



Evolutionary Biology of plant pathogens

Nichola Hawkins



Pathogen evolution



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Home > News > Septoria disease rating dip revealed by early RL dataset release

Septoria disease rating dip revealed by early RL dataset release

Thursday, 23 September 2021

AHDB has issued the Recommended Lists (RL) 2022/23 septoria tritici ratings early, following high levels of the disease in the 2020/21 growing season and concerns about the breaking of resistance.

[AHDB Recommended Lists home page](#)

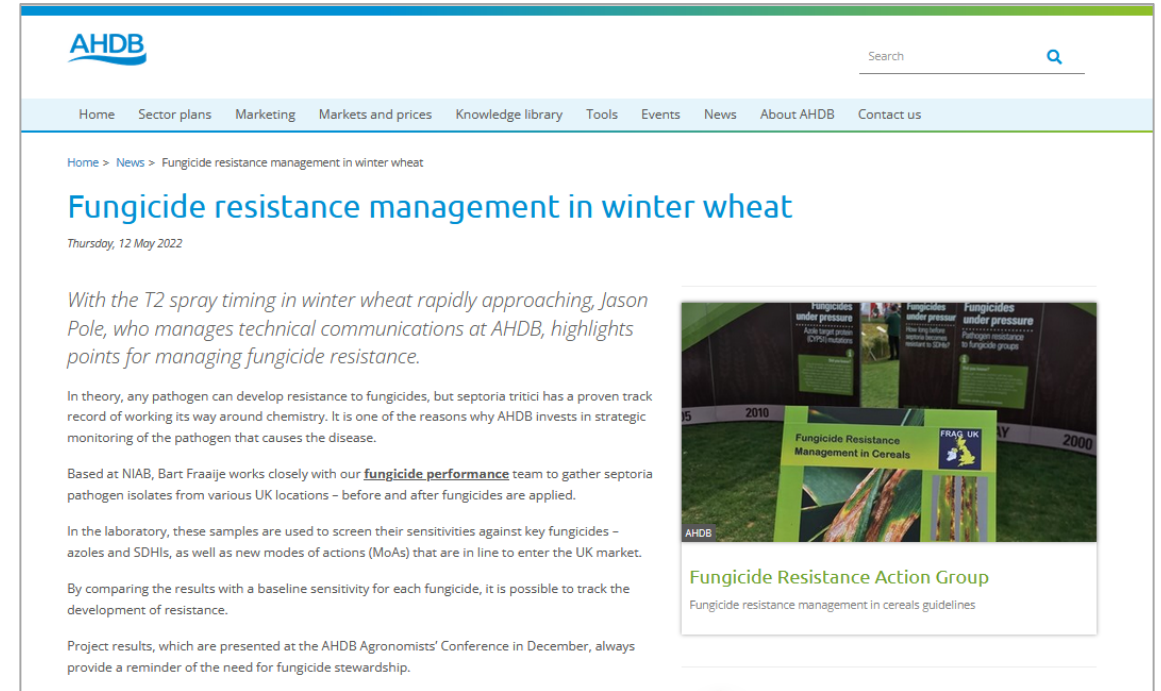
Disease ratings have declined for many winter wheat varieties, with the largest reductions in varieties with Cougar in their parentages.

The ratings have been prepared using a standard three-year dataset, in addition to a one-year dataset, to help reveal the influence of the 2021 disease season.

Paul Gosling, who leads the RL project at AHDB, said: "Following subdued septoria levels in RL trials and commercial crops during early spring, the disease increased rapidly in June. It looked as if there would be a downward shift in disease ratings for those varieties with the old Cougar variety in their parentages. Analysis of disease data has translated to lower ratings for many varieties, with 'Cougar-types', as expected, suffering the largest falls."



Introduced in 2013, Cougar had the highest septoria tritici rating on the RL (7). By 2015, its



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Fungicide resistance management in winter wheat

Thursday, 12 May 2022

With the T2 spray timing in winter wheat rapidly approaching, Jason Pole, who manages technical communications at AHDB, highlights points for managing fungicide resistance.


In theory, any pathogen can develop resistance to fungicides, but septoria tritici has a proven track record of working its way around chemistry. It is one of the reasons why AHDB invests in strategic monitoring of the pathogen that causes the disease.

Based at NIAB, Bart Fraaije works closely with our **fungicide performance** team to gather septoria pathogen isolates from various UK locations - before and after fungicides are applied.

In the laboratory, these samples are used to screen their sensitivities against key fungicides - azoles and SDHIs, as well as new modes of actions (MoAs) that are in line to enter the UK market.

By comparing the results with a baseline sensitivity for each fungicide, it is possible to track the development of resistance.

Project results, which are presented at the AHDB Agronomists' Conference in December, always provide a reminder of the need for fungicide stewardship.



Fungicide Resistance Action Group
Fungicide resistance management in cereals guidelines

Overcoming host resistance

Resistance to chemicals

Screenshots from AHDB News

Pathogen evolution

Any control measure will select in favour of strains that can overcome control

BUT

Not all control measures are at equal risk

How complex an evolutionary step is needed?

Control Measure

How much genetic variation is present?

Pathogen

How strong is the selection?

Management

How complex an evolutionary step is needed?

Solo, single-site fungicides



Mixture of single-site fungicides



Multi-site fungicides

Solo, major gene resistance



Stacked major gene resistance



Stacked including quantitative resistance



Non-host crops

How much genetic variation is present?

