



# New Tools in Disease Management

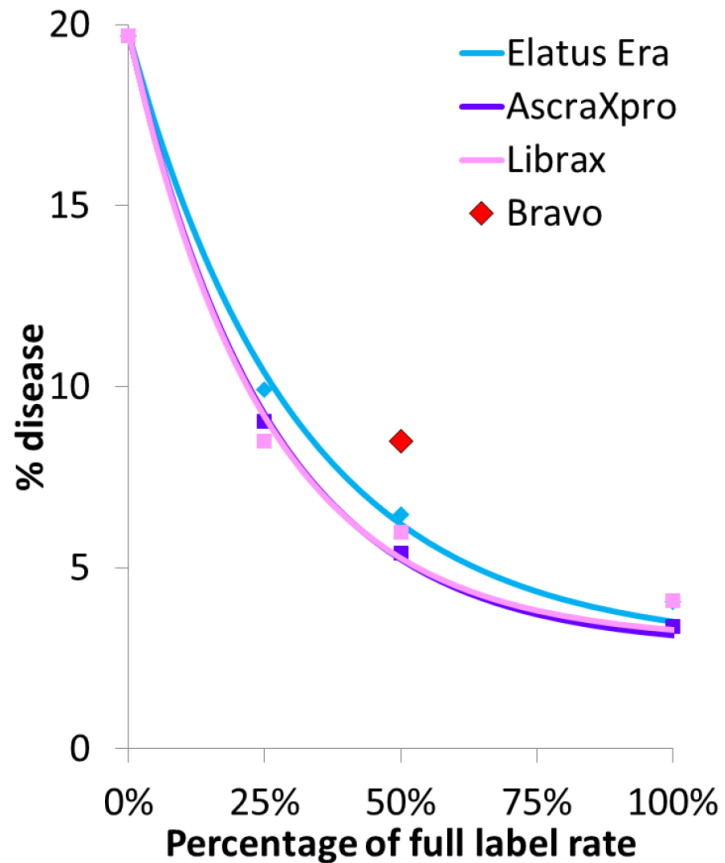
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Keith Norman, Independent Consultant.

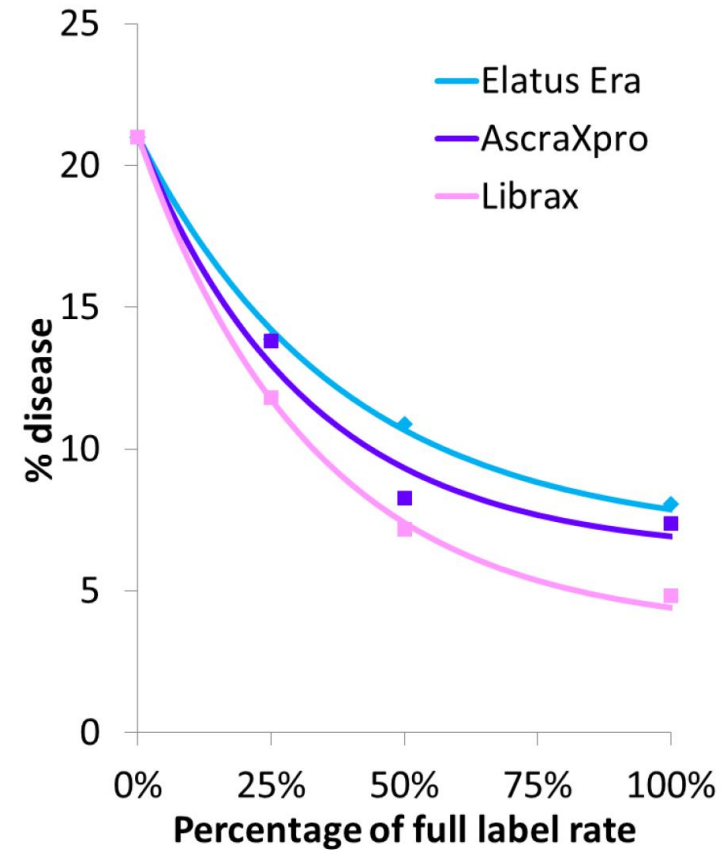
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Why timing is so important

