AHDB Agronomists' Conference 2019

Tuesday 3 – Wednesday 4 December 2019

AHDB Agronomists' Conference 2019

Session One – Crop protection in cereals & oilseeds

AHDB fungicide performance

IPM and fungicides: Finding the appropriate level of intervention for wheat, barley and oilseed rape disease management

Jonathan Blake

CEREALS & OILSEEDS

Note: The graphs in these slides show dose-response curves up to 100% label dose.

The graphs at the AHDB Agronomists' Conference showed dose-response curves up to 200% label dose.

Fungicides are tested at double rate to improve the 'fit' of the dose-response curves.

Wider considerations

Choosing fungicides

- Match fungicides to the primary disease risk, which depends mainly on variety, sowing date, location and local weather.
- Mixtures and alternations of fungicides with different modes of action, from different fungicide groups, are often most effective and reduce the likelihood that fungicide resistance will develop in pathogens.
- Resistance poses a significant threat to the ongoing performance of fungicides. It is essential to take resistance management into account when planning fungicide programmes.
- For further information, visit the Fungicide Resistance Action Group's (FRAG) web page: ahdb.org.uk/frag

Protection and curative

- 'Protectant' curves show the activity of fungicides when they are applied soon after the emergence of a leaf layer, before much infection has occurred.
- 'Curative' curves indicate fungicidal activity after infection has occurred but before symptoms become visible.
- Performance of products on each leaf layer and at each site was classified as protectant or curative based on timing of leaf emergence relative to spray application.
- Performance of individual active ingredients can be assessed by comparing dose-response graphs. These show average performance measured across a range of sites, seasons and leaf layers.

Integrated pest management in cereals and oilseeds

- Variety choice / disease resistance ratings – AHDB Recommended Lists

- Other agronomic factors that affect disease development
  - Sowing date
  - Seed rate

AHDB Project no 21120007: Combining agronomy, variety and chemistry to maintain control of septoria tritici in wheat

- Fungicide choice and dose

AHDB Project no 21120013
Fungicide Performance in wheat, barley and oilseed rape

Trial methods

- In order to provide a good test of the fungicides:
  - Trials are located in areas that are at high risk from the target disease in most years
  - Trials are carried out on varieties that are very susceptible to the target disease and not too susceptible to other diseases
- If necessary, over-sprays that are not active against the target disease are used to reduce the effect of other diseases on the trial
- Fusarium trial inoculated with fusarium species and mist-irrigated before and after inoculation to establish infection

Fungicide performance 2019 update for wheat

Septoria tritici efficacy data 2019

Site (Organisation)	Protectant	Curative	Mixed	Growth stage of application	Variety
Herefordshire (ADAS)	✓		✓	GS37	KWS Kielder
Hampshire (NIAB)	✓		✓	GS32	Dickens
East Lothian (SRUC)	✓	✓	✓	GS39	Viscount
Carlow, Ireland (Teagasc)	✓			GS37	KWS Lumos
Cardigan (ADAS)	✓	✓		GS39	KWS Santiago
Shropshire (NIAB)			✓	GS39	Dickens

Revystar XE

New fungicide product for 2020

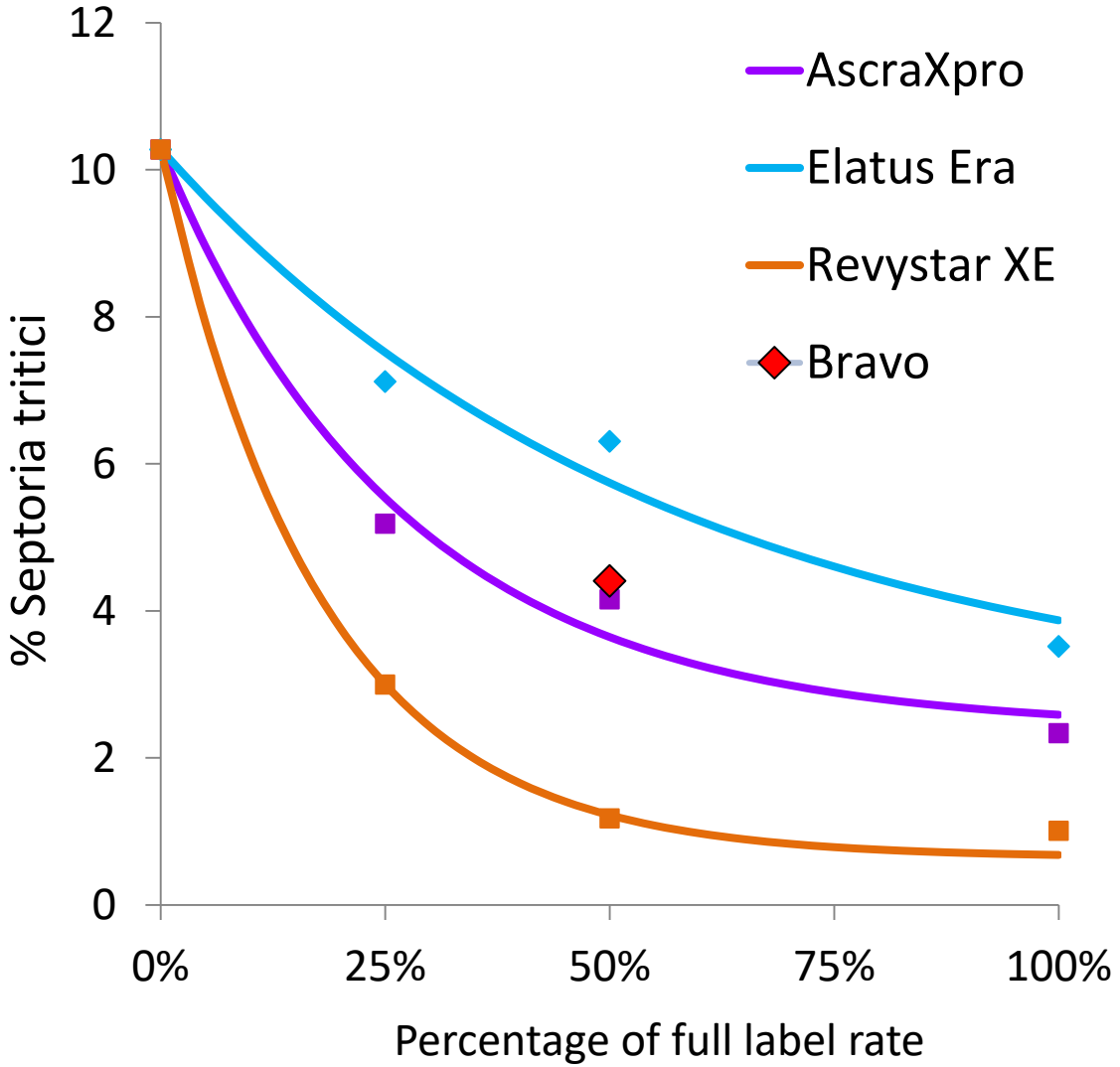
- Contains a new triazole (Revysol) and an SDHI (Xemium)
    - 100 g/L mefentrifluconazole + 47.5 g/L fluxapyroxad
- Maximum individual dose 1.5 L/ha
- Maximum of two applications
- To be applied before GS69
- Approved for wheat, barley, oats, rye, triticale, spelt and durum wheat

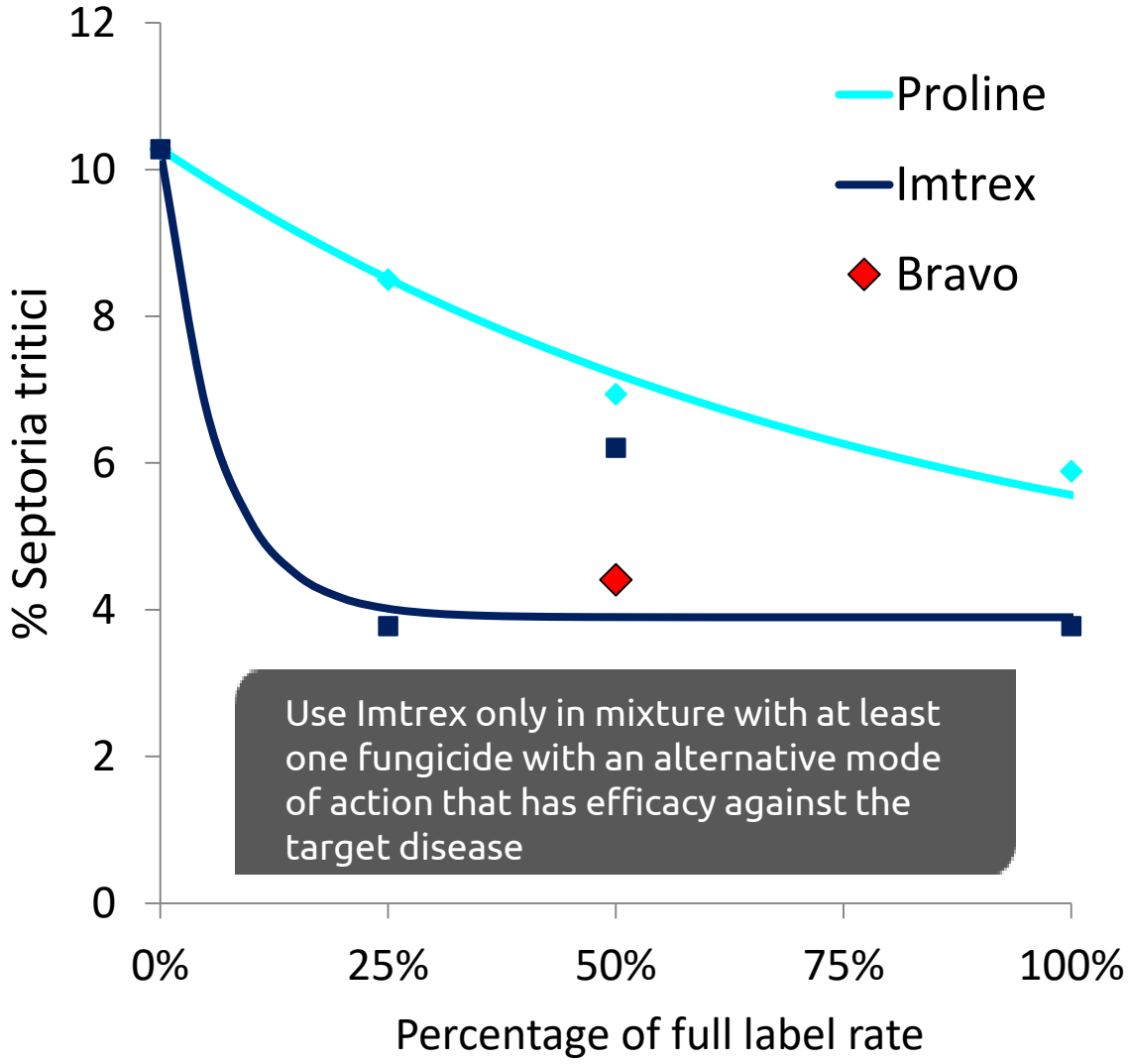
Wheat products 2019

Product	Active(s)	Septoria	Brown rust	Yellow rust
Bravo	chlorothalonil	✓*		
Proline	prothioconazole	✓	✓	
Bassoon	epoxiconazole			✓
Imtrex	fluxapyroxad	✓	✓	✓
Comet	pyraclostrobin		✓	✓
Amistar	azoxystrobin			✓
Ascra Xpro	bixafen + fluopyram + prothioconazole	✓	✓	✓
Librax	fluxapyroxad + metconazole		✓	
Elatus Era	solatenol + prothioconazole	✓	✓	✓
Revystar XE	mefentrifluconazole + fluxapyroxad	✓	✓	✓