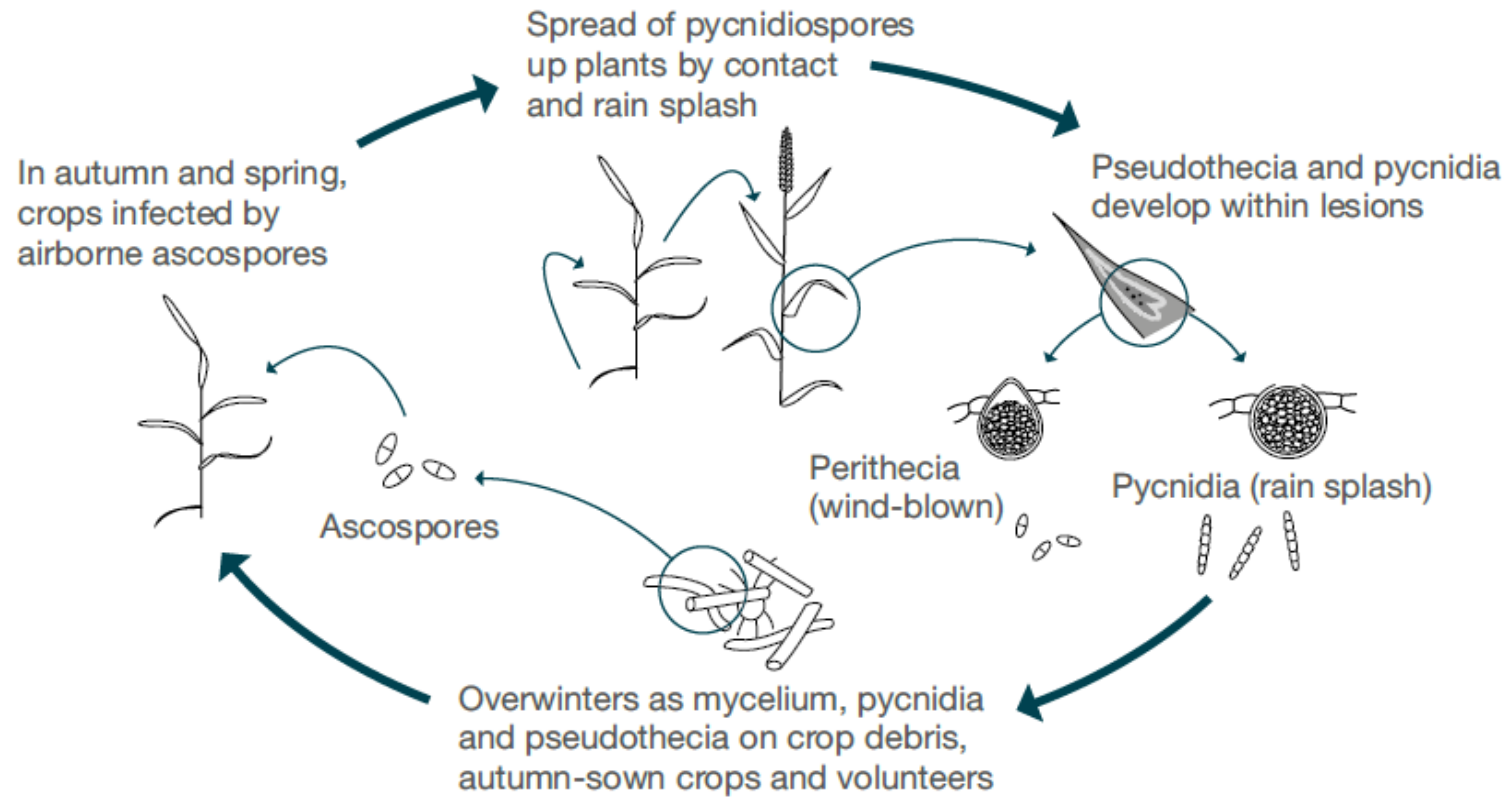
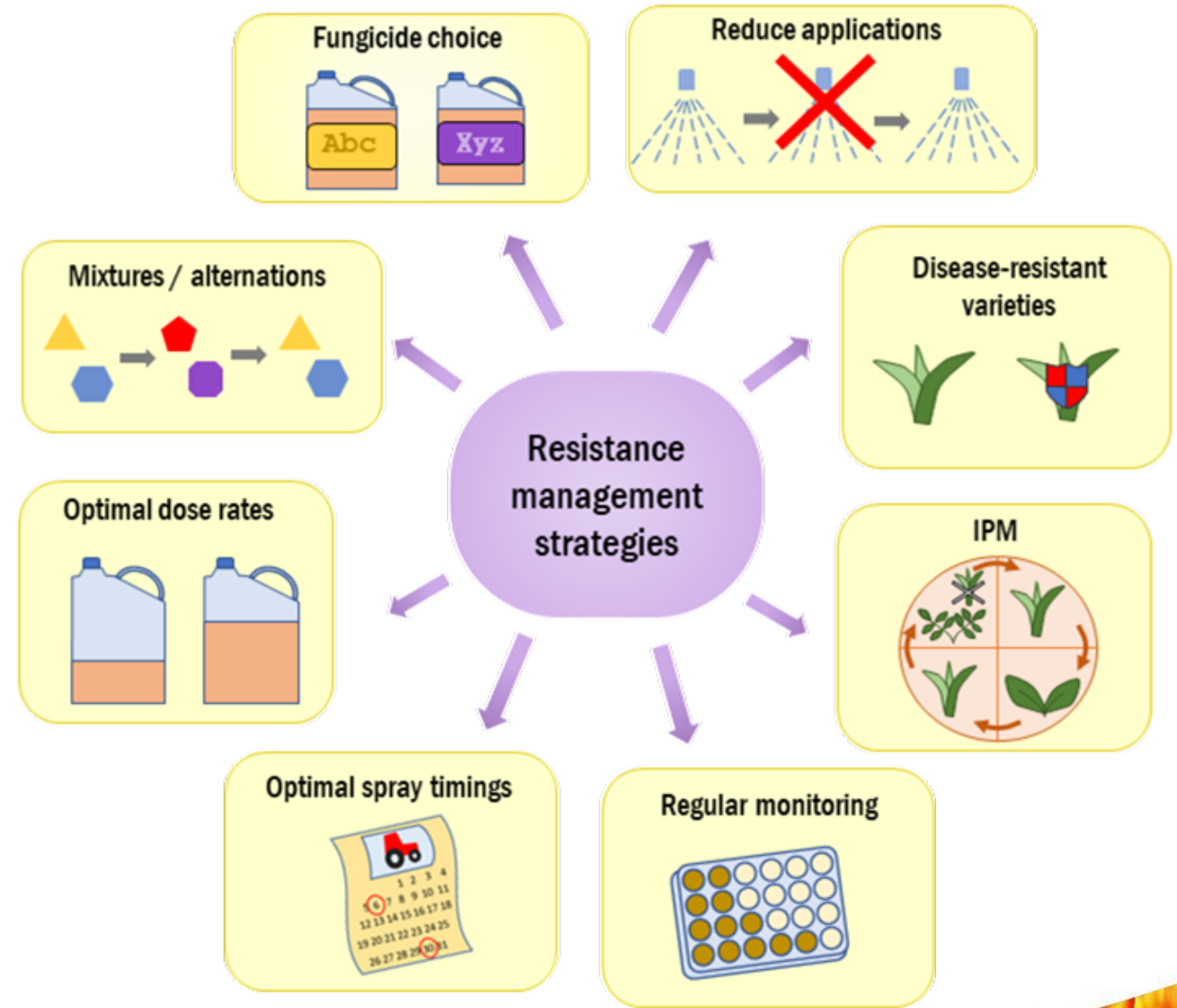