# The importance of timing – Septoria control



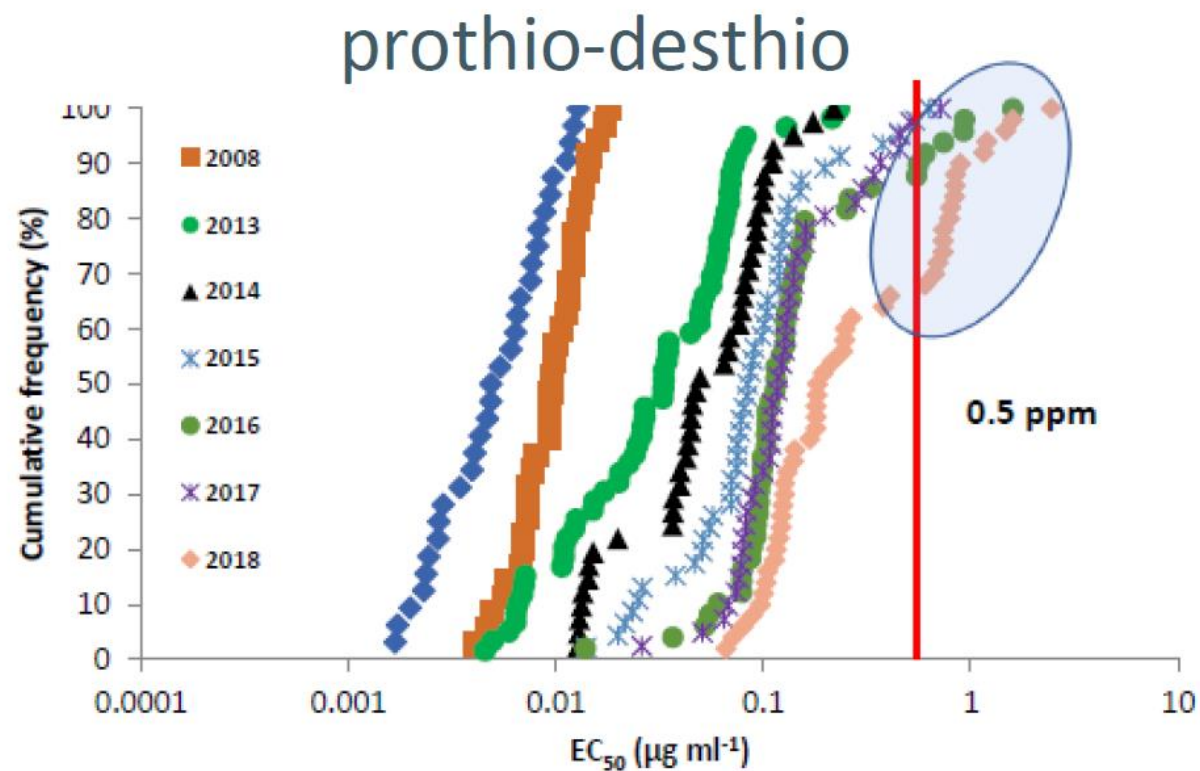
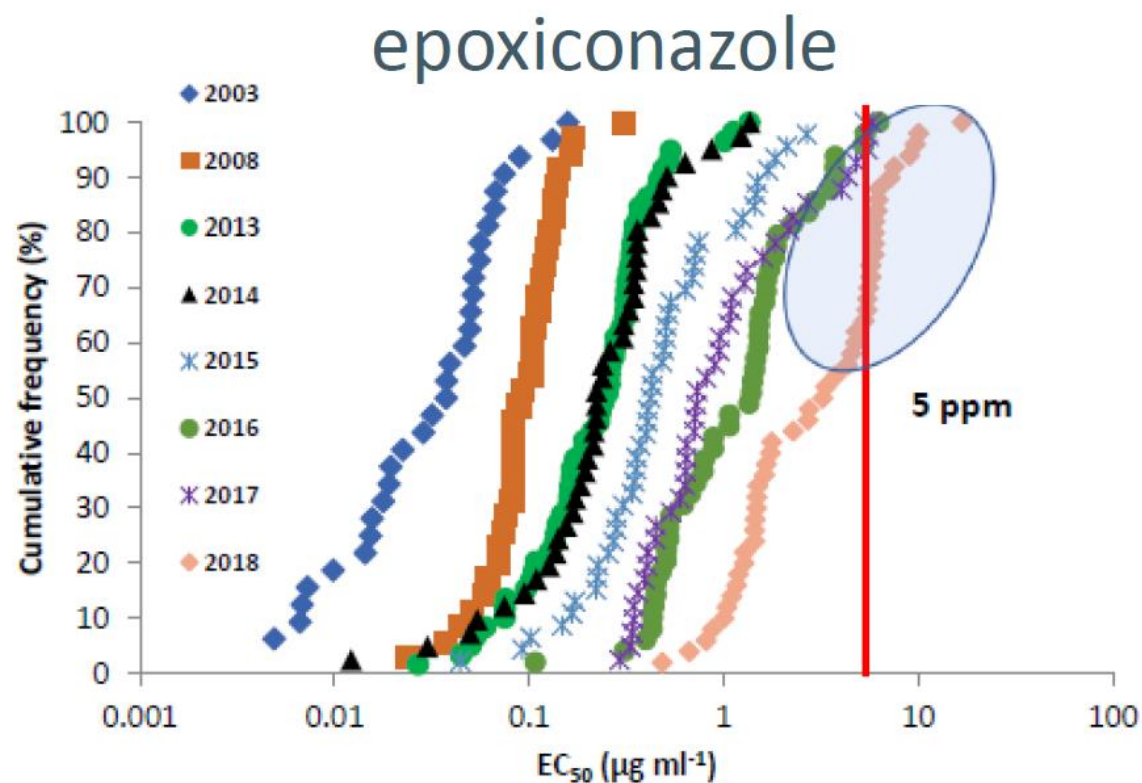
Protective