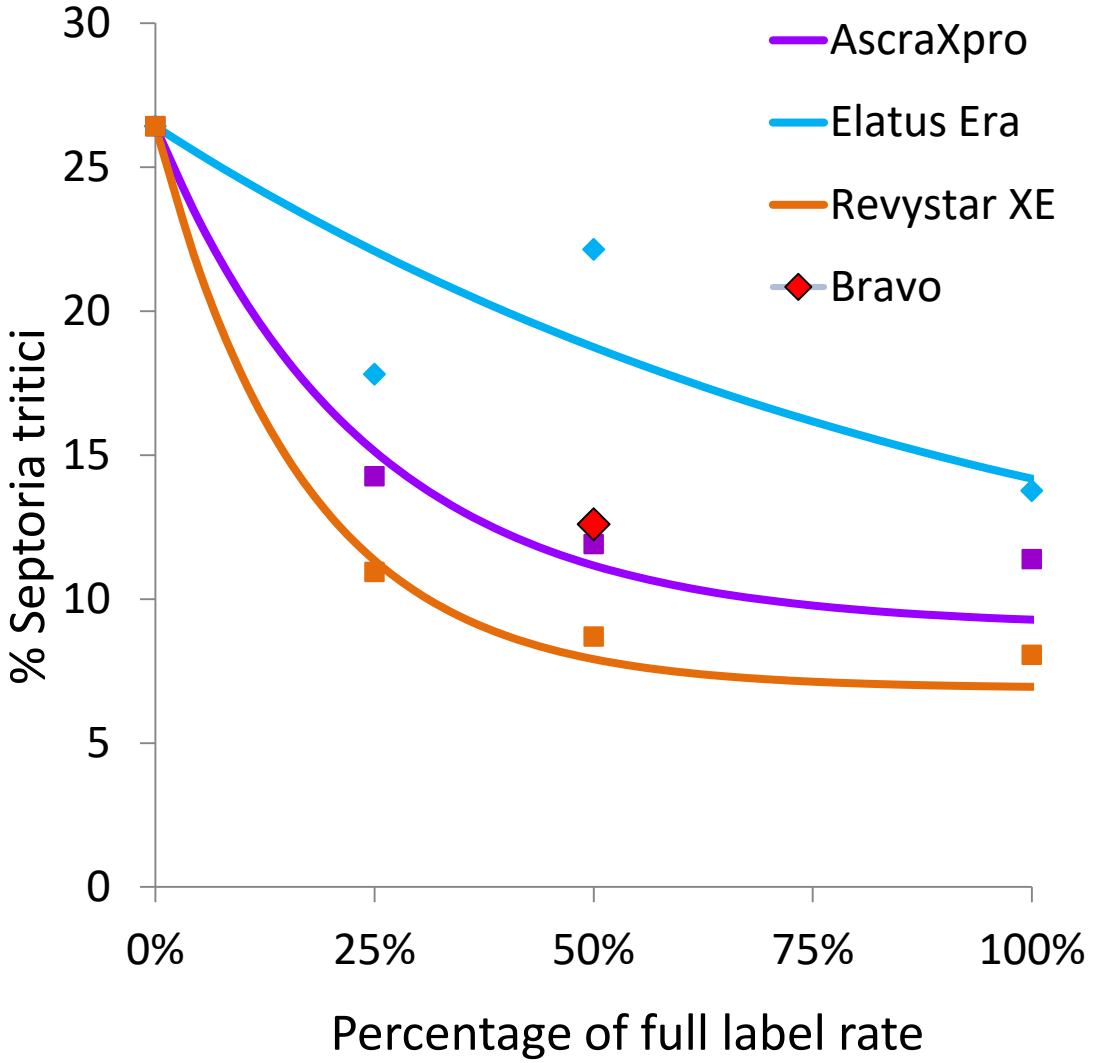
*Bravo at 50% dose only

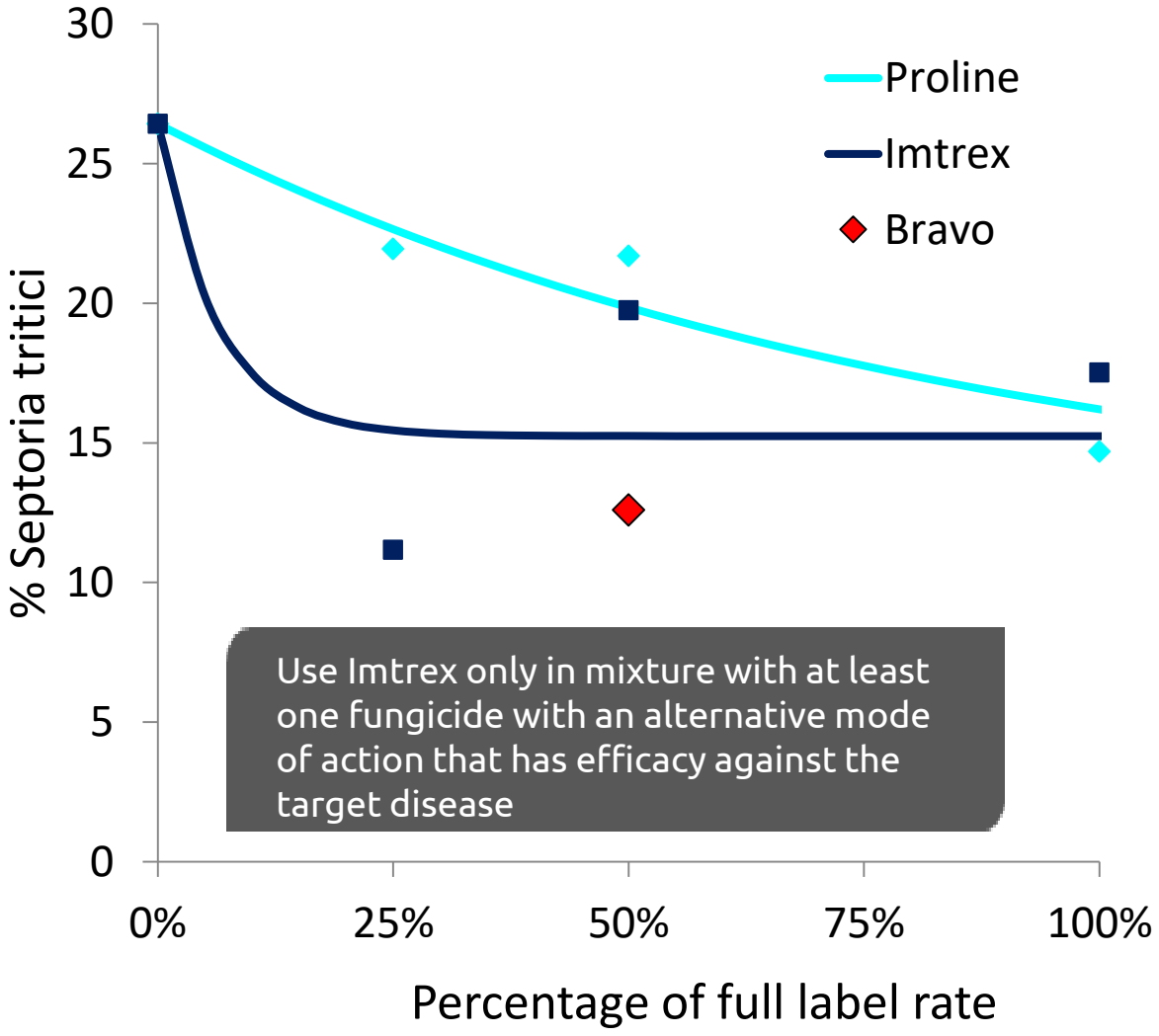
Septoria tritici protectant 2019 (5 trials)



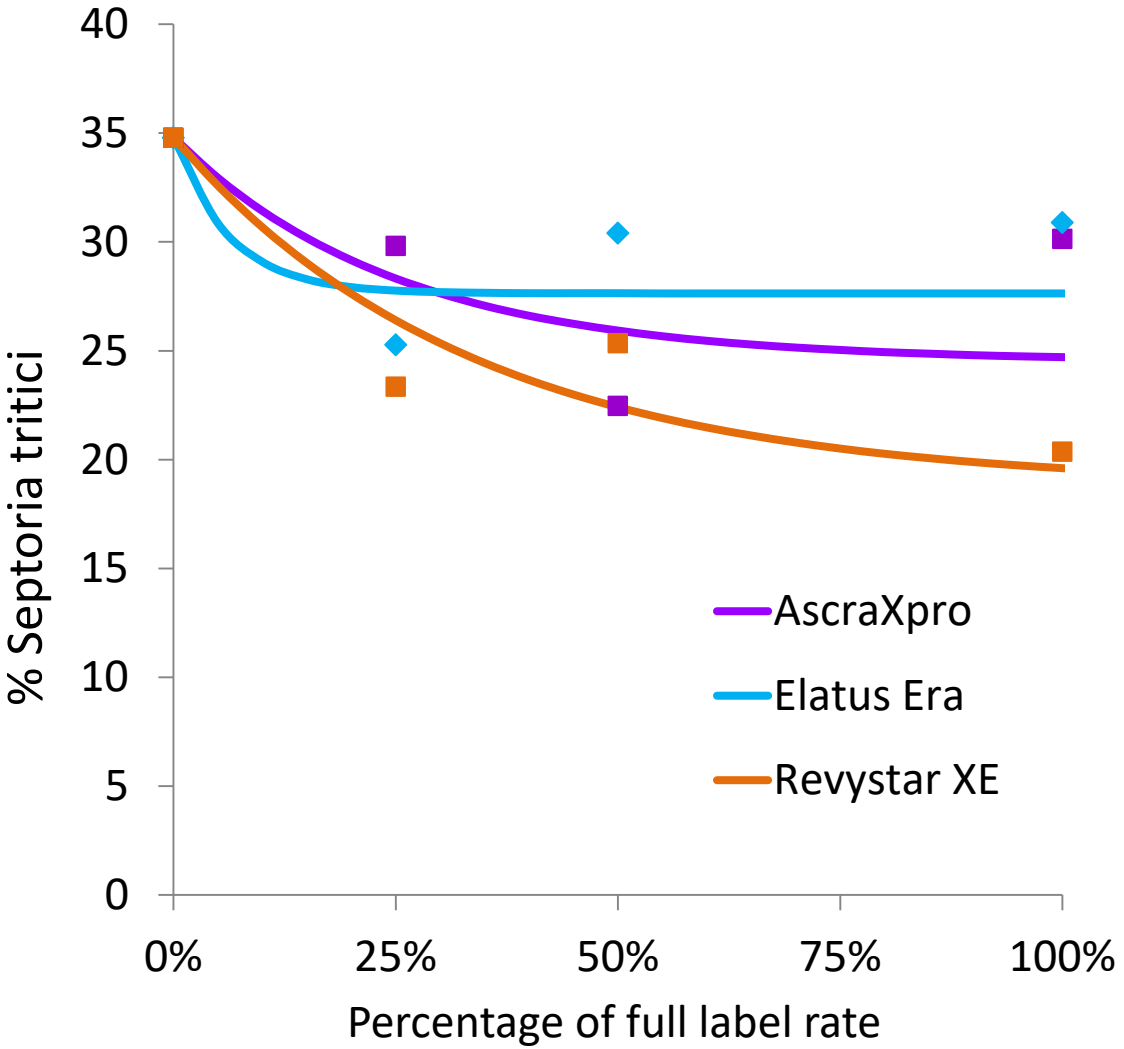


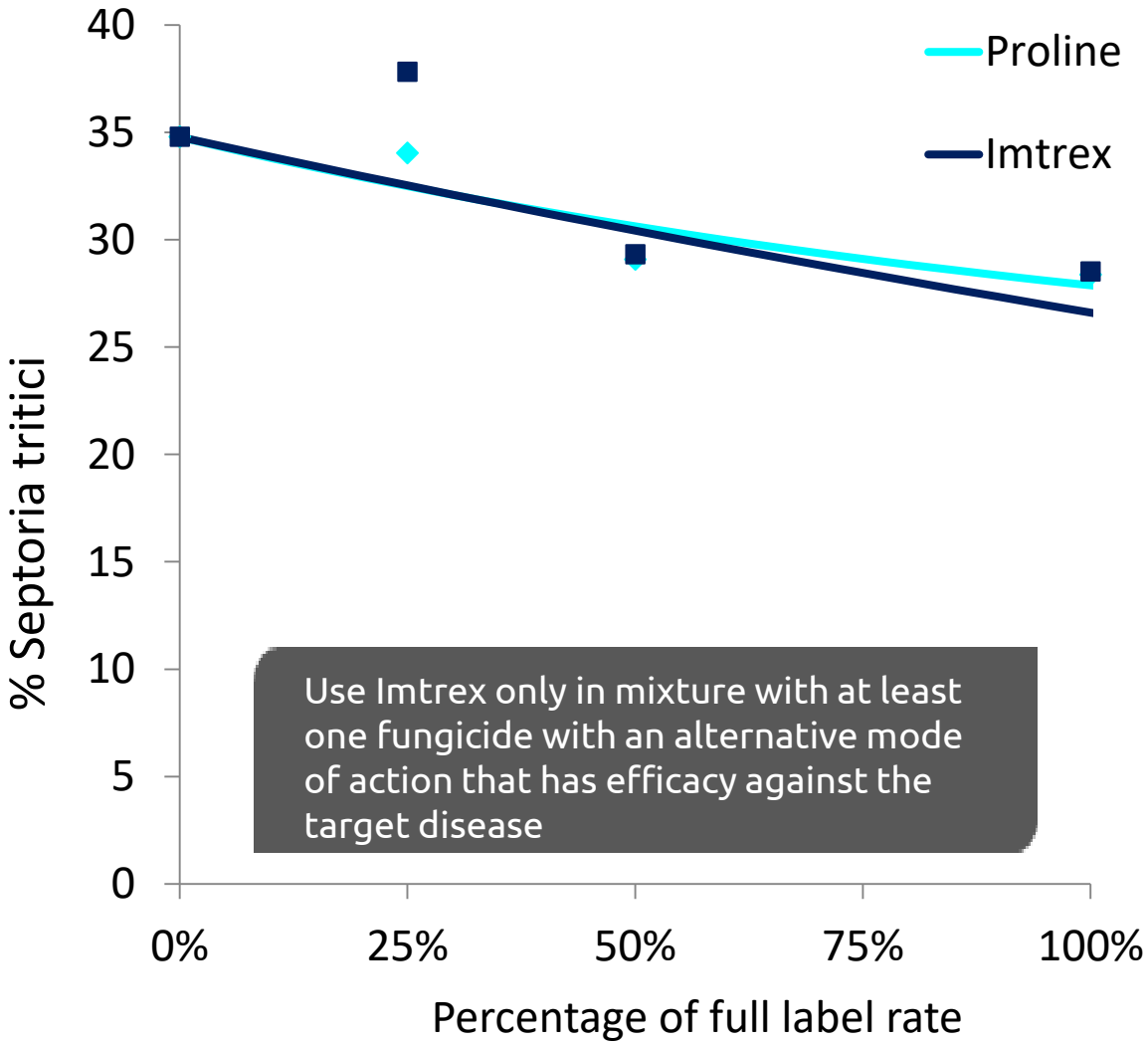
Septoria tritici mixed protectant and curative 2019 (4 trials)