Figure from *The encyclopaedia of cereal diseases*, AHDB 2020

How strong is the selection?

Rely less heavily on any single control measure:

- Use less of that measure
- Combine with more other measures



Resistance risk assessment

↓ Fungicide Classes *	↓ Fungicide Risk	Combined Risk			↓ Agronomic Risk
benzimidazoles dicarboximides phenylamides QoI fungicides SDHI fungicides**	high = 6	6 3 1.5	12 6 3	18 9 4.5	high = 1 medium = 0.5 low = 0.25
SBI fungicides anilinopyrimidines phenylpyrroles	medium = 4	4 2 1	8 4 2	12 6 3	high = 1 medium = 0.5 low = 0.25
multi site fungicides (e.g. dithiocarbamates) MBI-R inhibitors SAR inducers	low = 1	1 0.5 0.25	2 1 0.5	3 1.5 0.75	high = 1 medium = 0.5 low = 0.25
Pathogen risk →		low = 1	medium = 2	high = 3	
Pathogen groups * →		seed borne pathogens (e.g. <i>Pyrenophora</i> sp. <i>Ustilago</i> sp.) soil-borne pathogens (e.g. <i>Phytophthora</i> sp.) rust fungi <i>Rhizoctonia</i> sp. <i>Fusarium</i> sp. <i>S. sclerotiorum</i>	<i>E. necator</i> <i>G. fujikuroi</i> <i>Oculimacula</i> sp. <i>R. commune</i> <i>P. teres</i> <i>Z. tritici</i> <i>S. homoeocarpa</i> <i>Monilinia</i> sp. <i>Cercospora</i> sp. <i>P. infestans</i>	<i>B. graminis</i> <i>B. cinerea</i> <i>P. viticola</i> <i>P. oryzae</i> <i>V. inaequalis</i> <i>P. fijiensis</i>	

High risk control measure

+ high risk pathogen

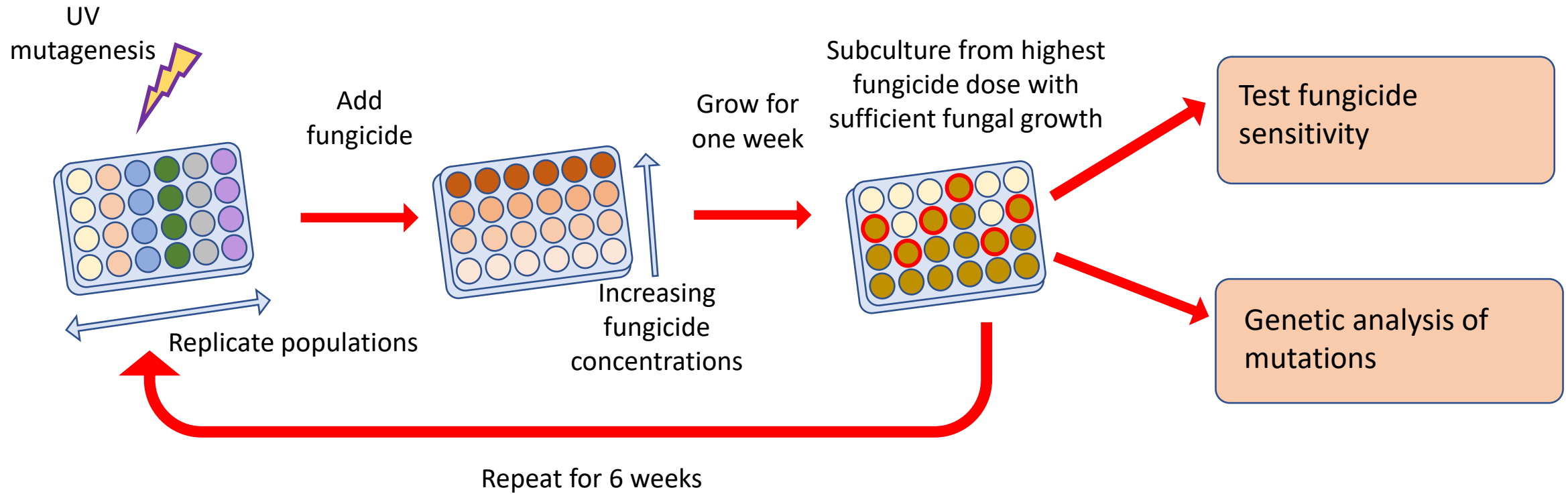
= high importance of reducing agronomic risk