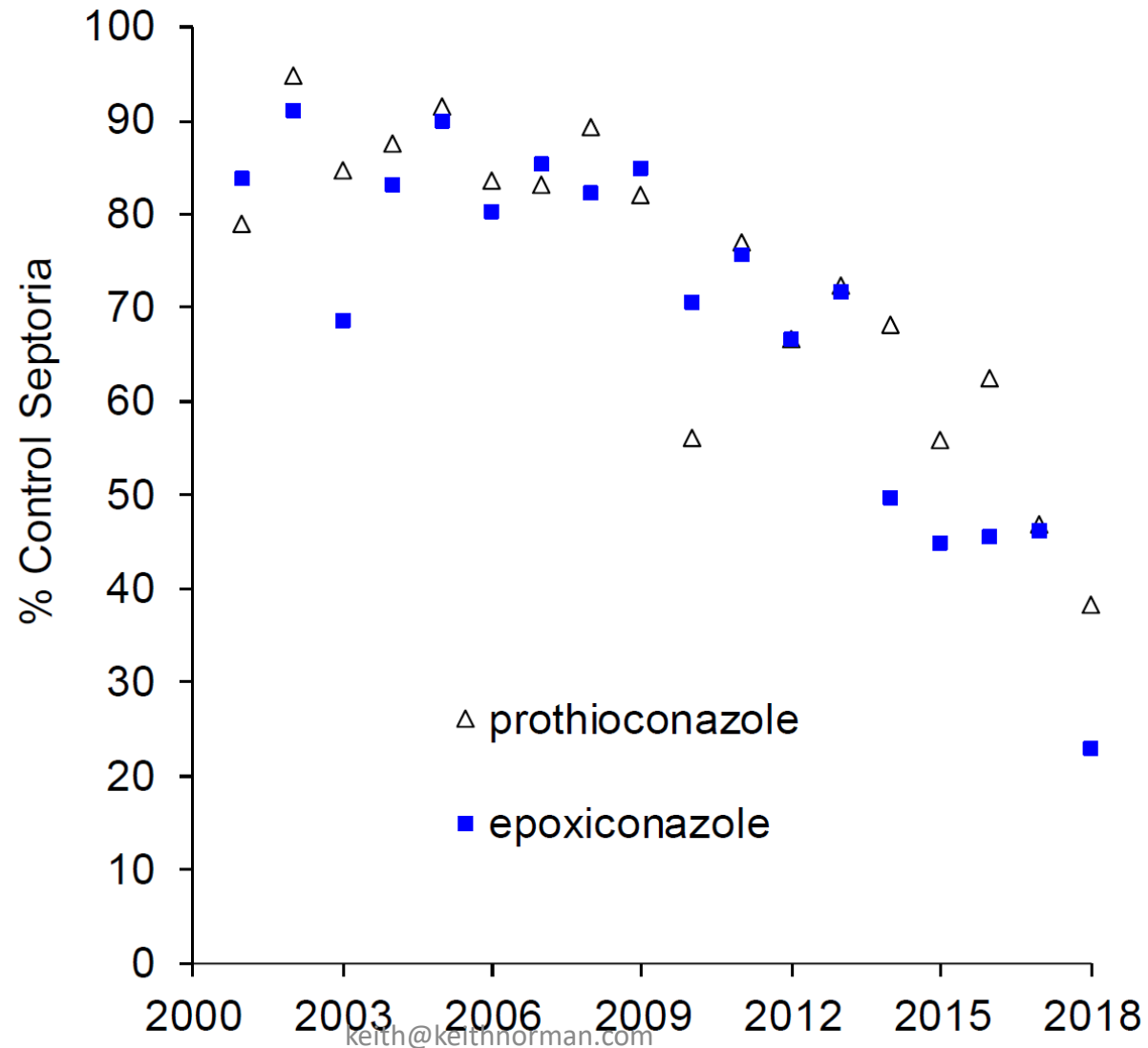
Curative

# Septoria: early season sensitivity monitoring

Rothamsted (updated 2018): azoles

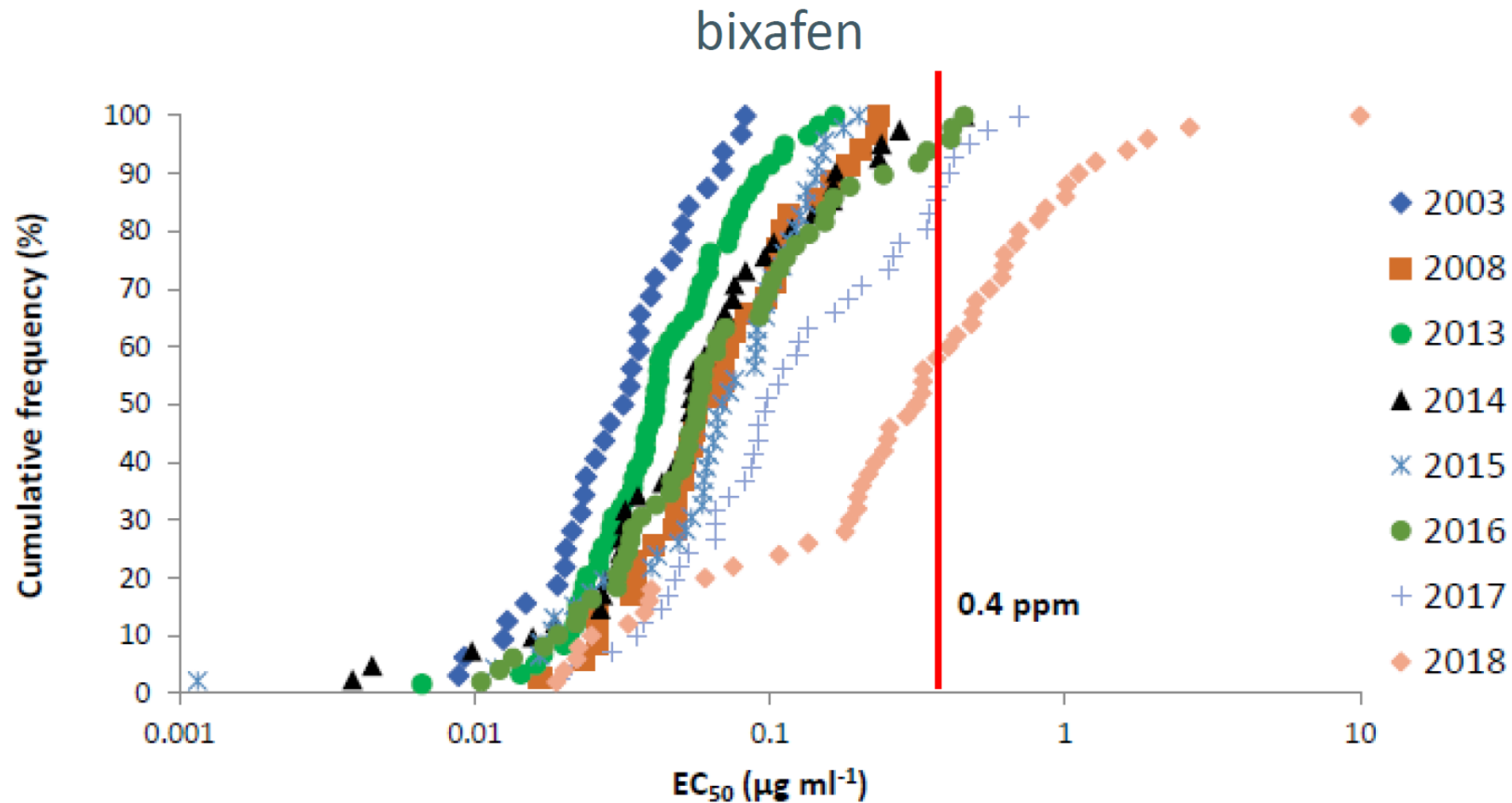


# Septoria: azole performance over time (protectant, full label dose)



# Septoria: early season sensitivity monitoring

Rothamsted (updated 2018): SDHI



# Septoria: SDHI performance over time

2013

2014

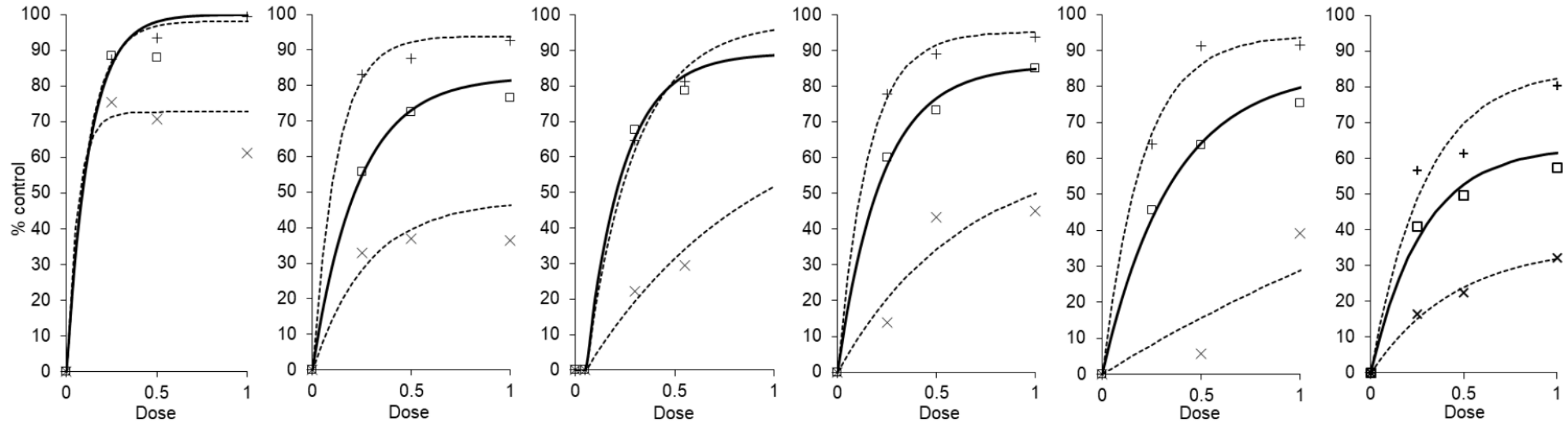
2015

2016

2017

2018

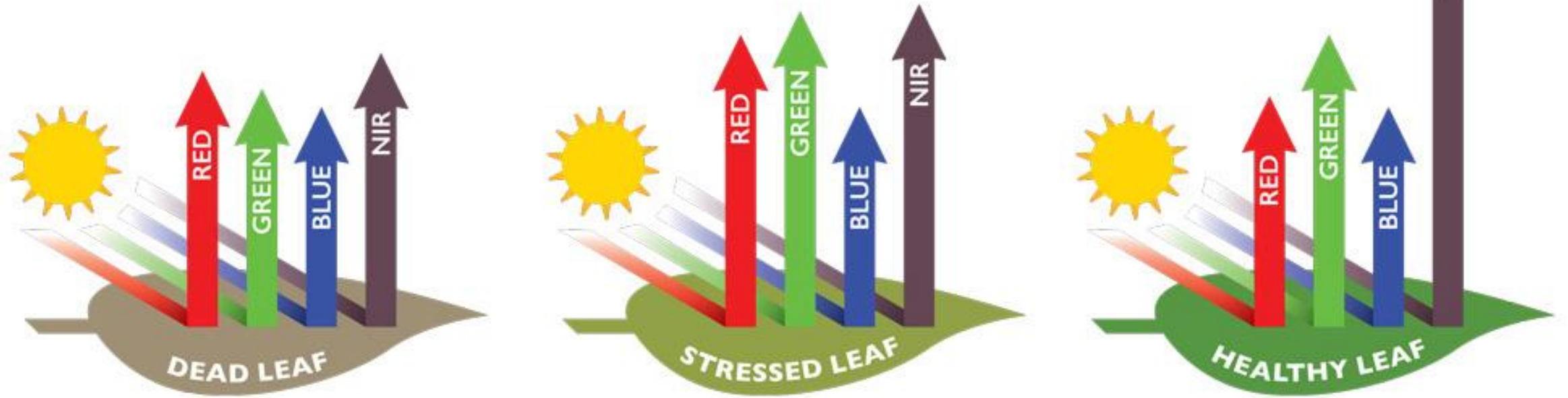
