strip. This is photographed by automated microscopy with an artificial intelligence function, then comparing the images to a database of images. While it offers rapid results and automated function, challenges remain and it can be a very costly method, Jon says. "Currently, it can't distinguish between pathotypes and races, or detect genetic mutations."

● The contributors were speaking to *Farmers Weekly* at a Surveillance and Monitoring in Plant Protection event at Rothamsted Research as part of Agri-Tech Week 2024



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