= stricter risk management needed

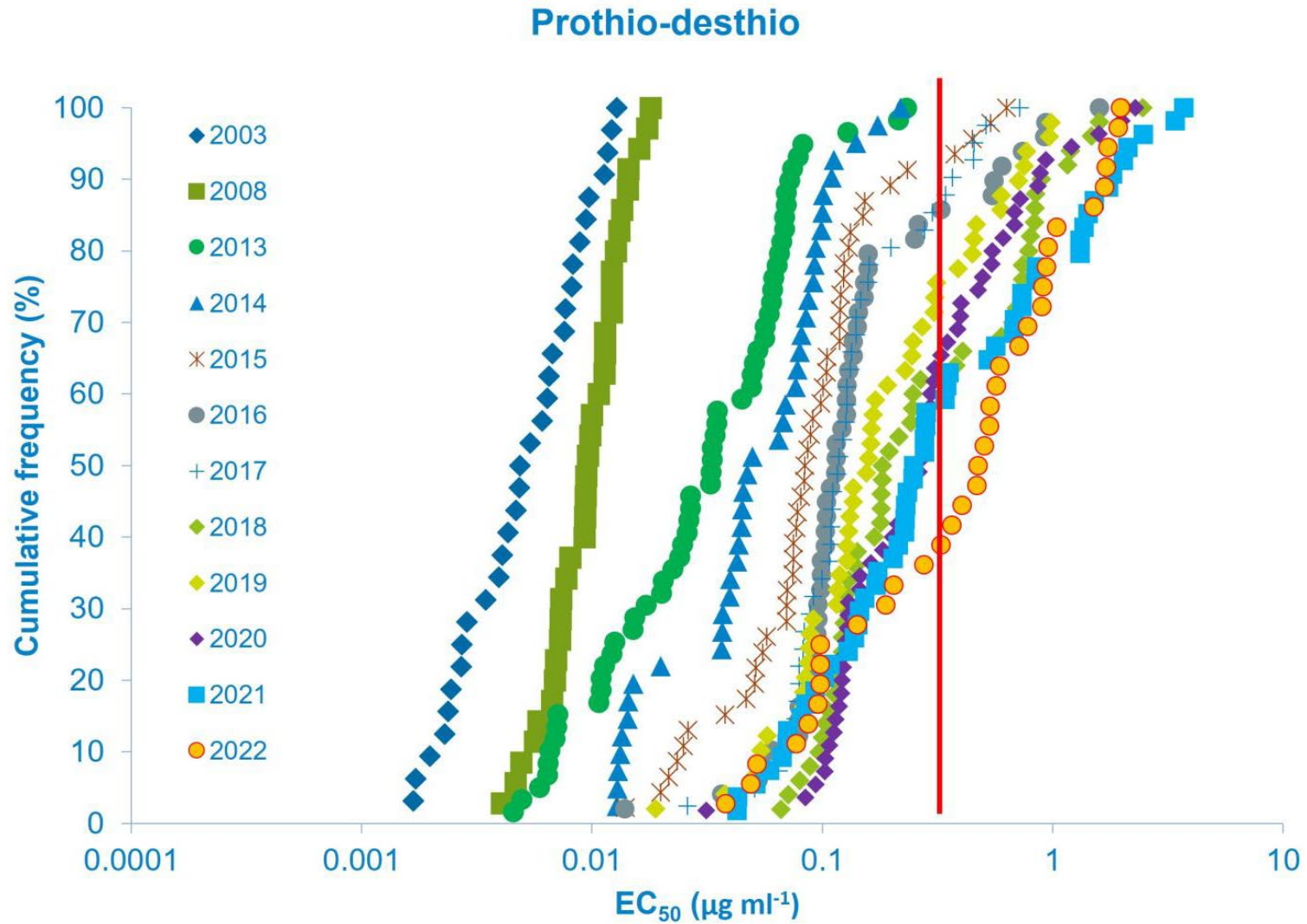
e.g. high risk fungicides to be used only in mixtures, only one spray per season