Imtrex (top curve = best control achieved, middle = average control, bottom = worst control)



# Spectral Imagery for Crop Health



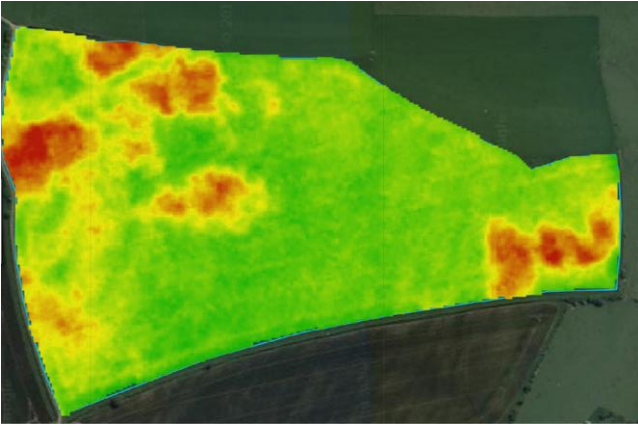
# Vegetation Reflectance



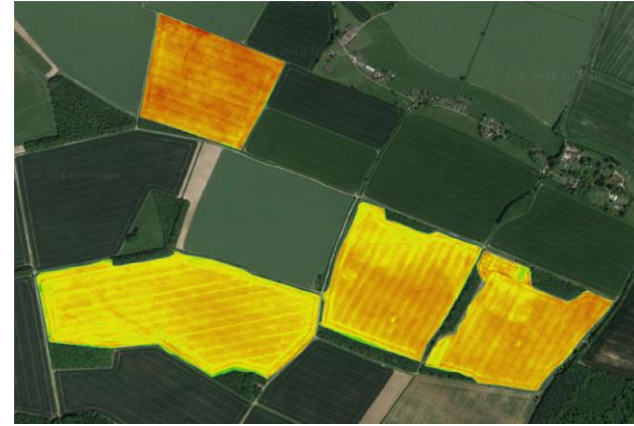
$$\text{NDVI} = \frac{(\text{NIR} - \text{Red})}{(\text{NIR} + \text{Red})}$$

Changes in photosynthesis, transpiration, stomatal conductance, accumulation of Salicylic acid all occur after infection  
Changes are reflected in NDVI

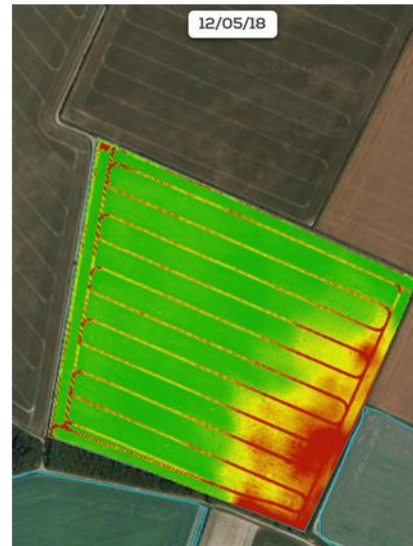
# The Importance of Monitoring Crop Health