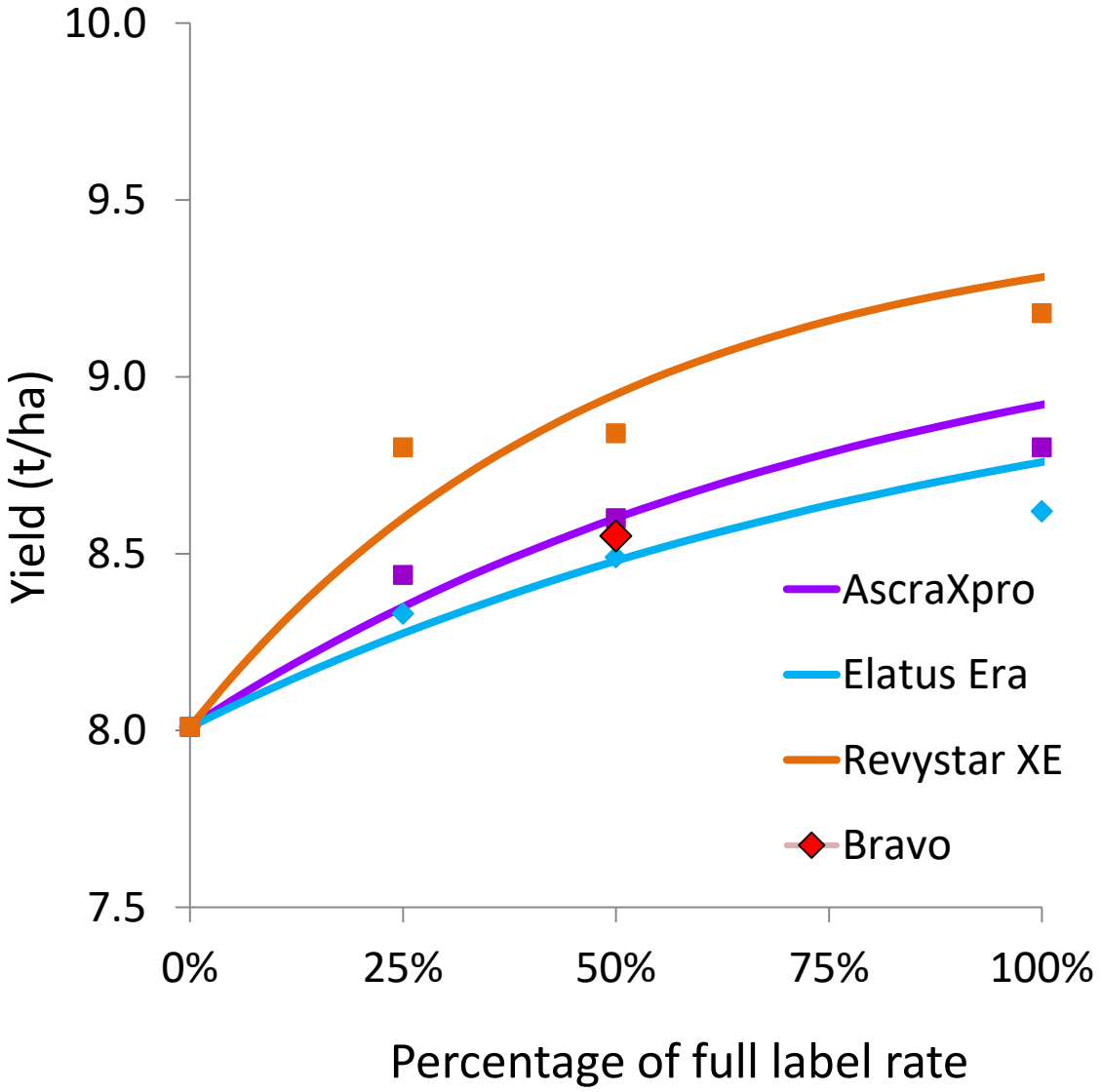


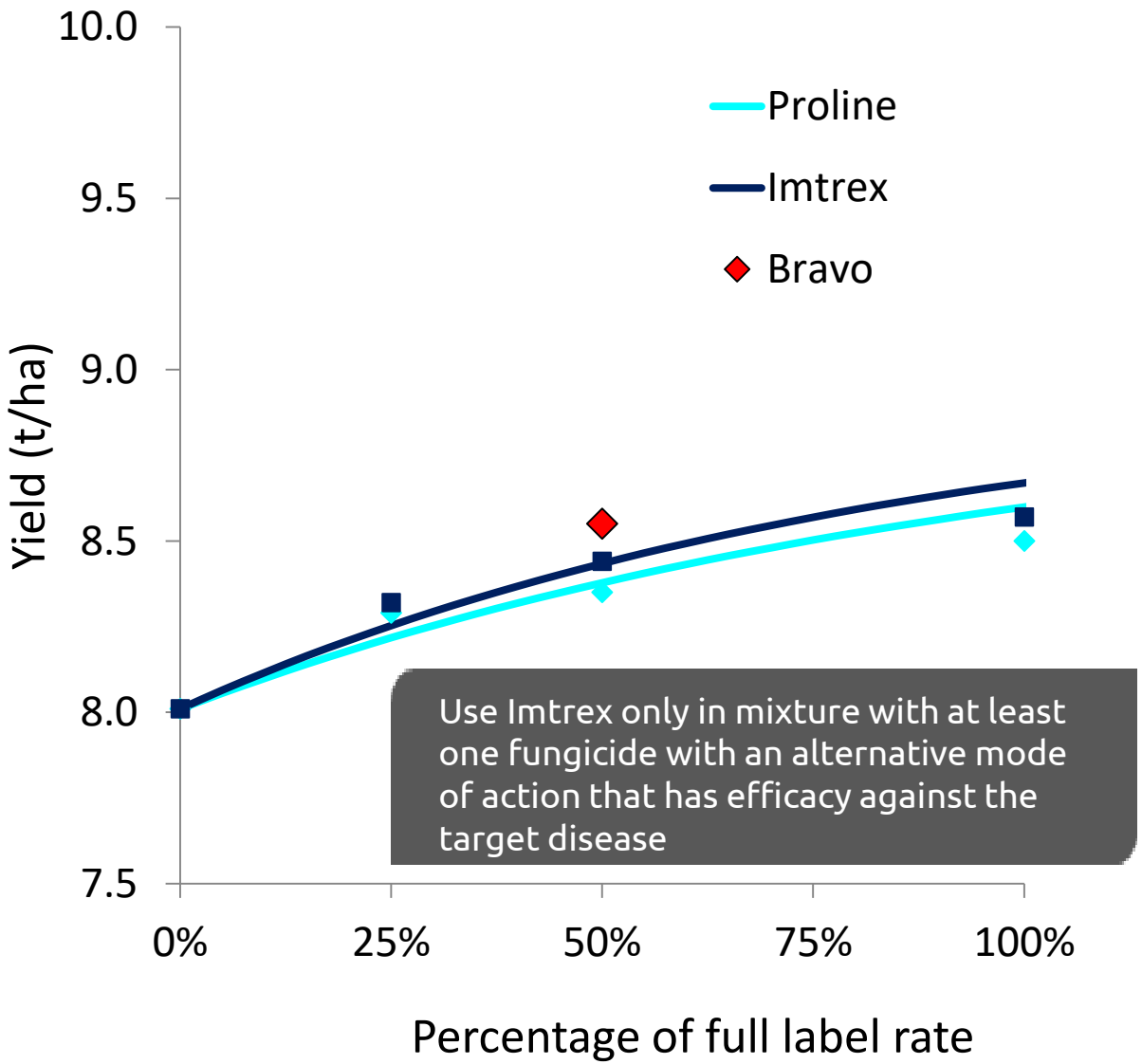
Septoria tritici curative 2019 (2 trials)



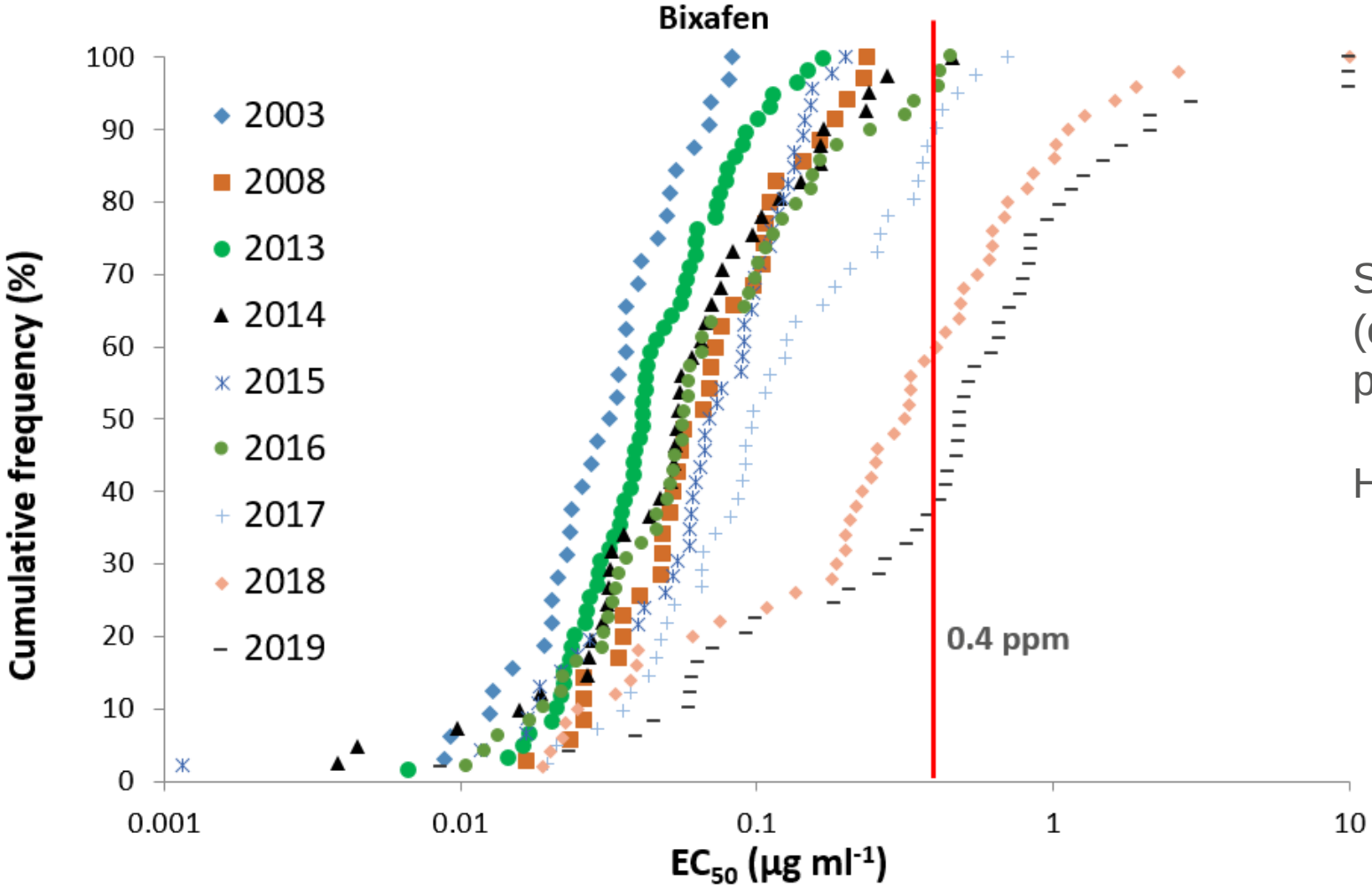


Septoria tritici trial yields 2019 (7 trials)





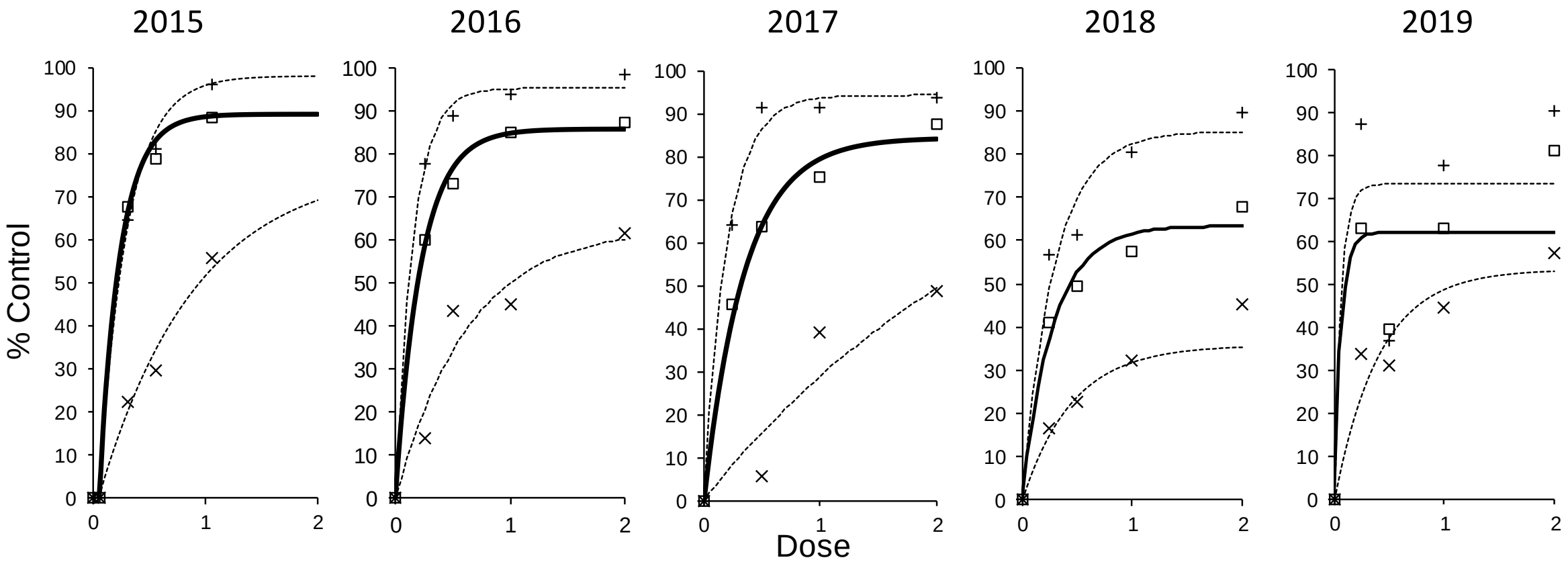
Rothamsted early season monitoring 2019 (n=49)



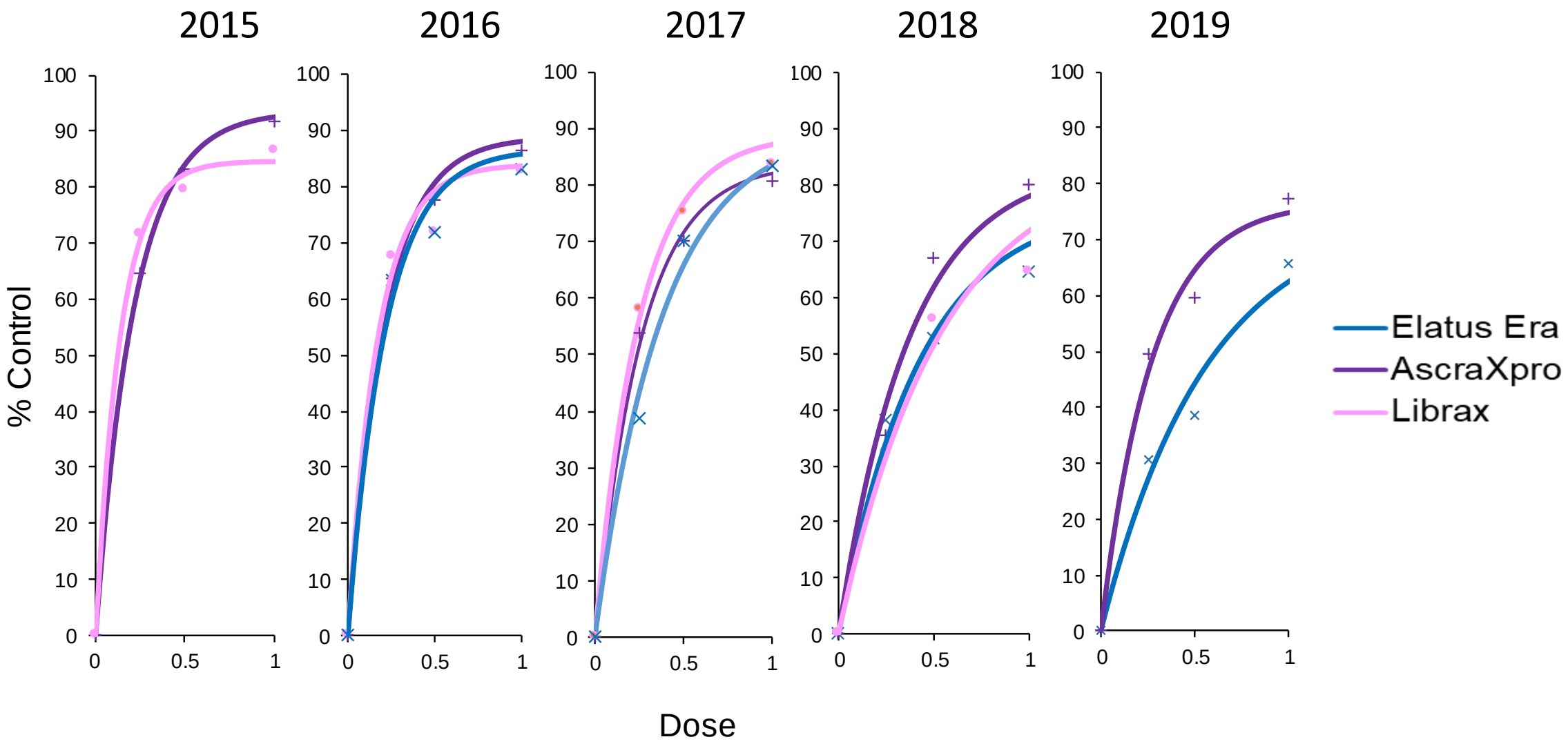
Strains less sensitive to SDHIs (e.g. T79N and N86S) now widely present in populations

H152R overwintered at this site

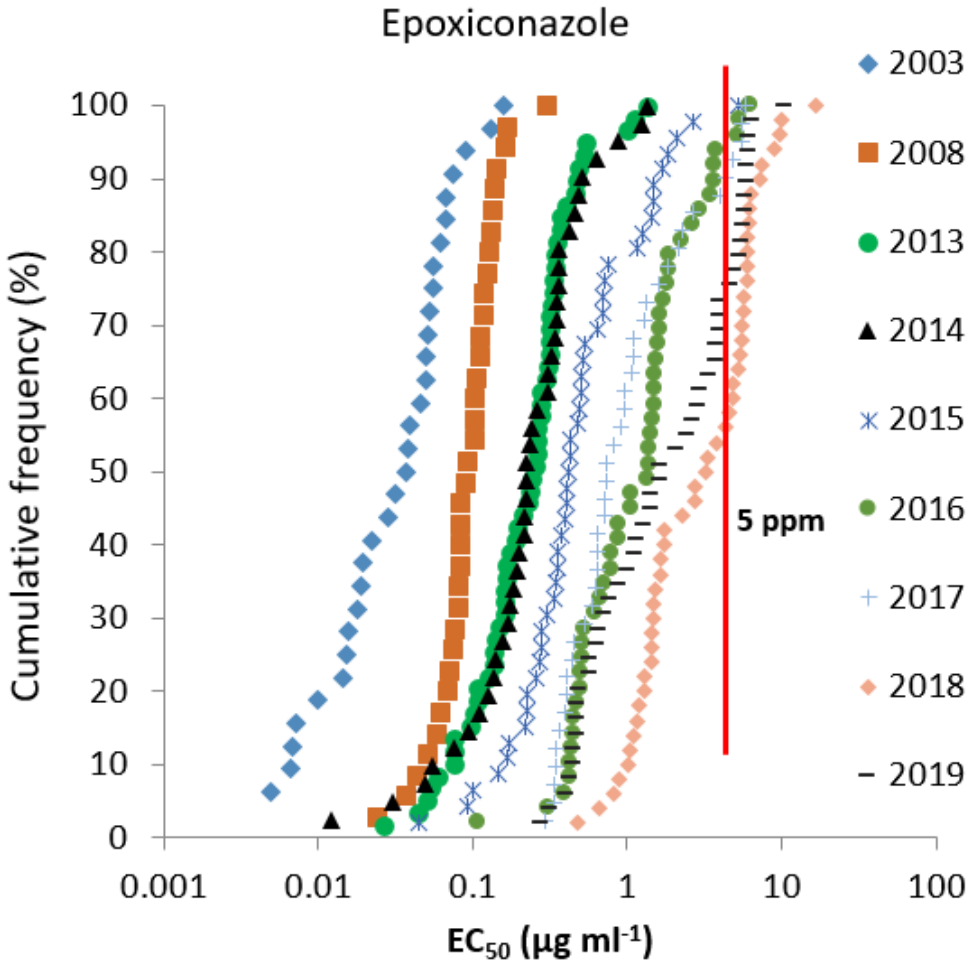
SDHI decline and stabilisation?