Table from the Pathogen Risk List, FRAC 2019

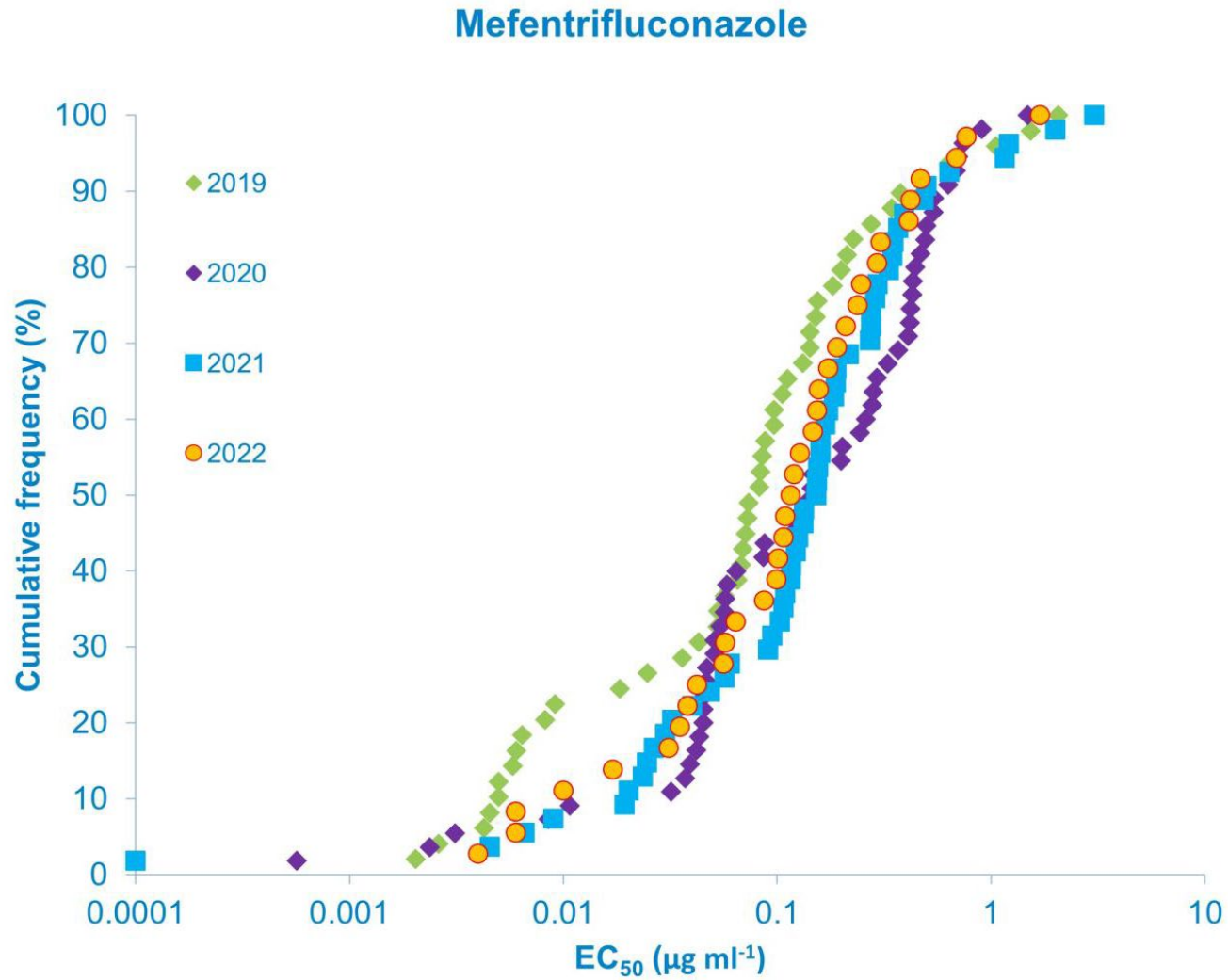
Predicting resistance in the lab