**Within a field** – identification of problem areas

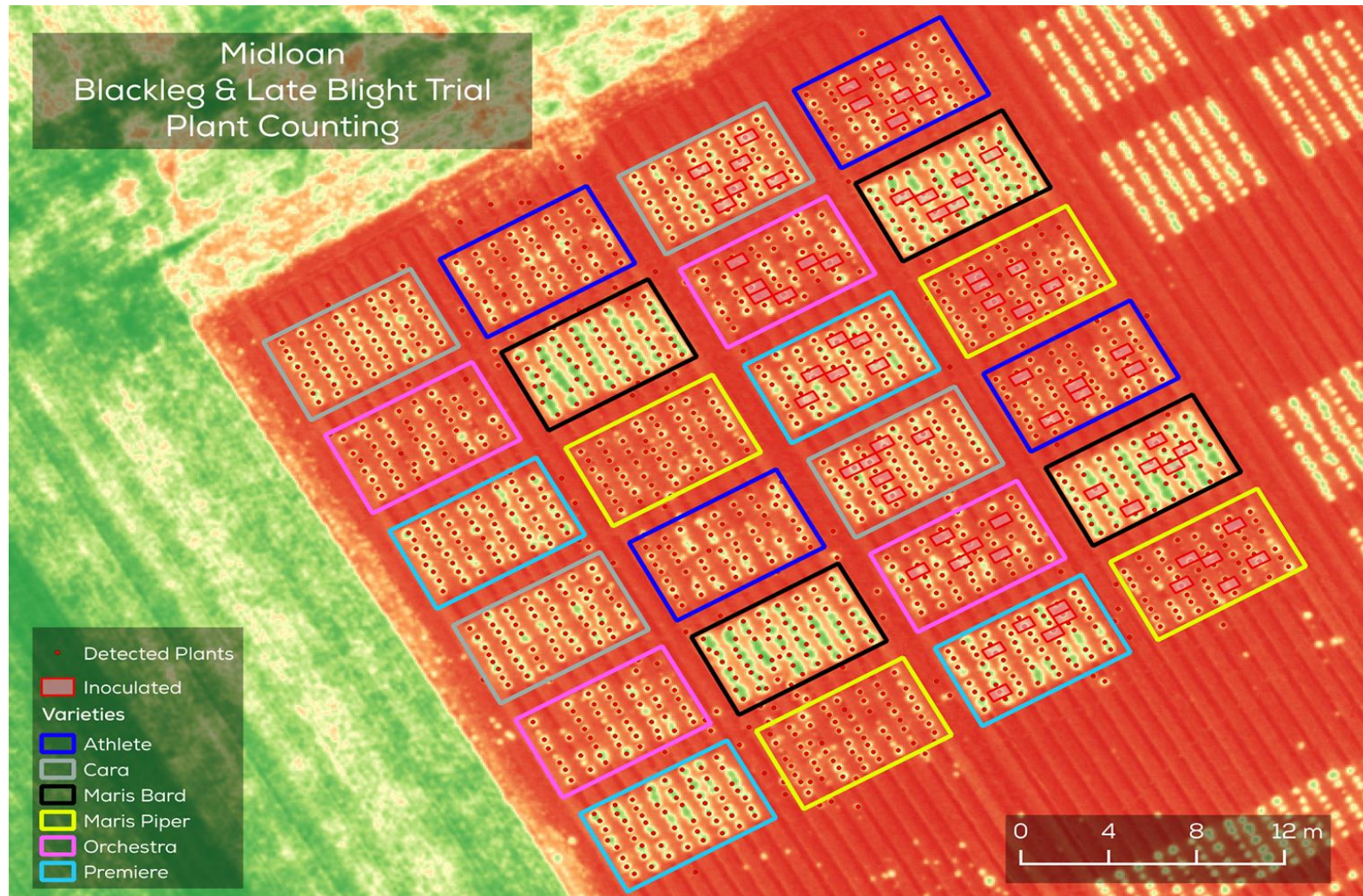


**Between fields** – Prioritise applications

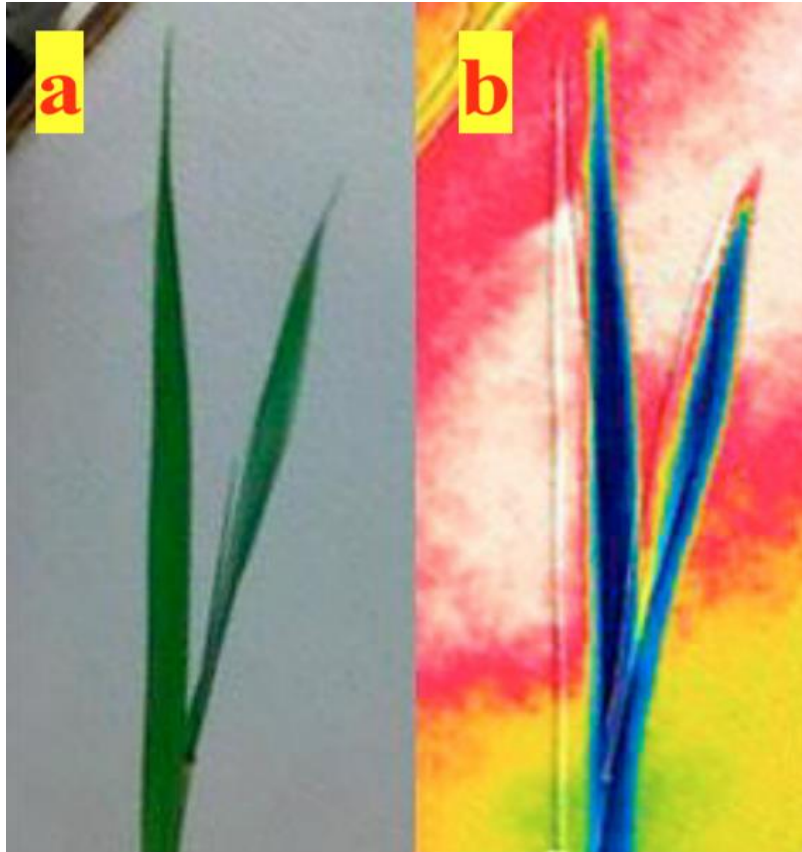


**Between Dates** – rate of changes

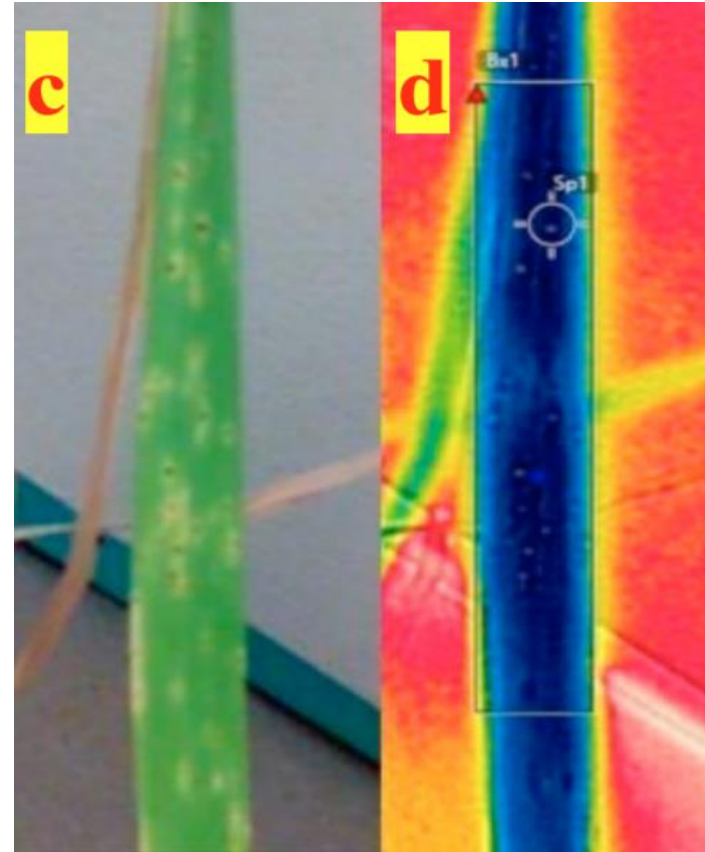
# Disease detection in potatoes



# Thermal Imaging of wheat



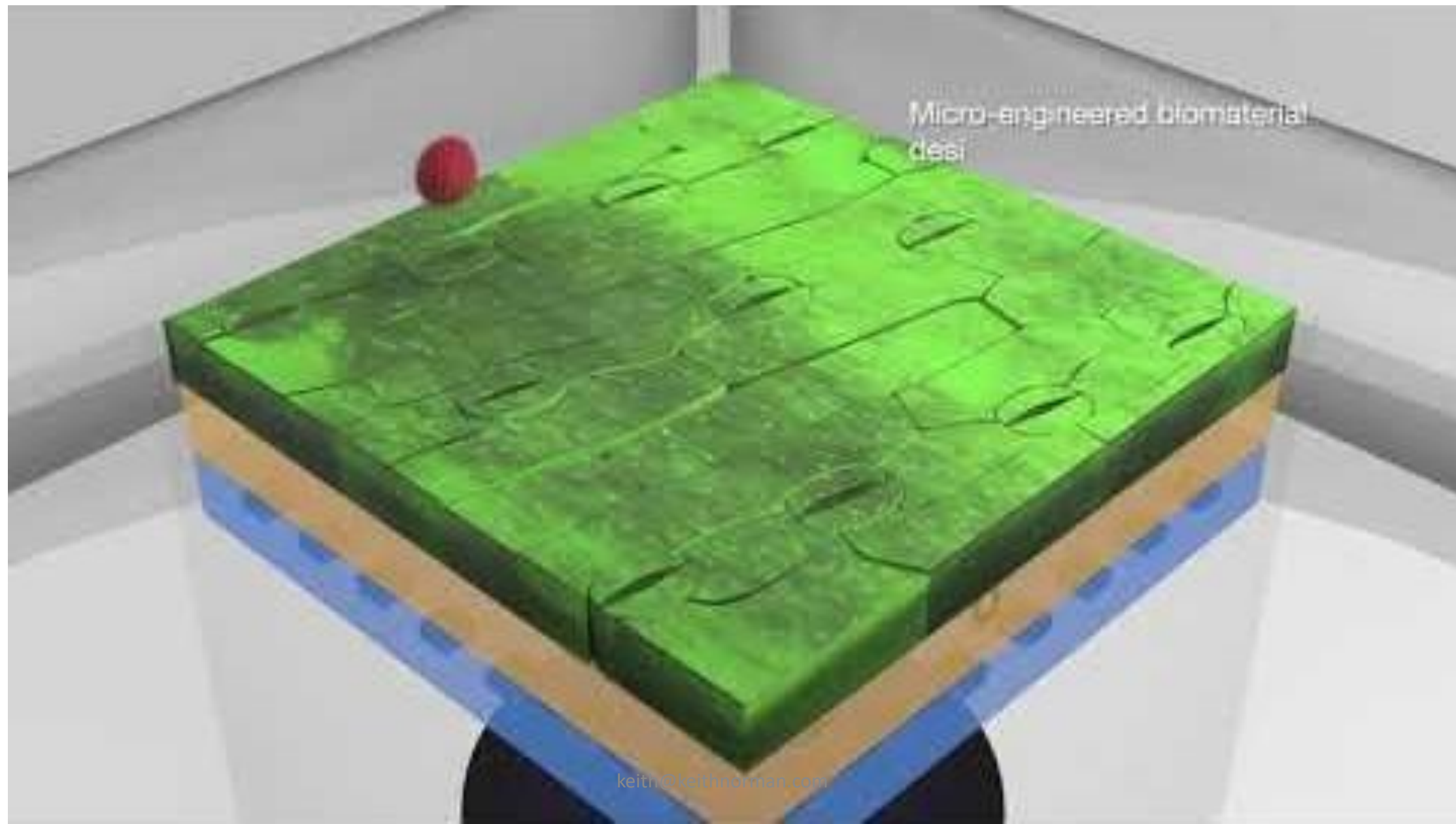
Healthy



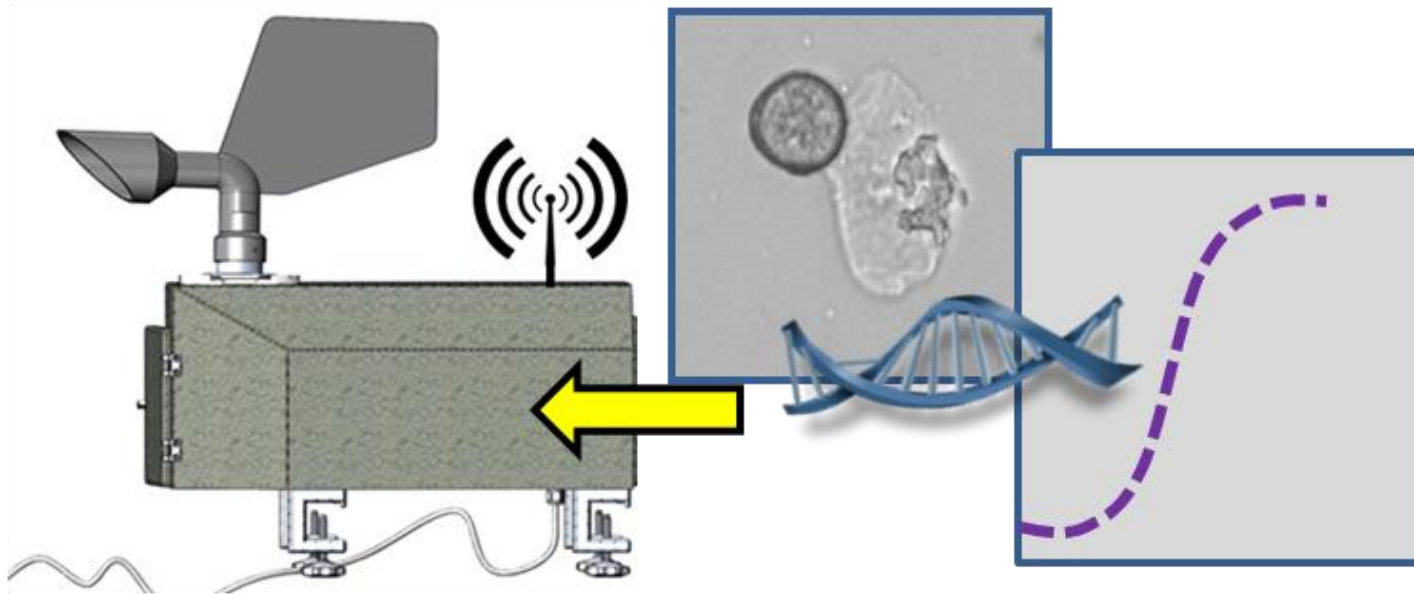
Diseased with Brown Rust

Results show a pre-symptomatic decrease in leaf temperature about 0.5-1.3 °C lower than the healthy leaves  
Symptoms detectable 7 days before becoming visible.

# Disease spore trapping using 3D printed leaves



## Part A: Real-time monitoring of airborne pathogen spores for disease risk alerts



- Sampler includes DNA release, isothermal amplification & quantification, wireless reporting.
- Result integrated with infection models & risk prediction sent to end-users.