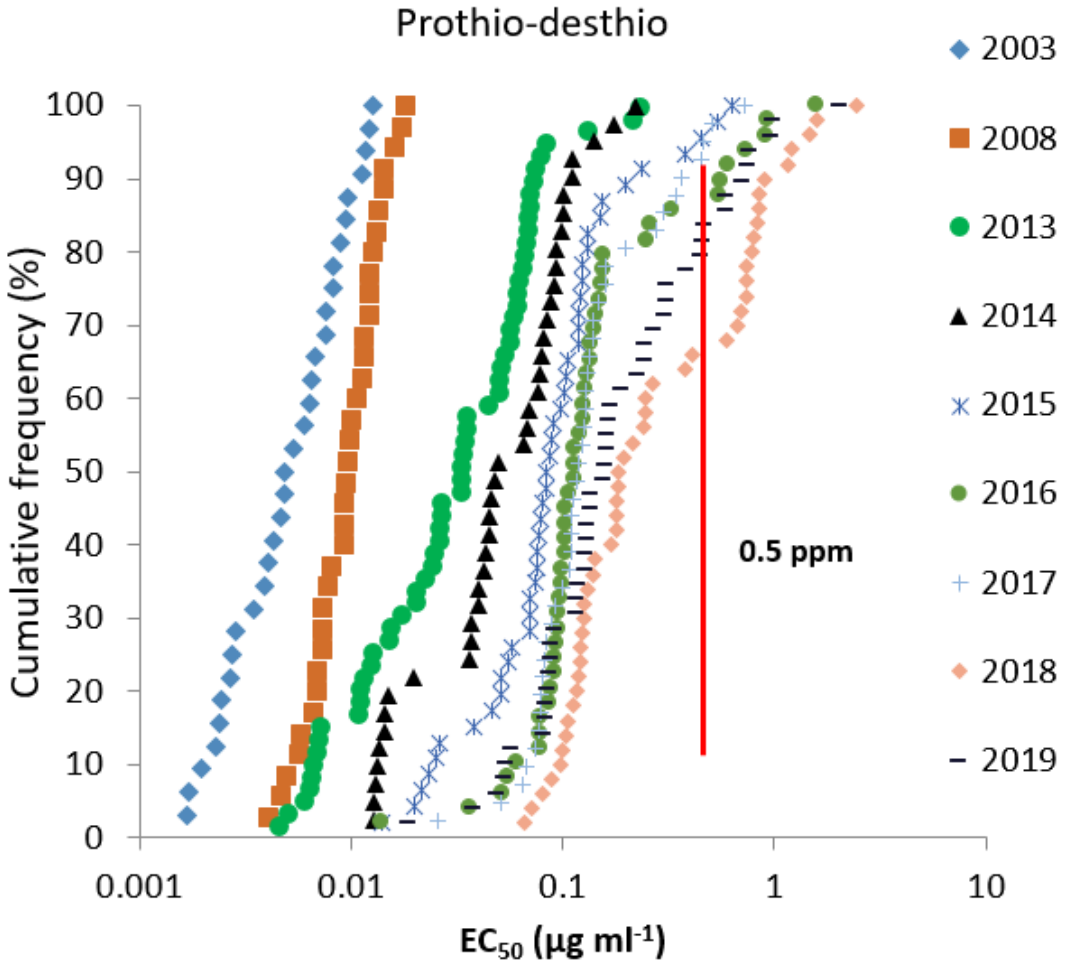


SDHI/azole efficacy on septoria tritici

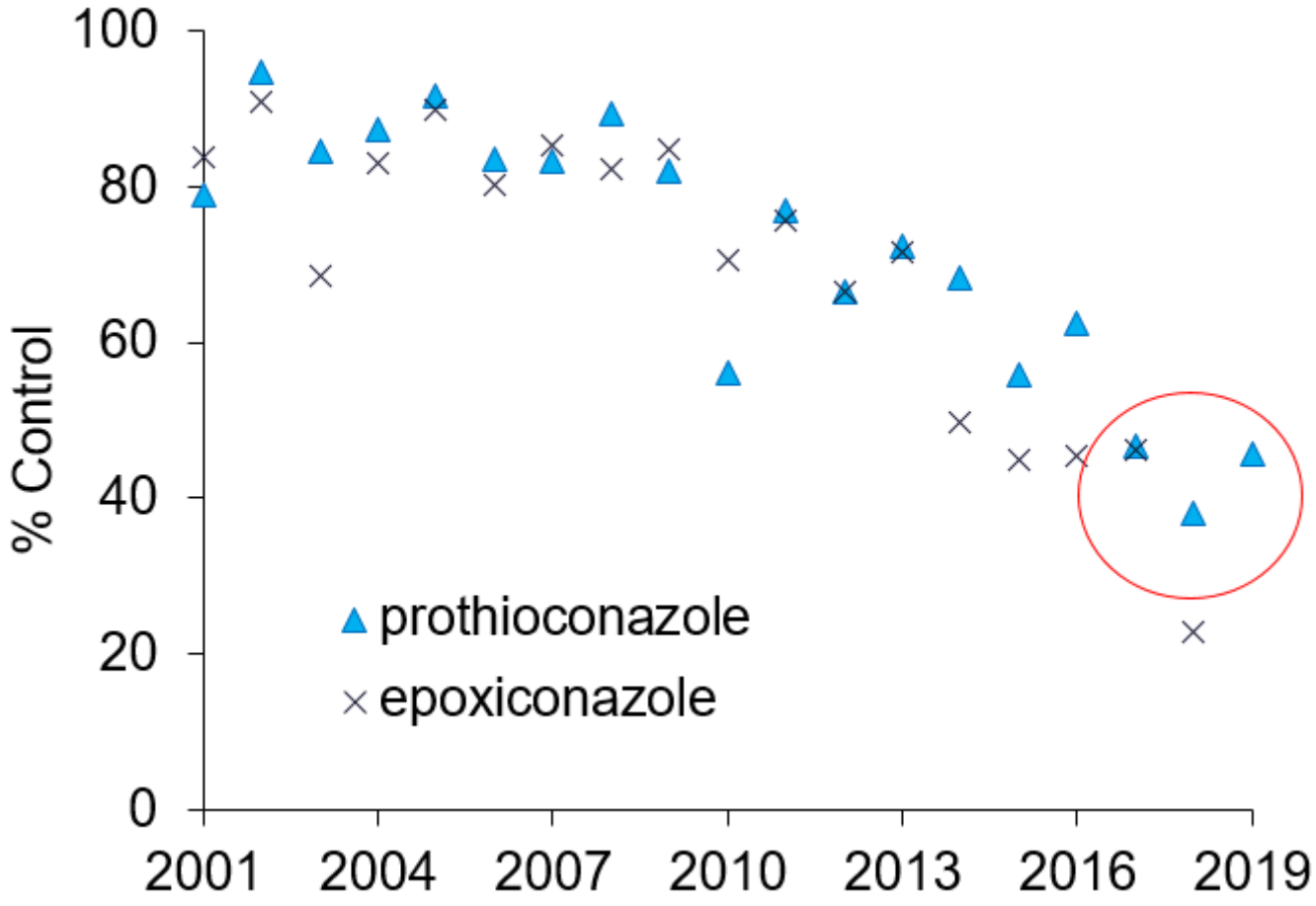


Rothamsted early season monitoring 2019

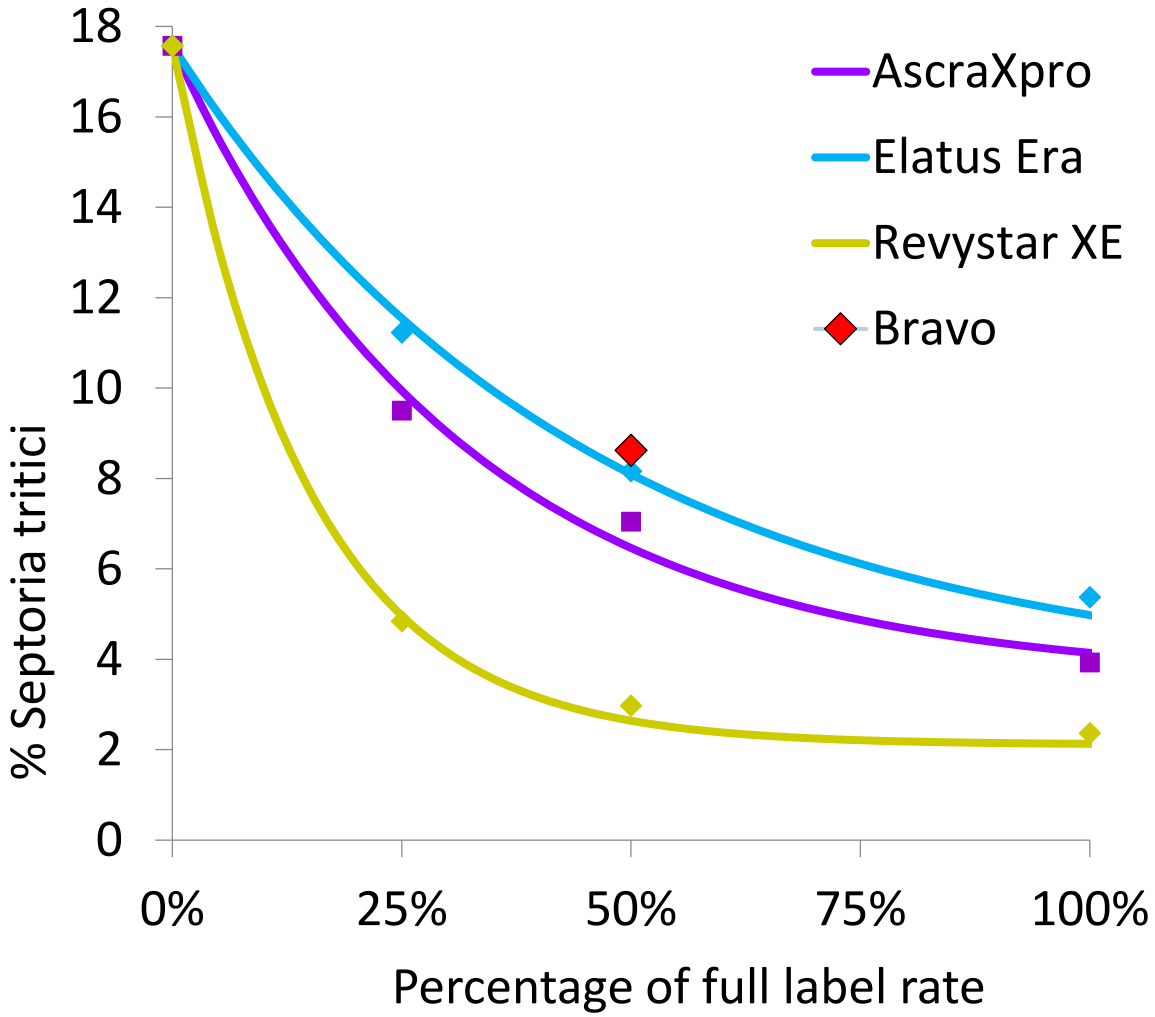


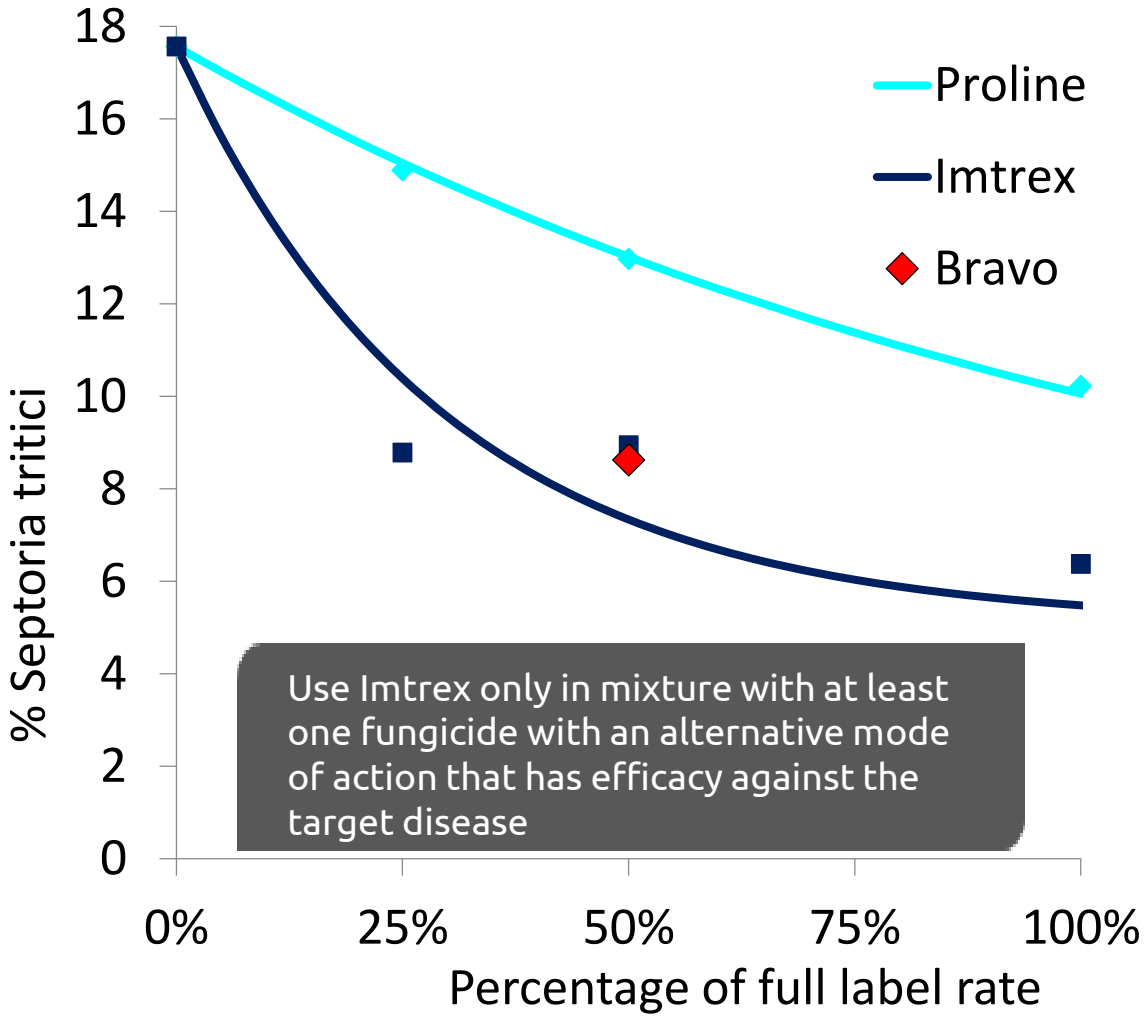


Azole efficacy on septoria tritici (2001–19)
Protectant activity at full rate

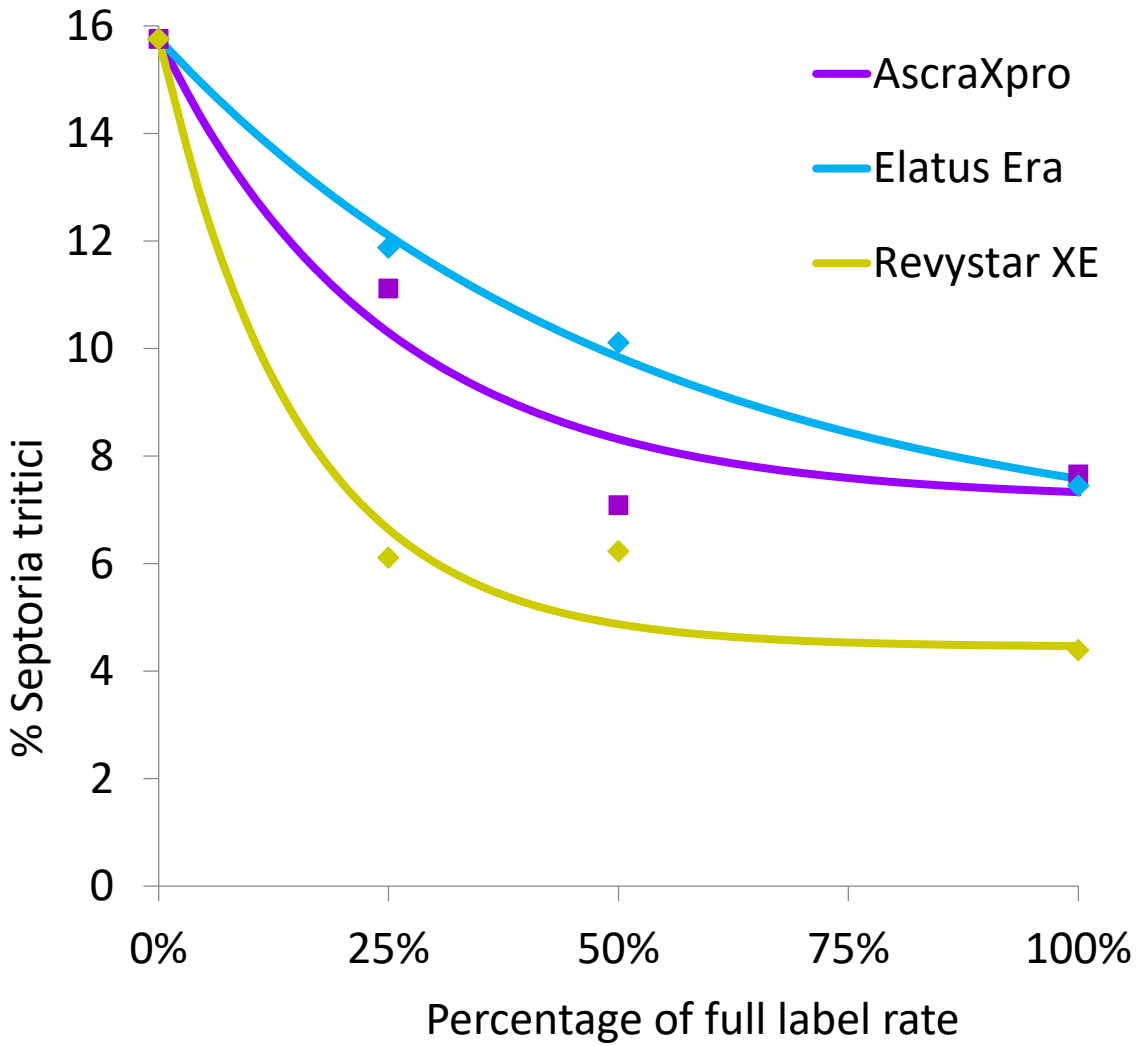