Monitoring resistance in the field

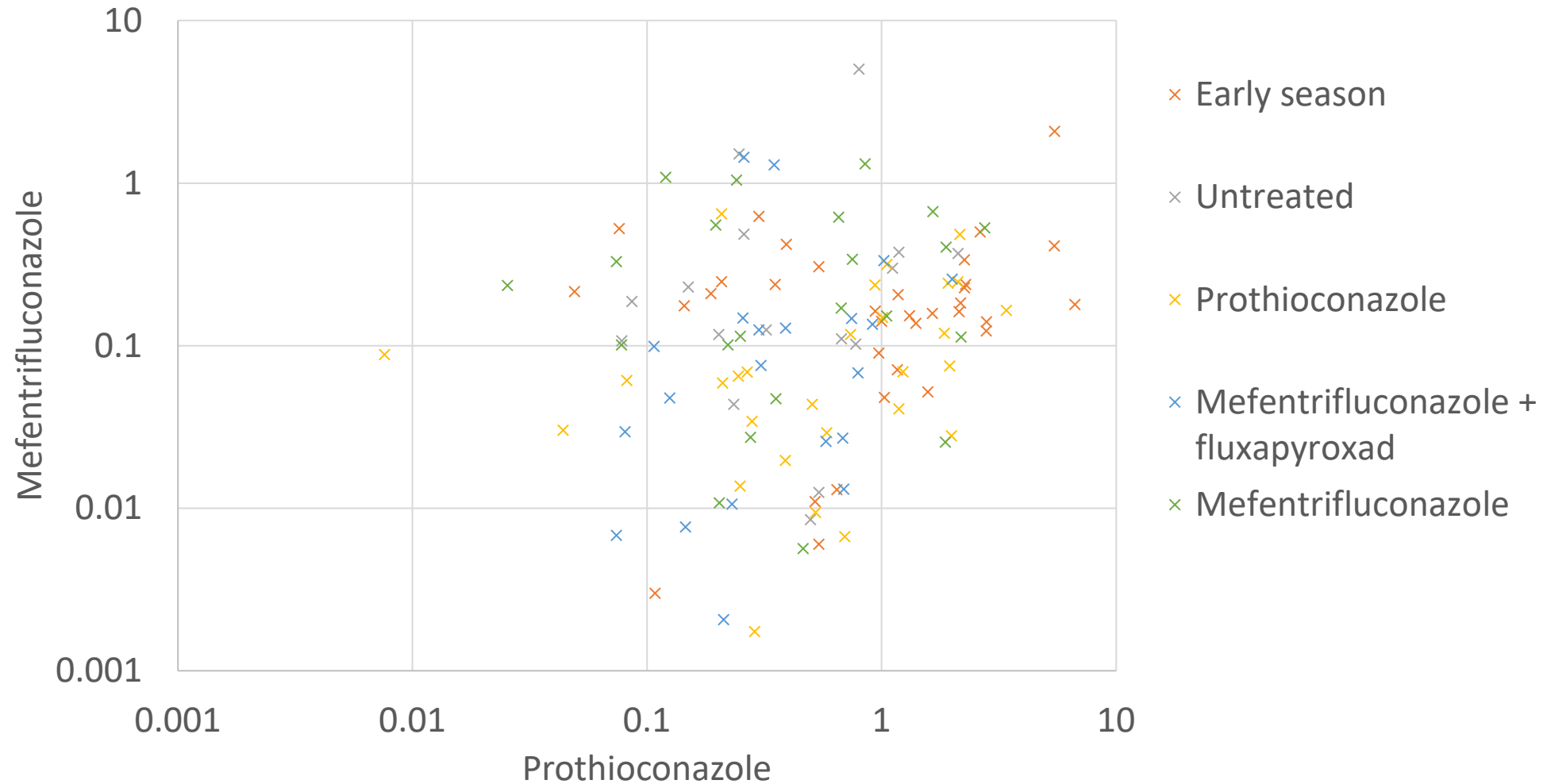


Monitoring resistance in the field

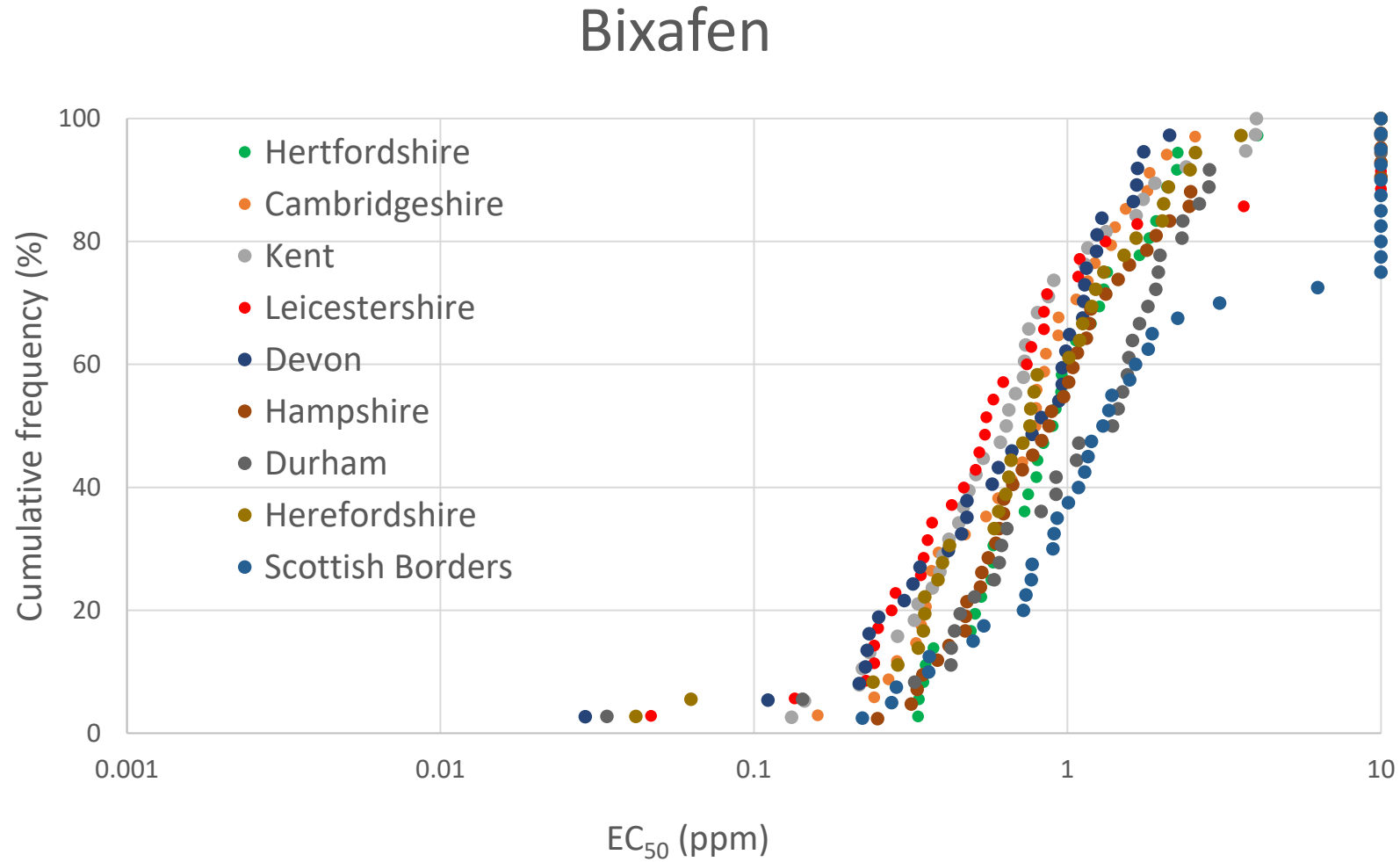