Crops: Potato, Beet (2 InnovateUK projects),  
Wheat & OSR (AHDB project)

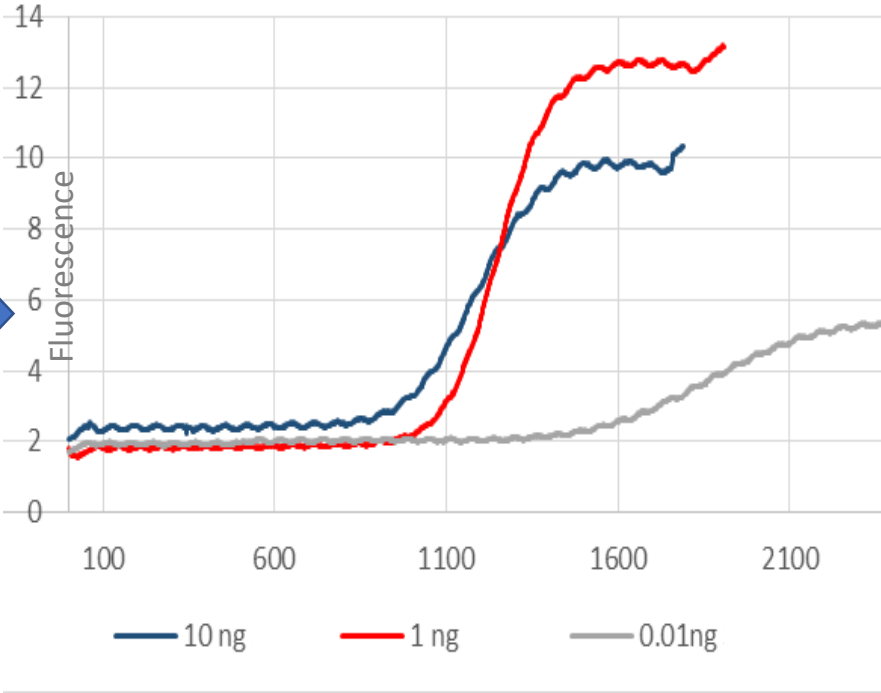
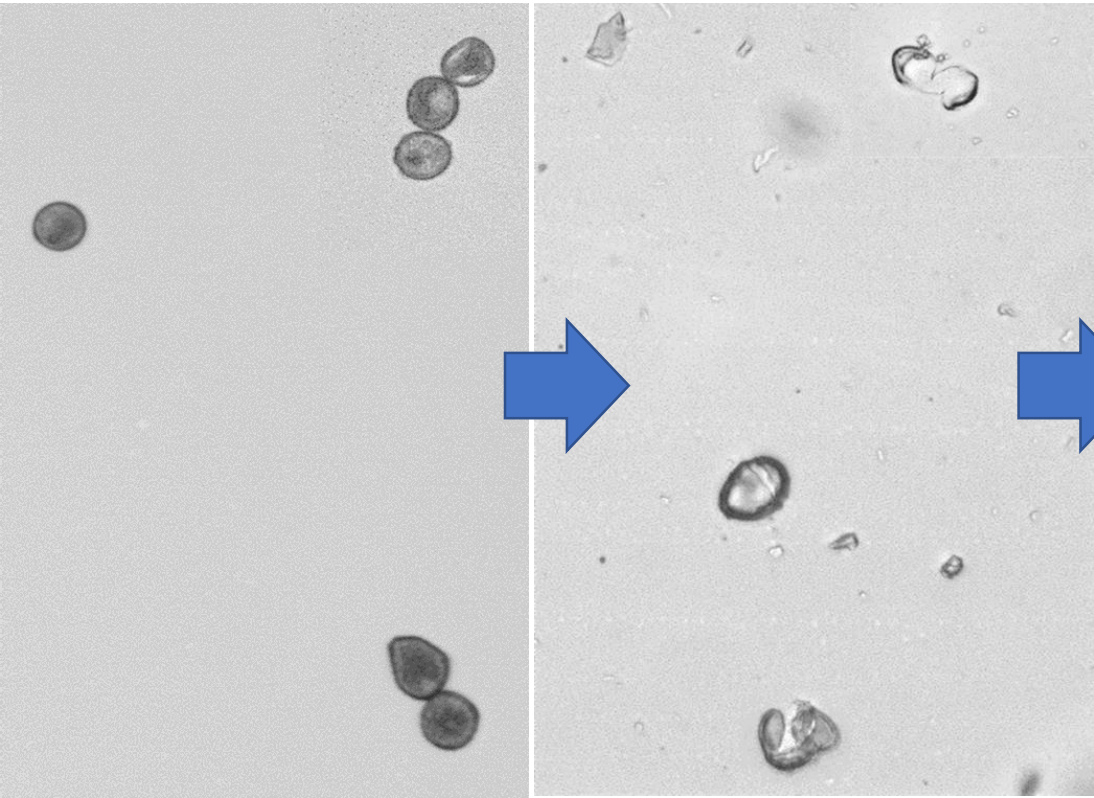