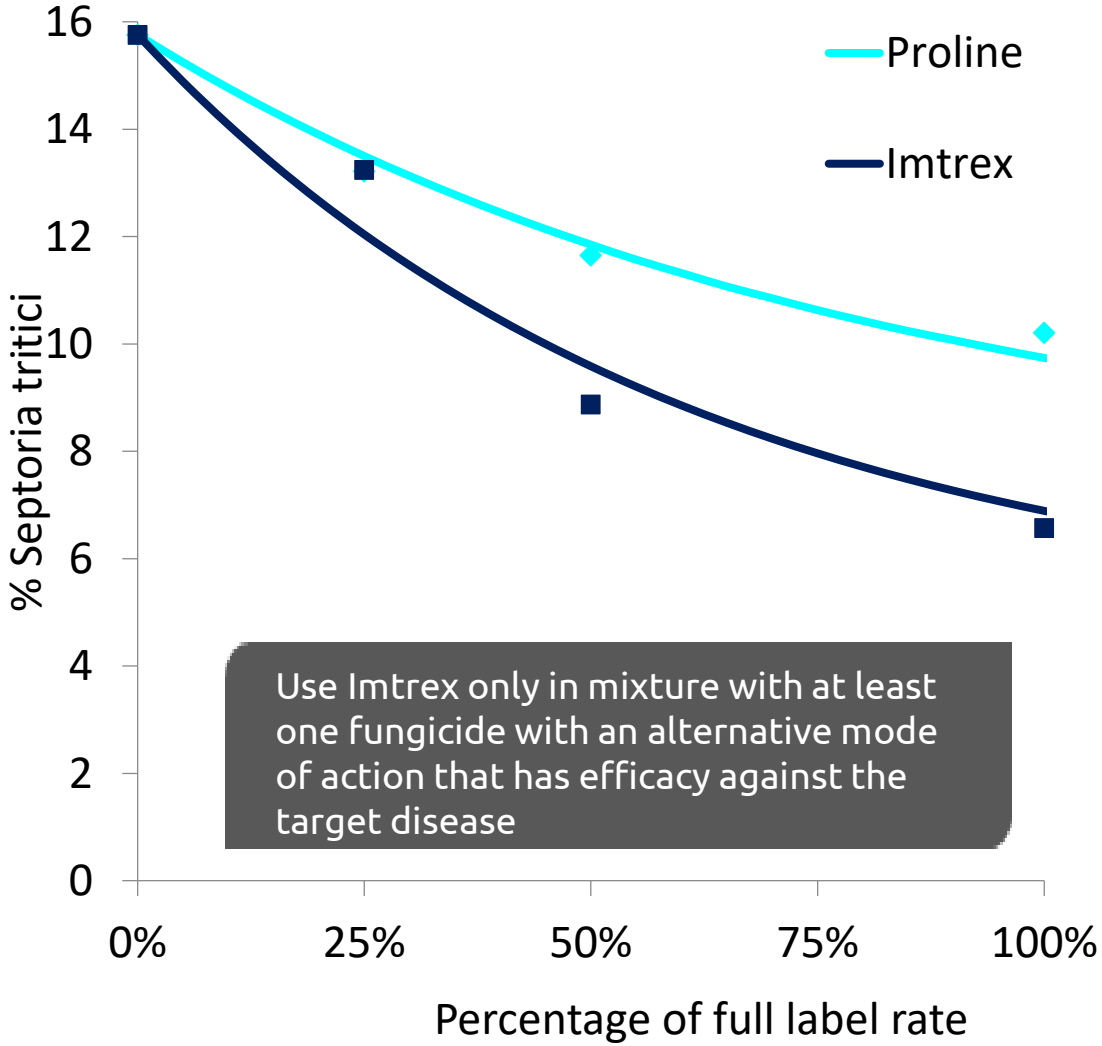
Septoria tritici protectant 2017–19 (15 trials)





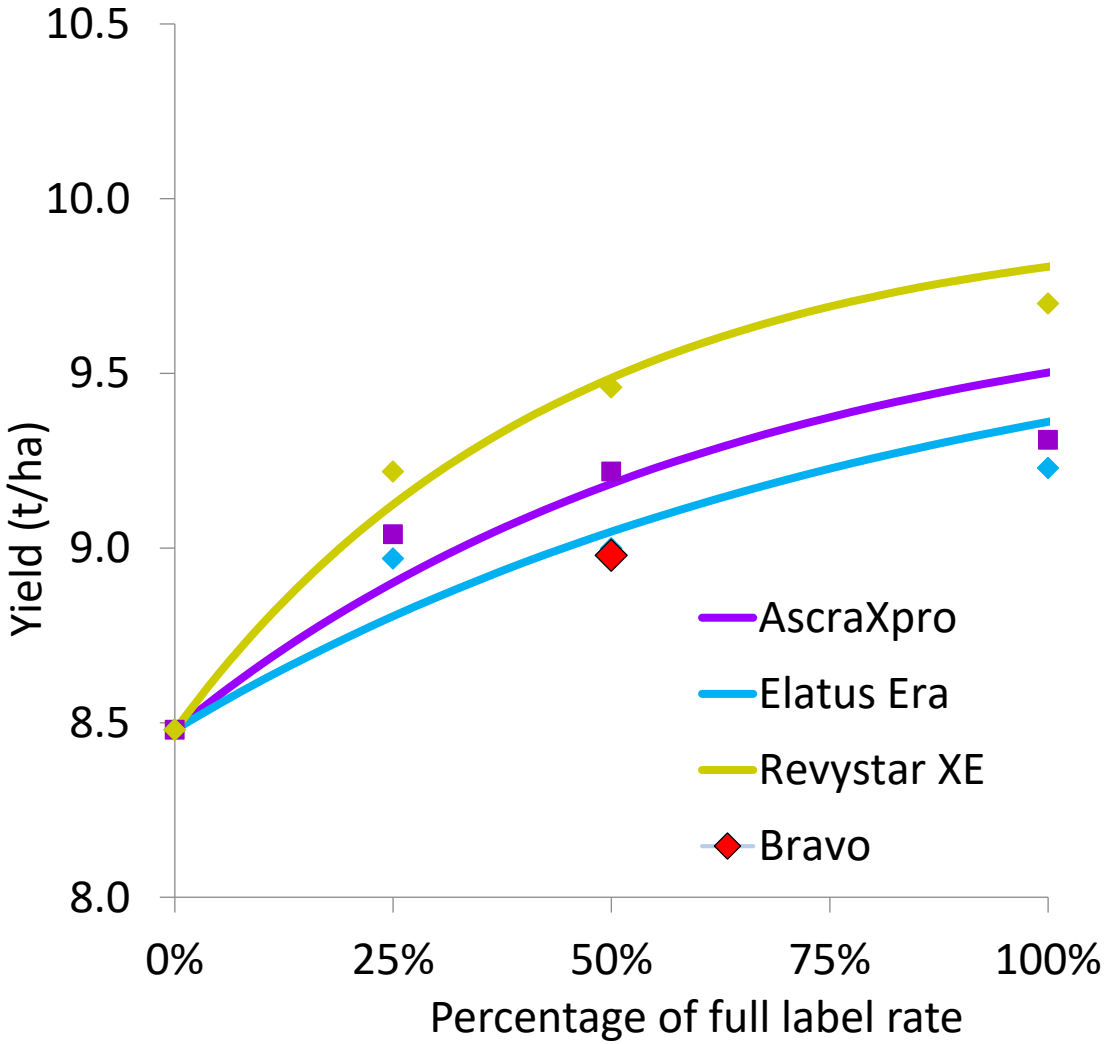
Septoria tritici curative 2017–19 (6 trials)

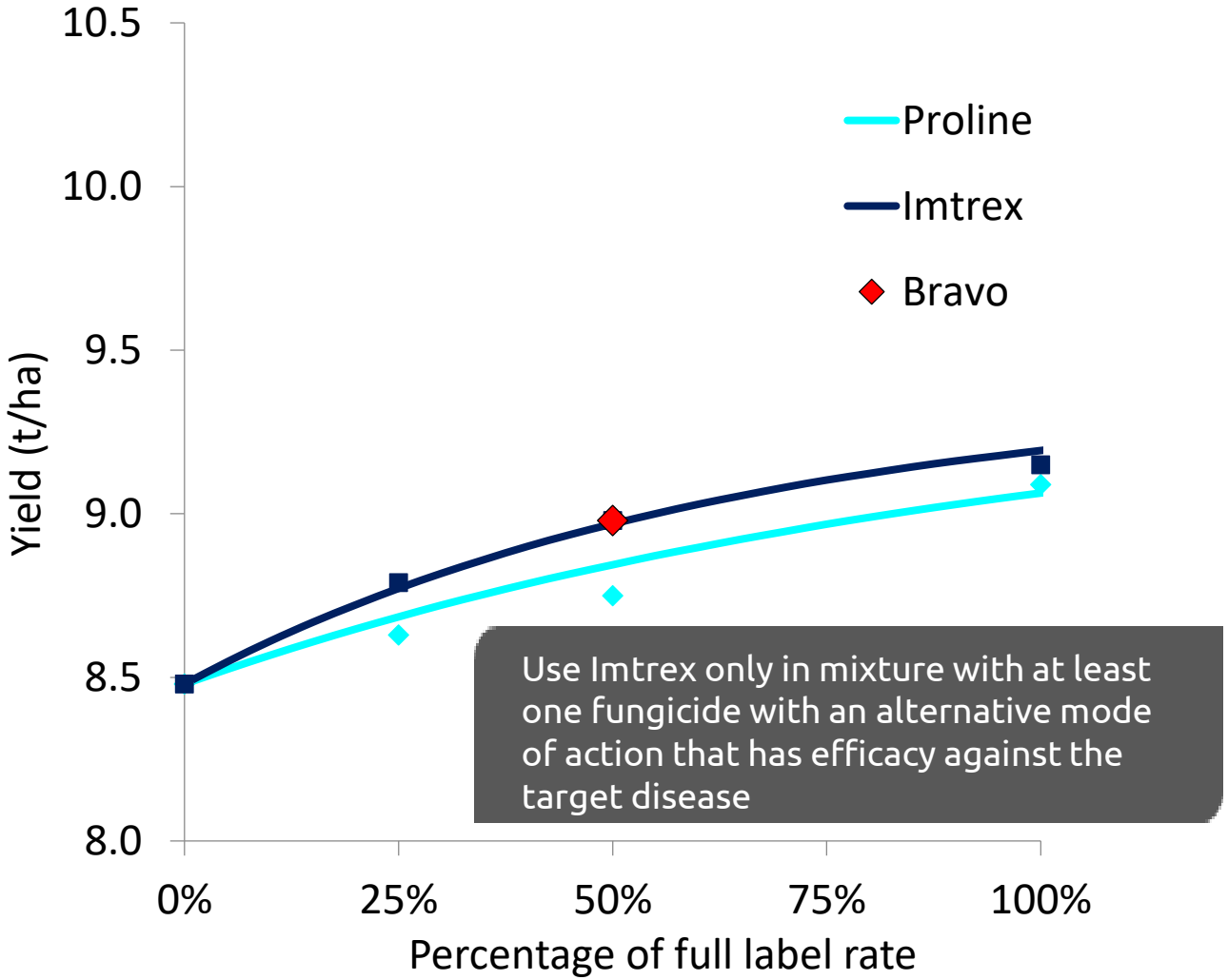




Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease

Septoria tritici trial yields 2017–19 (20 trials)





Yellow rust 2019

Reflection (near Kings Lynn)