Monitoring resistance in the field

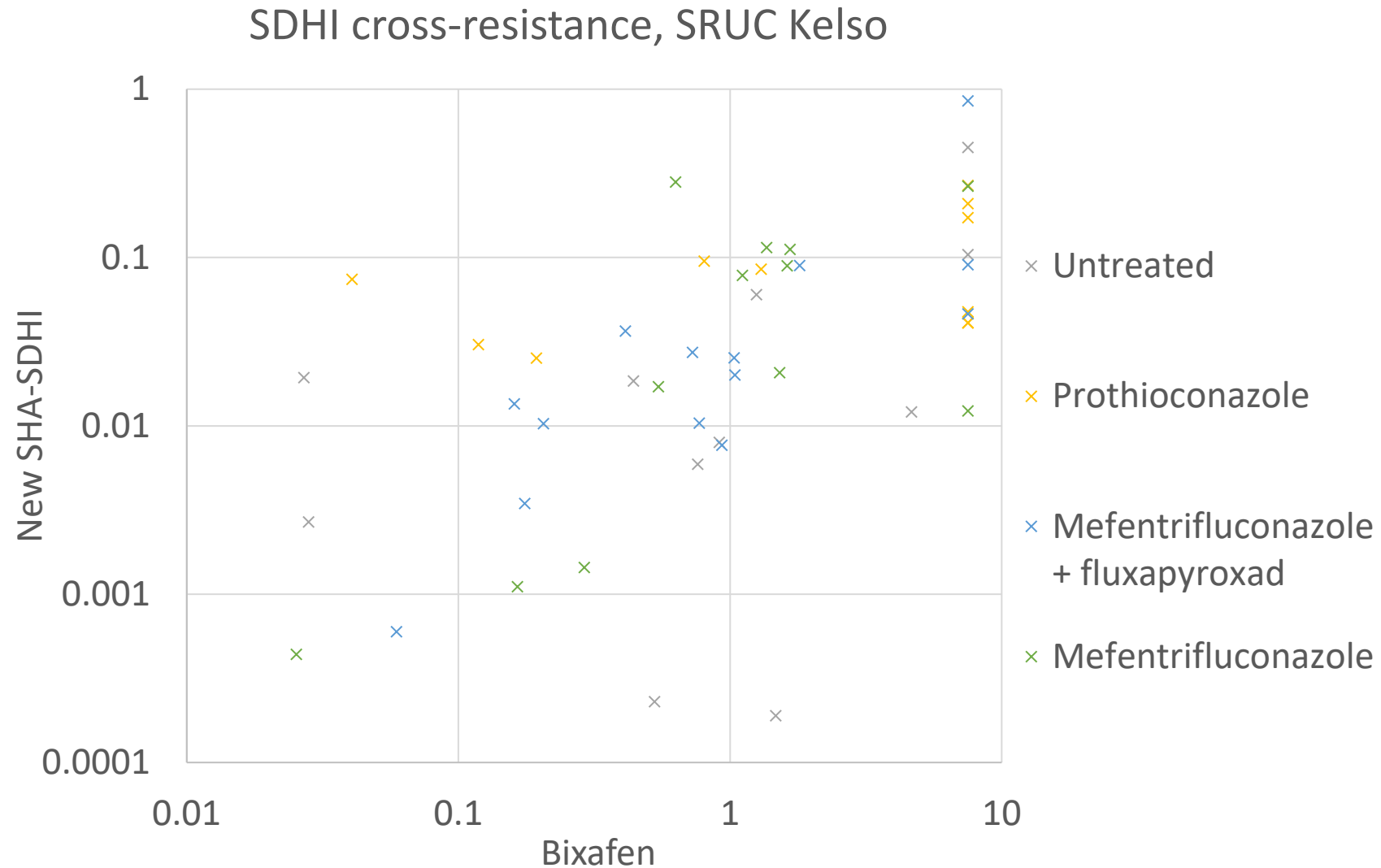
Azole cross-resistance, NIAB Sutton Scotney