# DNA release from collected spores

# LAMP assay results

Original spore suspension

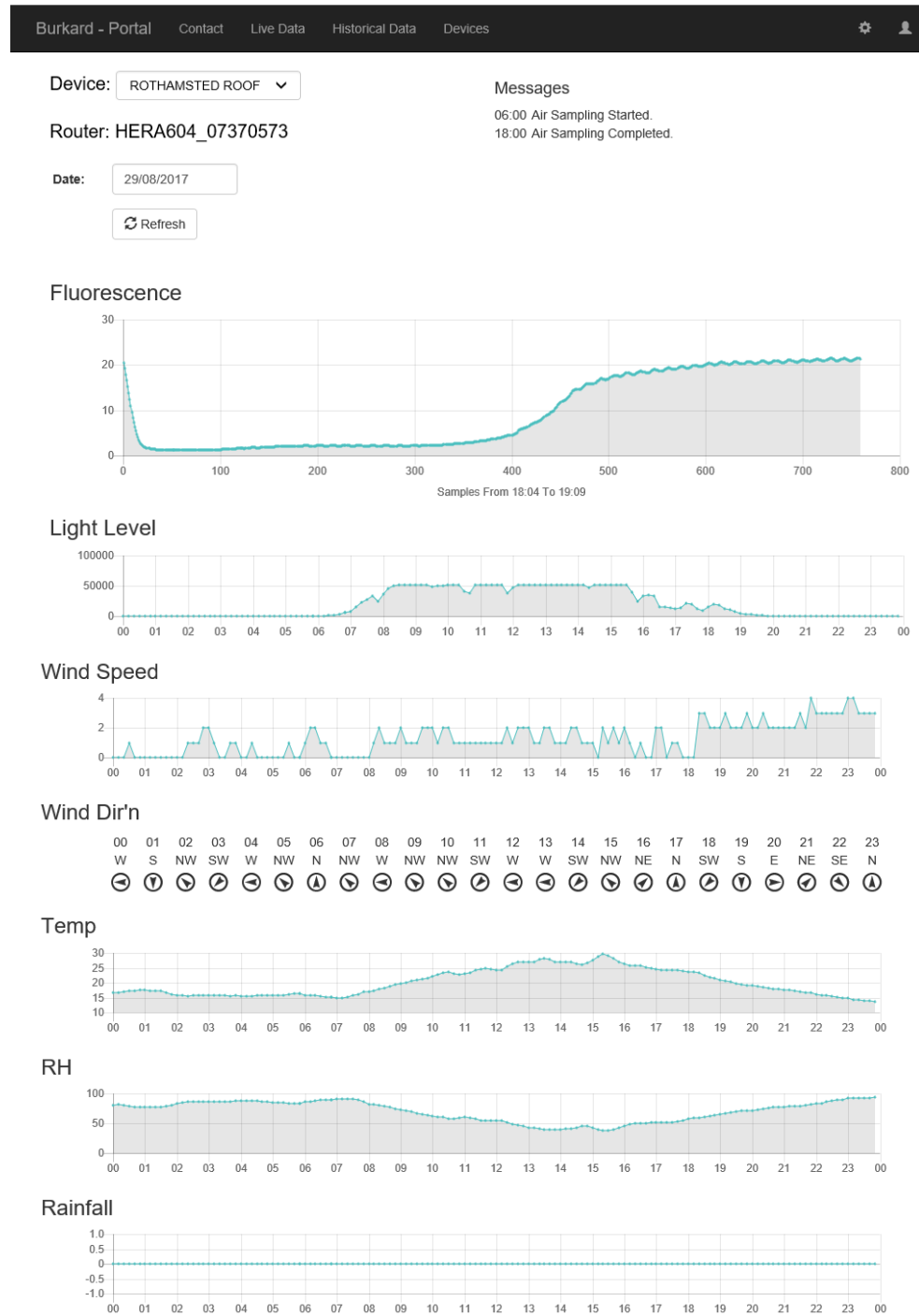
Disrupted spore suspension



# Screen-shot of the Sensor web-portal



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OptiSense Ltd, Fera, The University of Hertfordshire and Bayer Crop Science.



Portable in-field LAMP (loop mediated isothermal amplification) leaf testing kit for DNA Disease detection

# Volatile Organic Compound Detector

- Can detect Potato blight

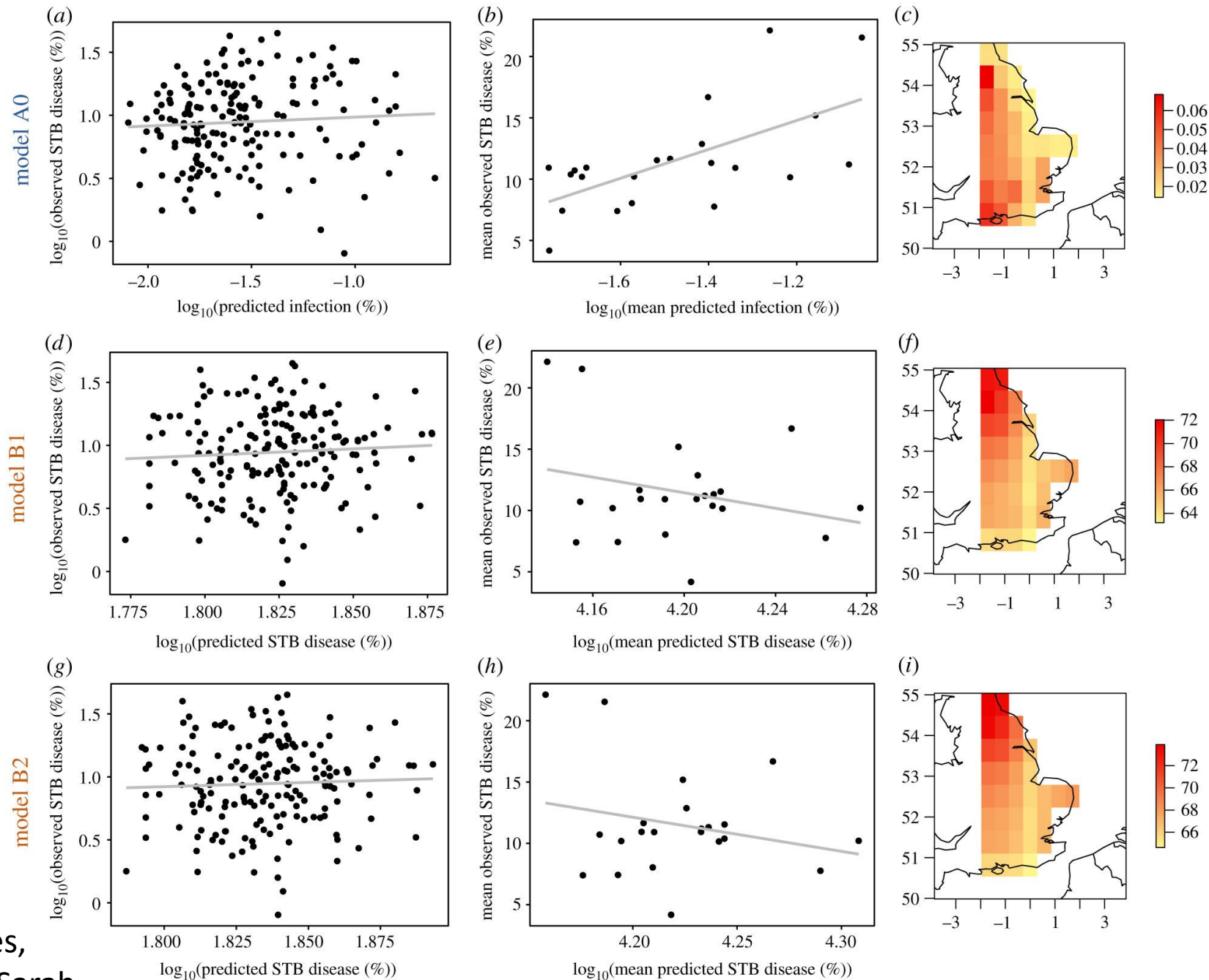


# Are variety blends back on the agenda?

In high disease risk areas the idea of blending varieties could be a way forward.

In addition to being complimentary in their disease resistance profiles, varieties in the blend would have to have similar maturity dates, straw length and marketing classification

# Disease Modelling – based on 2002 – 2016 data



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# Conclusions



There is a lot happening in disease detection



Some of the technology is not far from commercialisation



Still need more validation studies – sensor density, work on thresholds



This technology is vital to counteract decreasing efficacy with current agchem options



Subscription, lease or purchase options ?