Yellow rust – widespread in 2019

RL ratings changes

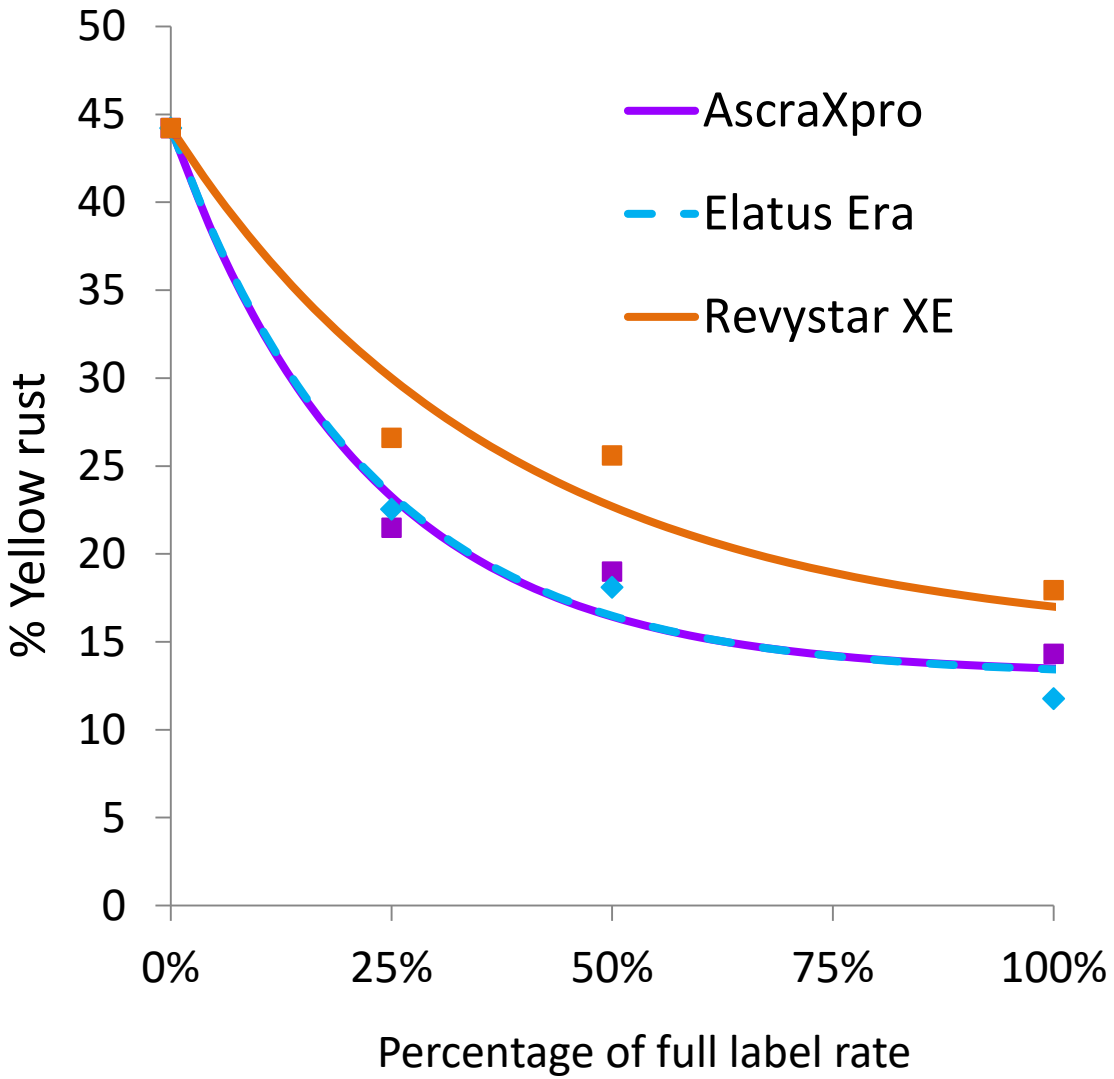
Zyatt 8 to 7

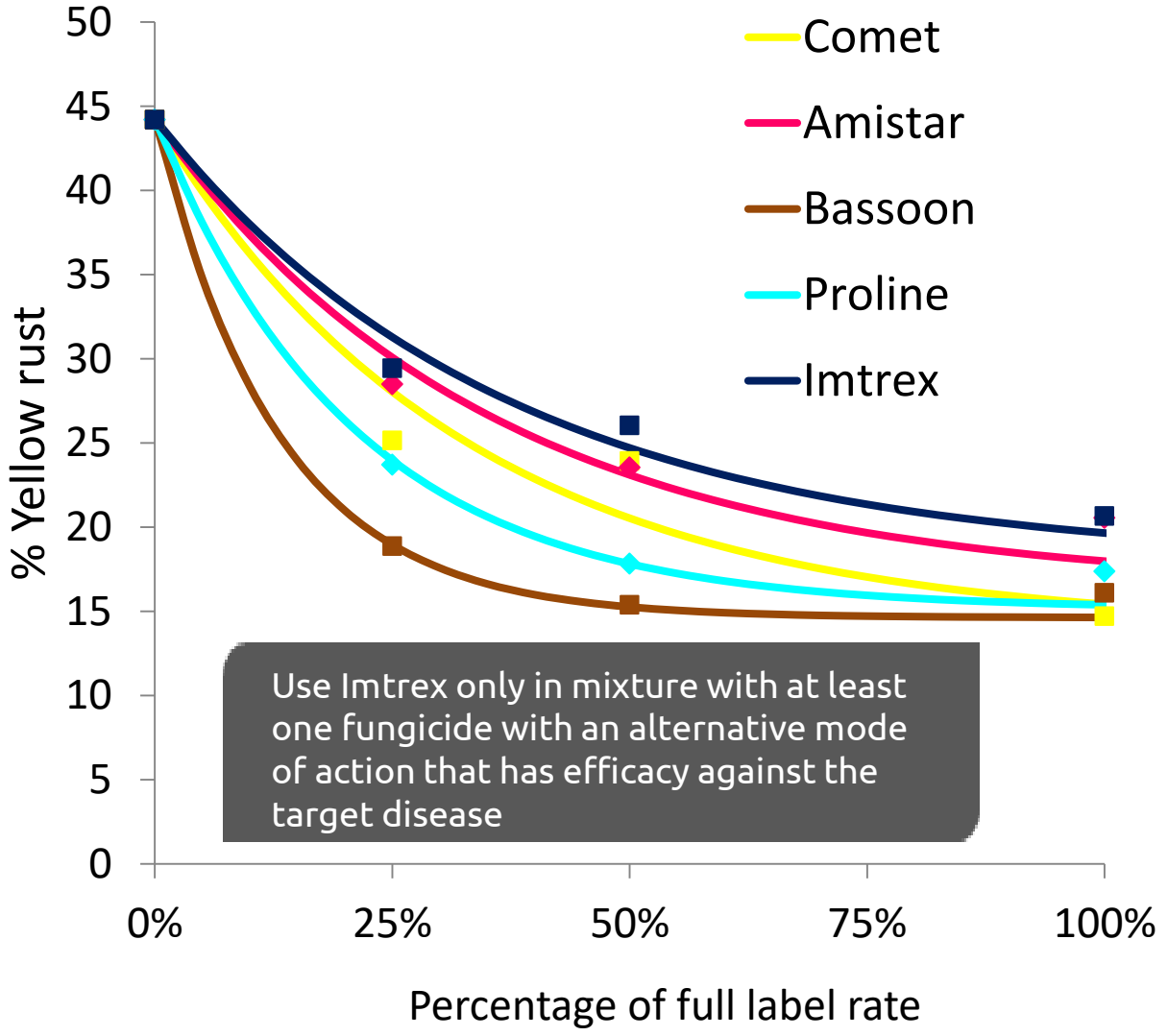
Bennington 6 to 5

Viscount 7 to 6

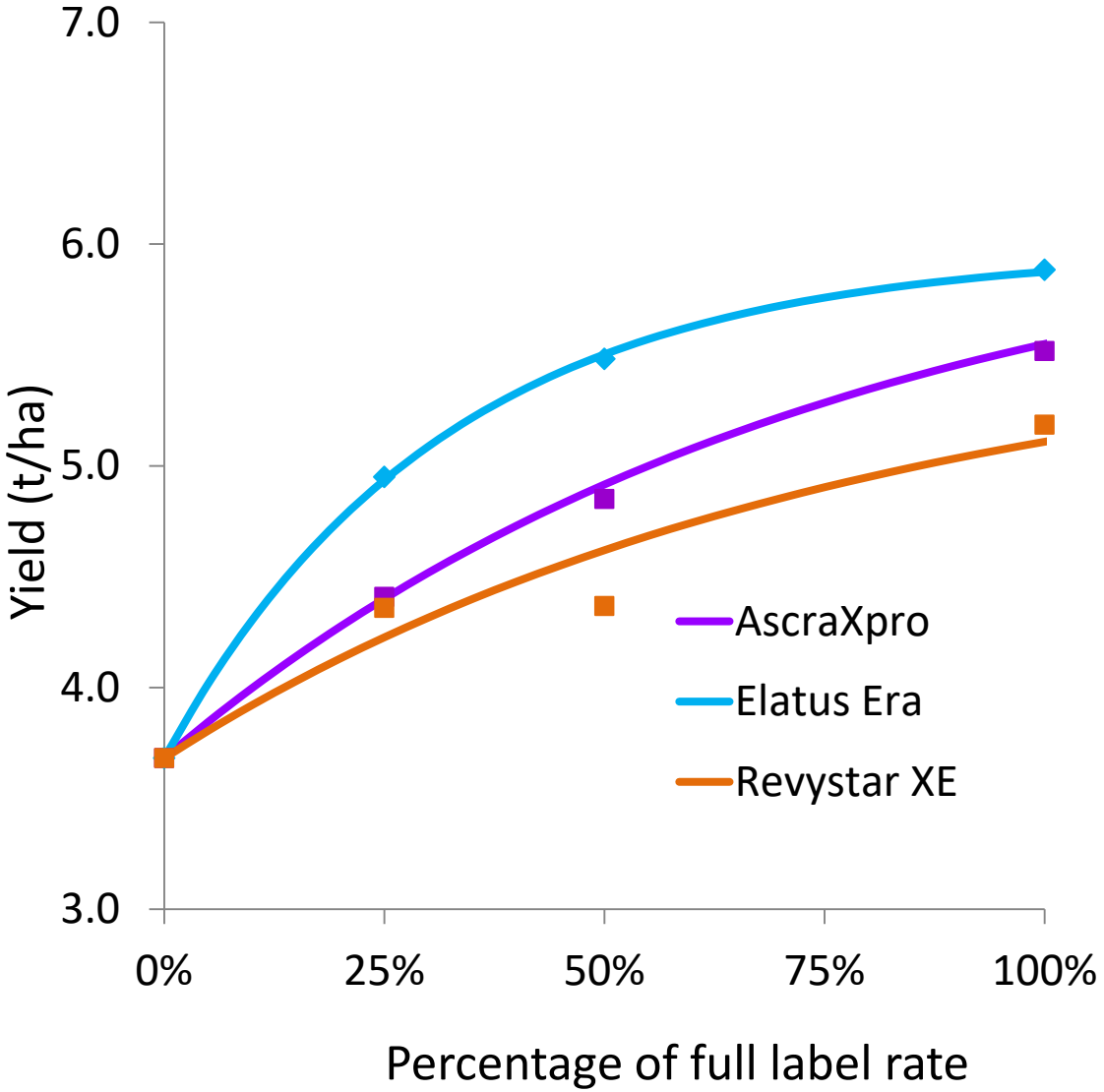
Late sowings can be higher risk

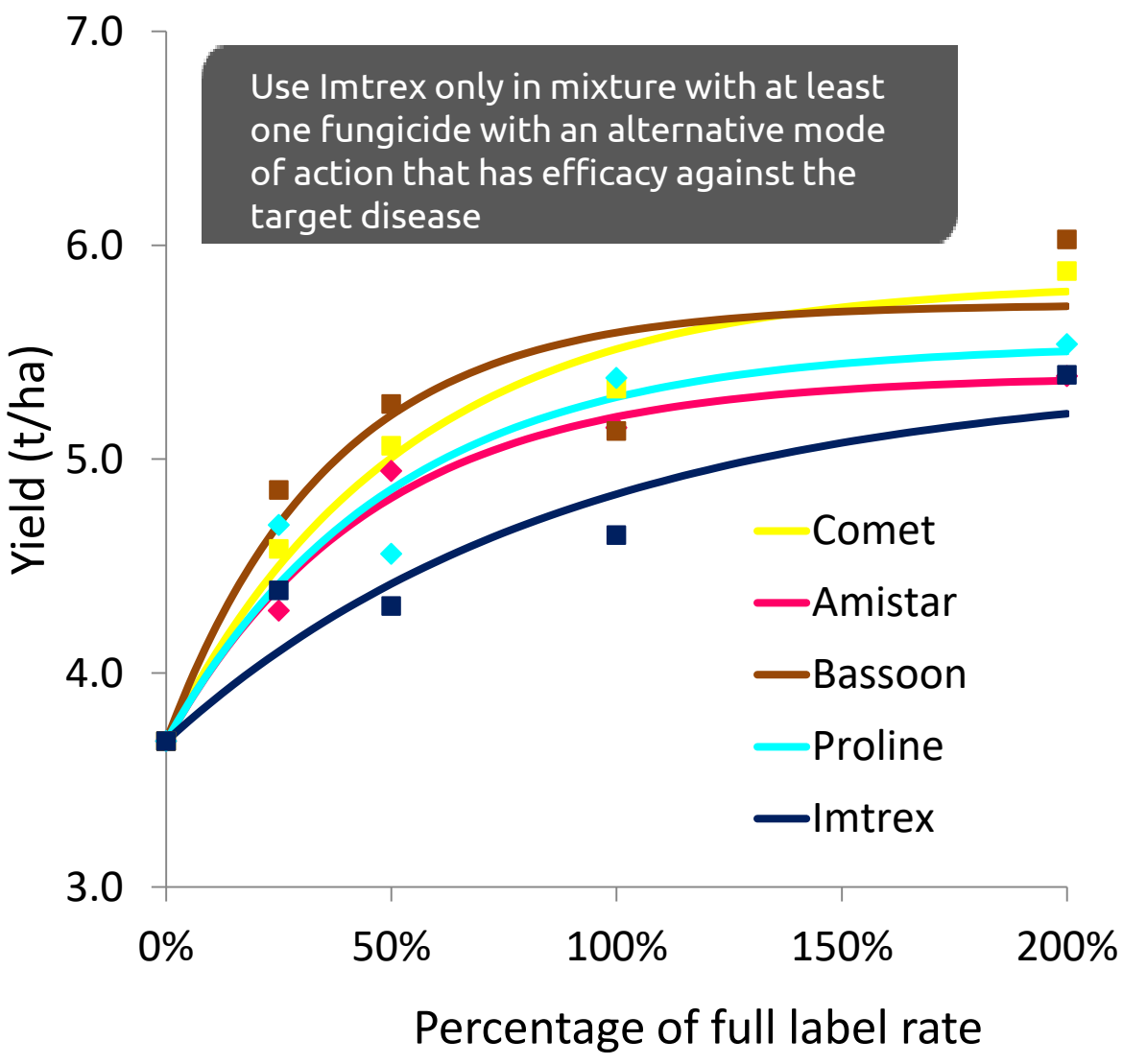
Yellow rust 2019 (1 trial)





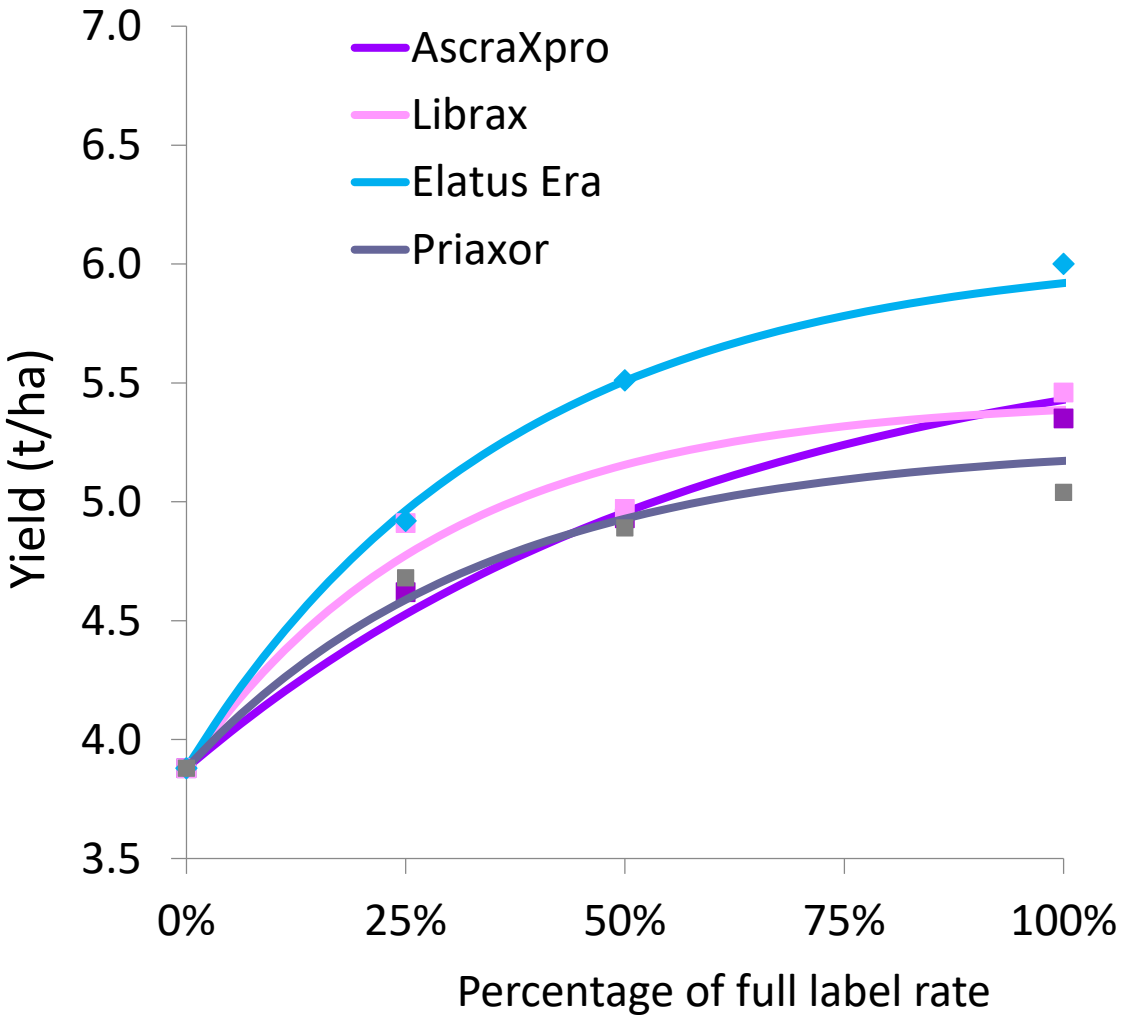
Yellow rust trial yields 2019 (1 trial)