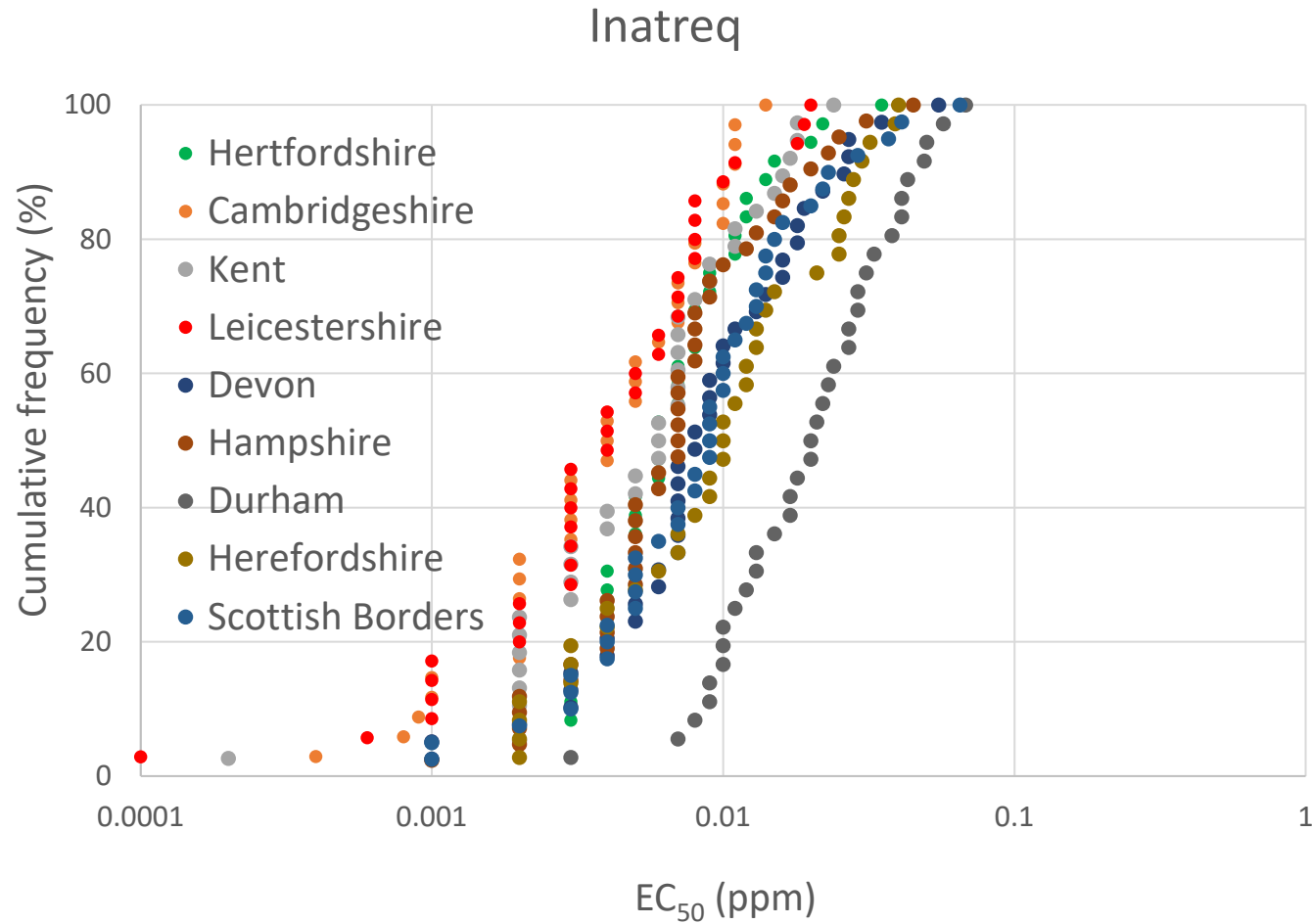
Monitoring resistance in the field



Monitoring resistance in the field



Monitoring resistance in the field



Summary

- Azoles: Continuing slide in sensitivity but not big jumps in resistance
- Partial cross-resistance between prothioconazole and mefentrifluconazole
- SDHIs: Mostly medium-sensitivity isolates but a few more resistant mutations which we need to keep monitoring
- New SDHIs in the pipeline: some cross-resistance but more active overall
- Qils: No resistance yet but considered high risk
- Our research into resistance evolution in the lab could improve resistance risk assessments for future products



Further information

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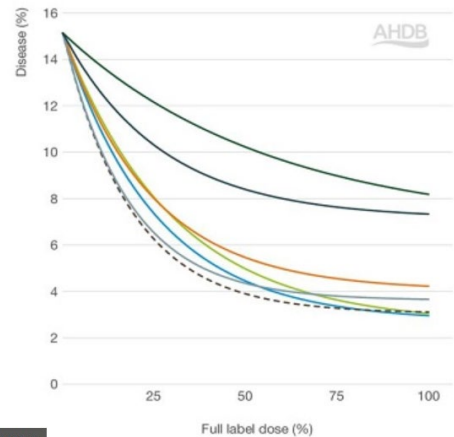
Fungicide performance in cereals and oilseed rape

- > Why is fungicide efficacy data important?
- > Fungicide performance 2022
- > Fungicide performance for wheat
- > Fungicide performance for barley
- > Fungicide performance for oilseed rape
- > How to use fungicide performance information
- > Fungicide resistance research

Our fungicide performance work provides high-quality, independent information on the efficacy of fungicides against key diseases in wheat, barley and oilseed rape.

Why is fungicide efficacy data important?

Knowledge of the potential power of an active ingredient is essential for effective management. First and foremost, it will help you make informed investment decisions. Critically, it can be used to develop a fungicide resistance management plan with the need to control disease with the need to protect the environment.



An illustration of fungicide dose response curves

FRAG UK

Fungicide Resistance Management in Cereals

2020/21

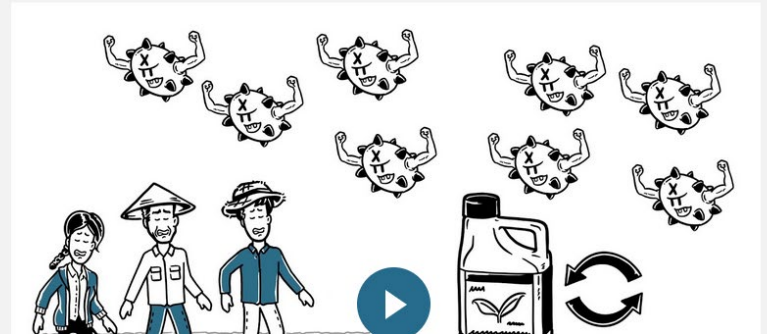
FUNGICIDE RESISTANCE ACTION COMMITTEE

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FRAC Videos

Resistance to fungicides is a serious threat to agriculture. In these videos, the Fungicide Resistance Action Committee (FRAC) explains why fungicide resistance happens, and how it can be managed. Several languages can be selected:

Learn about fungicide resistance and how to manage it:



www.frac.info

ahdb.org.uk