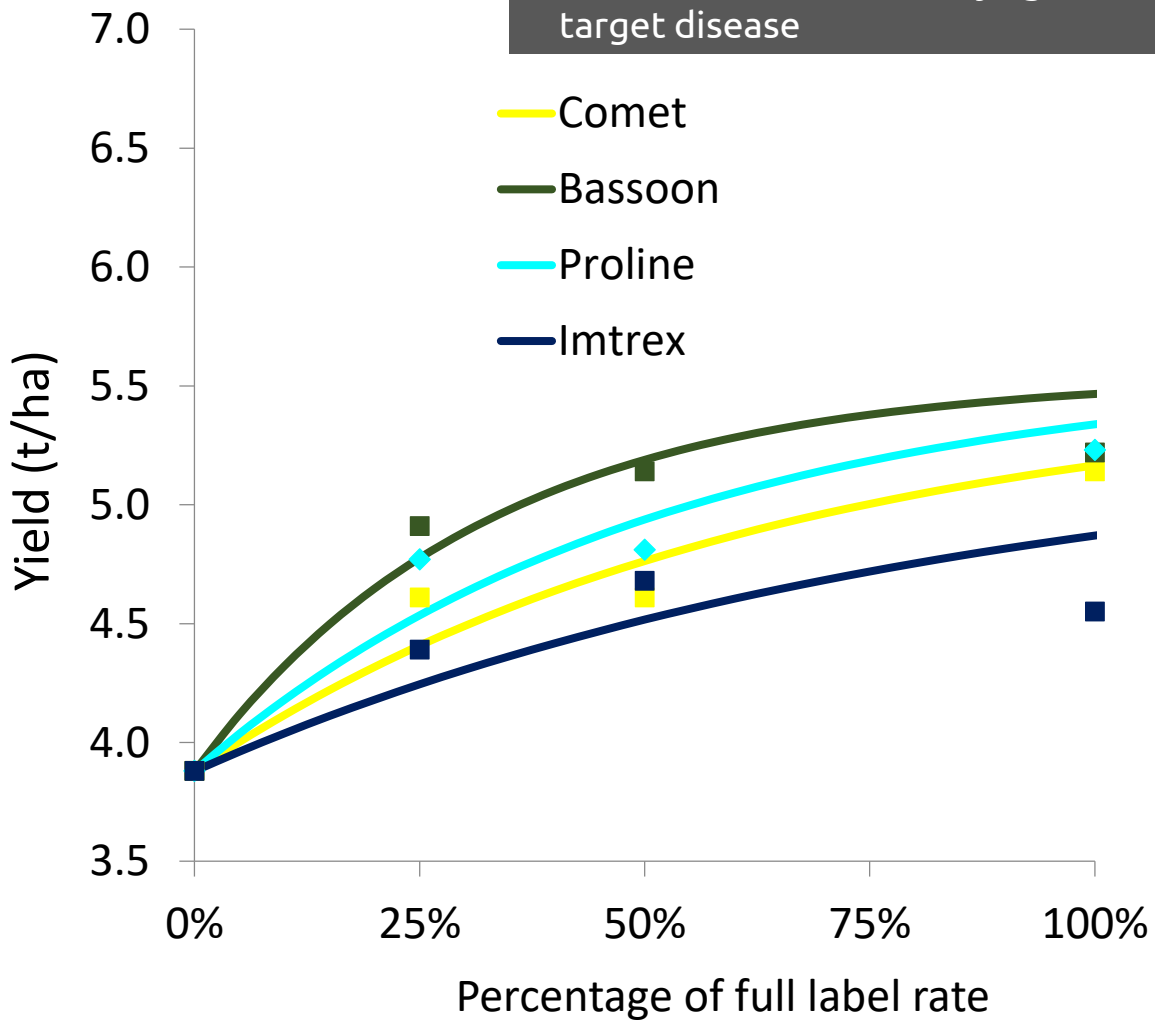




Yellow rust yield 2017–19 (3 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease





Priaxor = fluxapyroxad + pyraclostrobin

Brown rust 2019
Crusoe (Cambridge)

Slow to develop in 2019 following cool spring weather

RL ratings changes

Firefly 8 to 6

Viscount 9 to 8

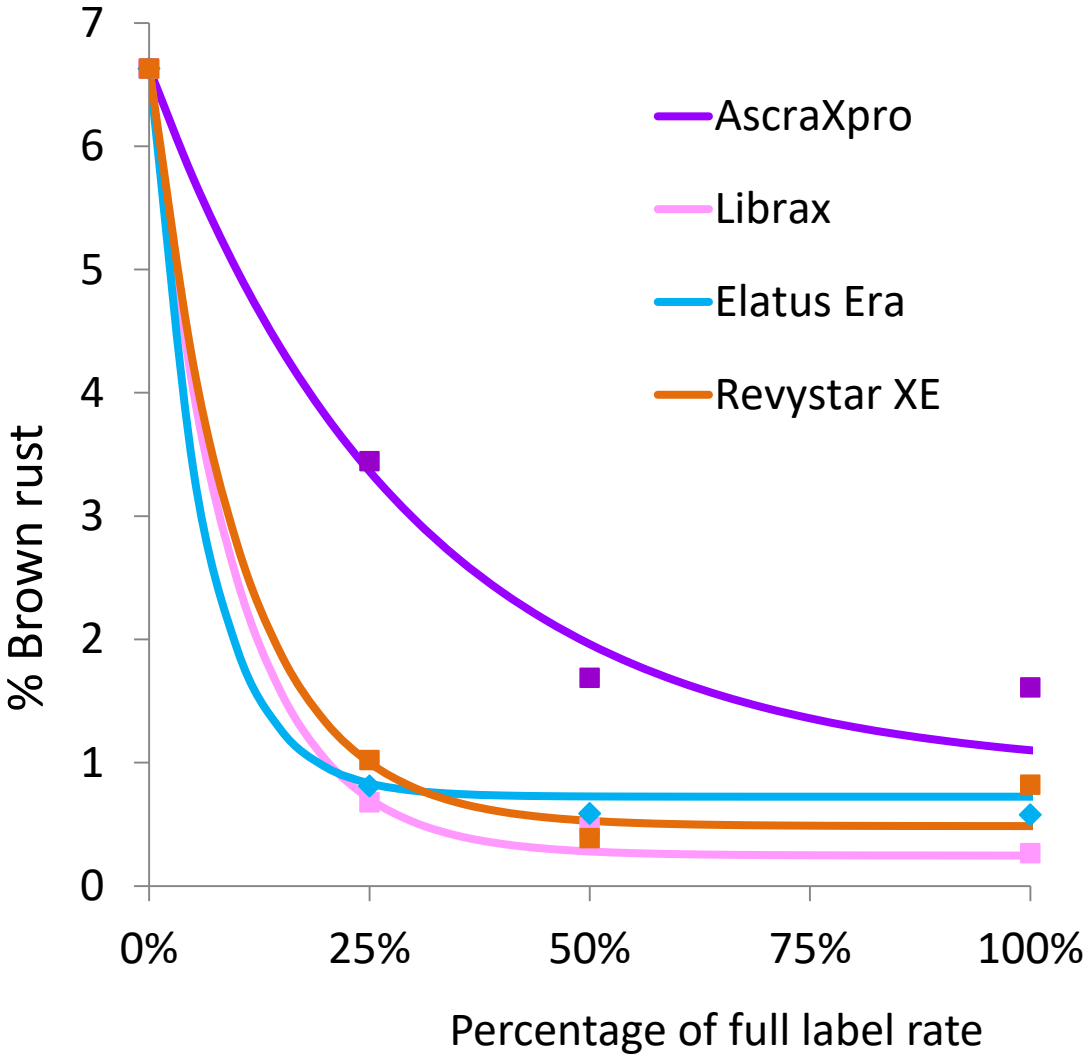
Skyscraper 5 to 6

Spotlight 6 to 7

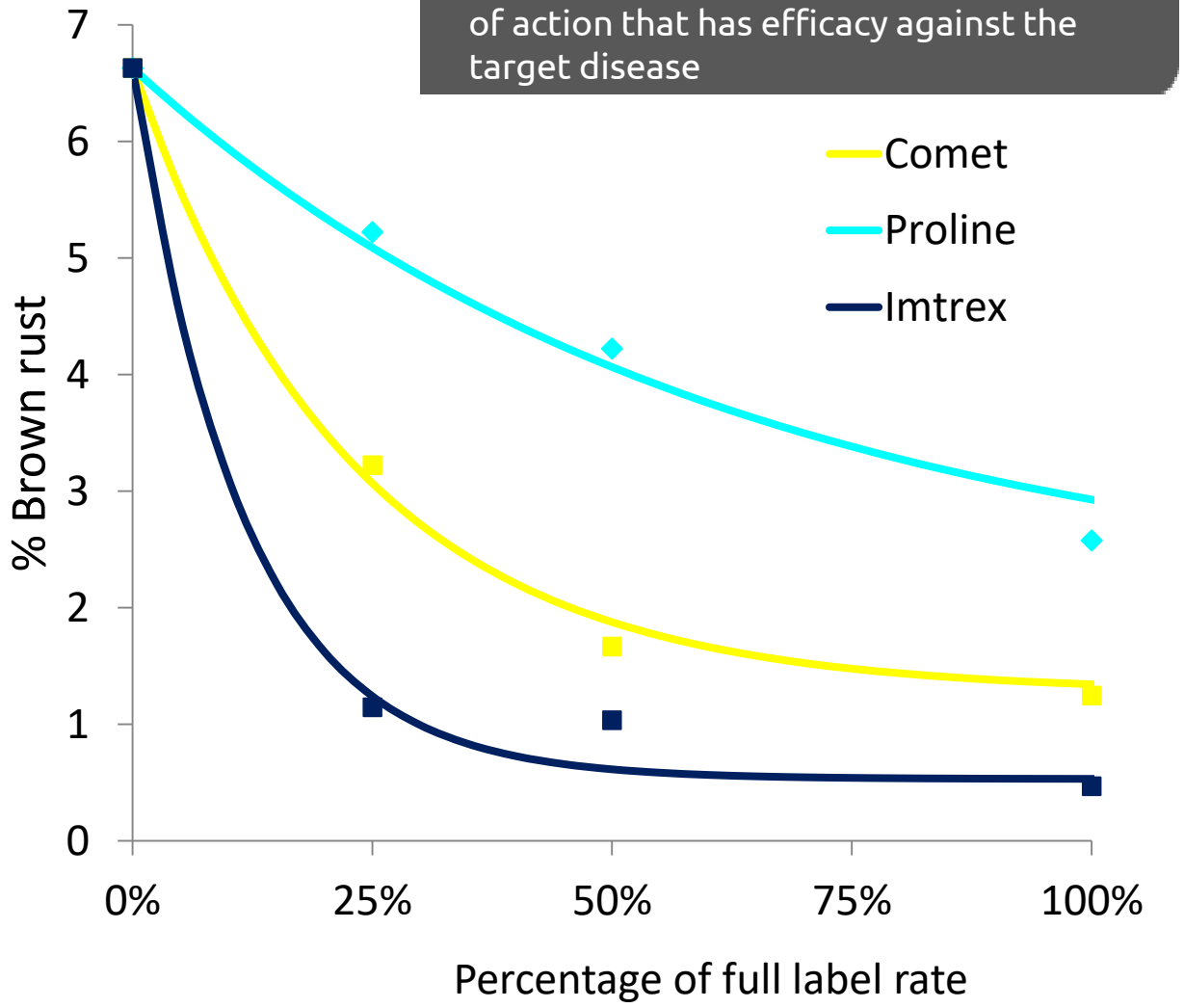
Fungicide performance trial (Cambridge)

- Crusoe
- GS 39 application

Brown rust 2019 (1 trial)

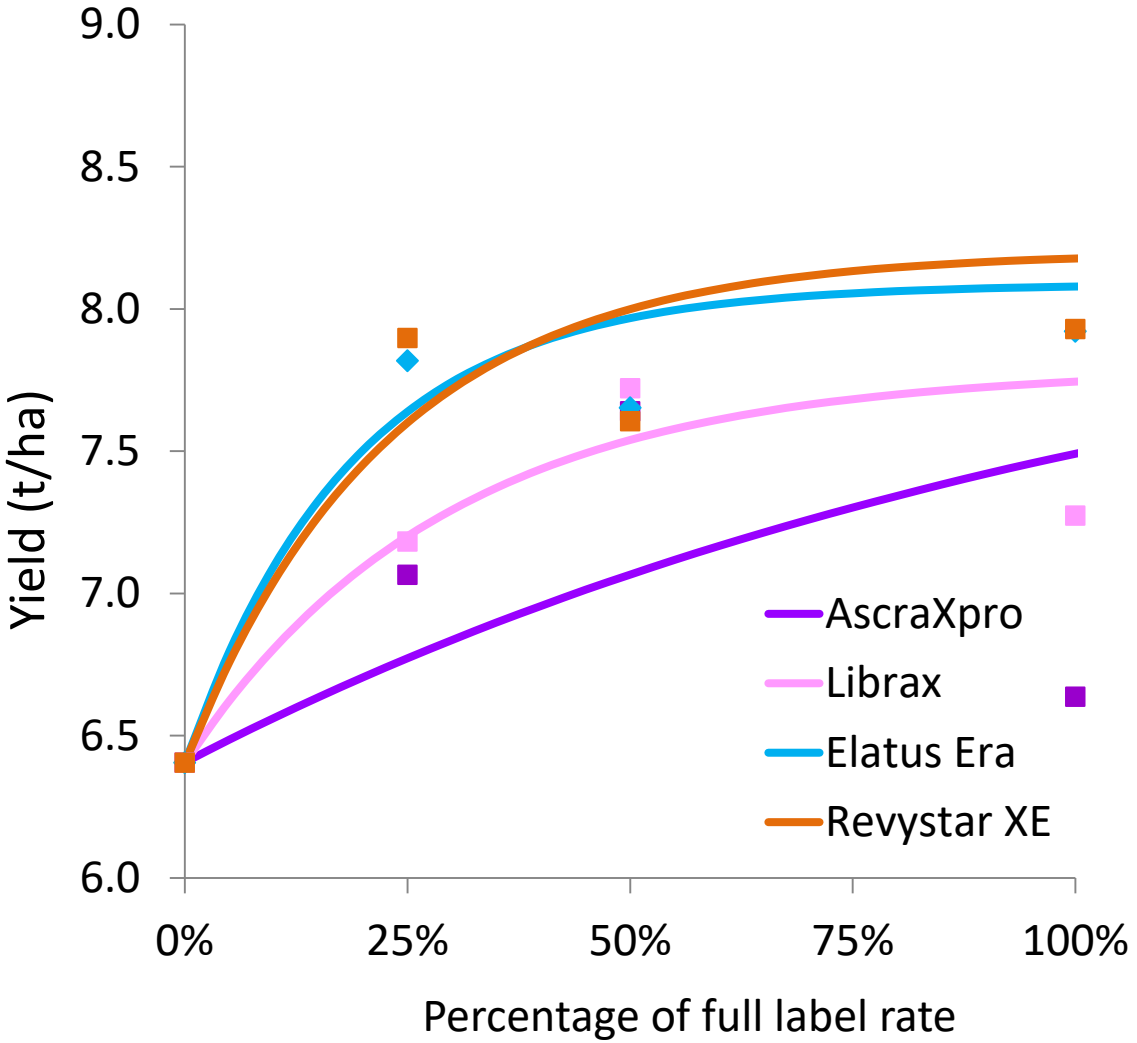


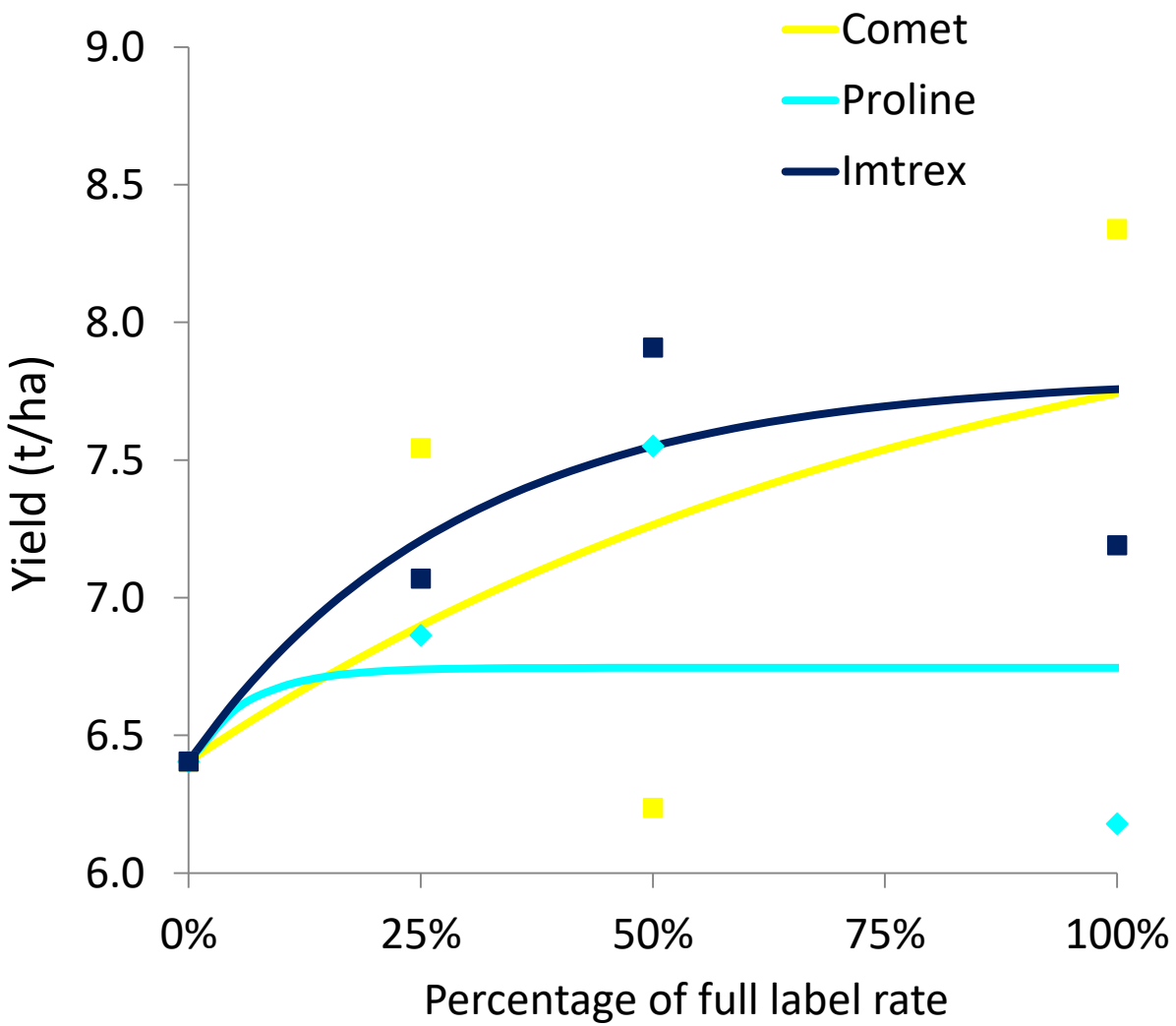
Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease



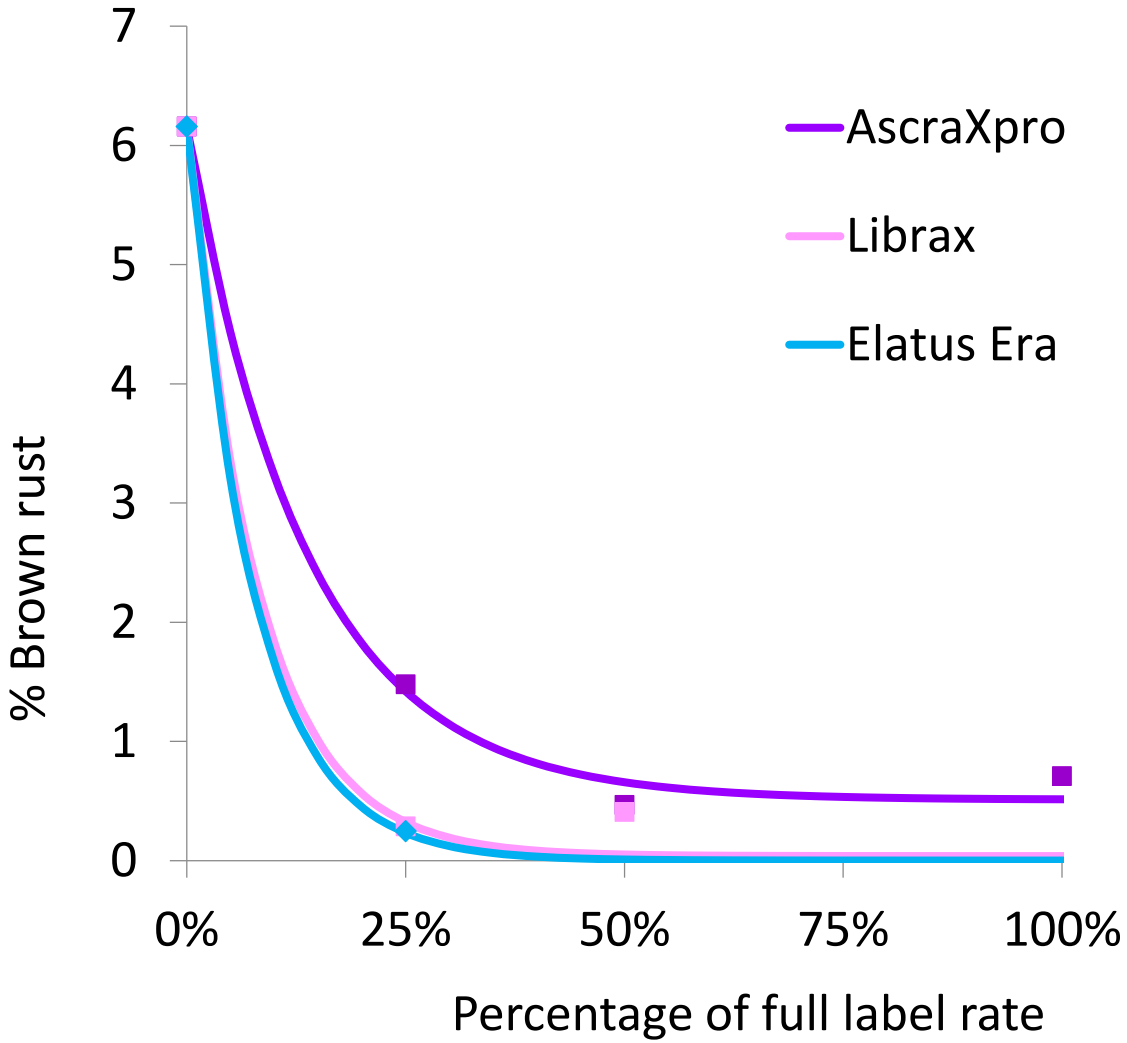
Brown rust yield 2019 (1 trial)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease

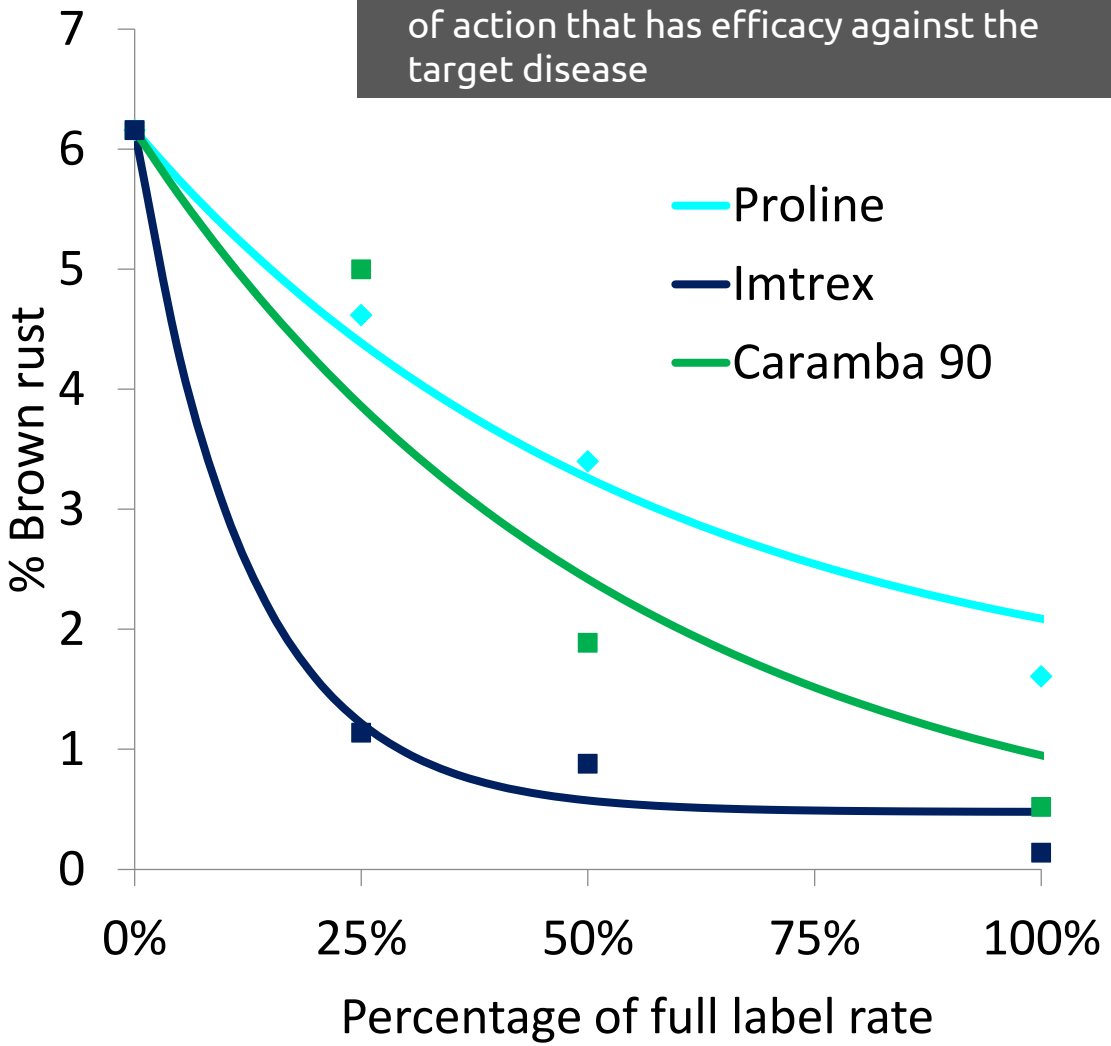




Brown rust 2017–19 (3 trials)



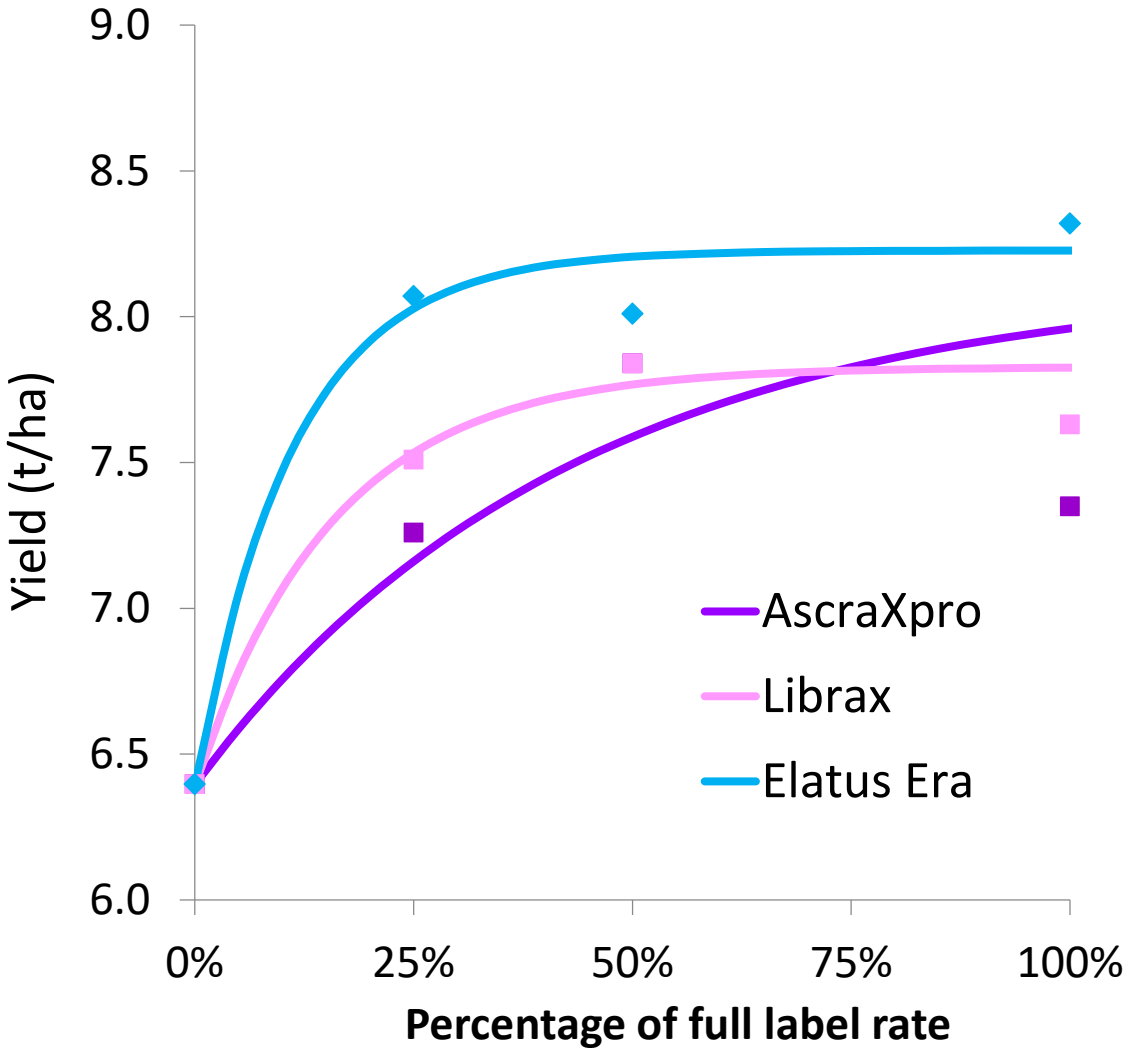
Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease

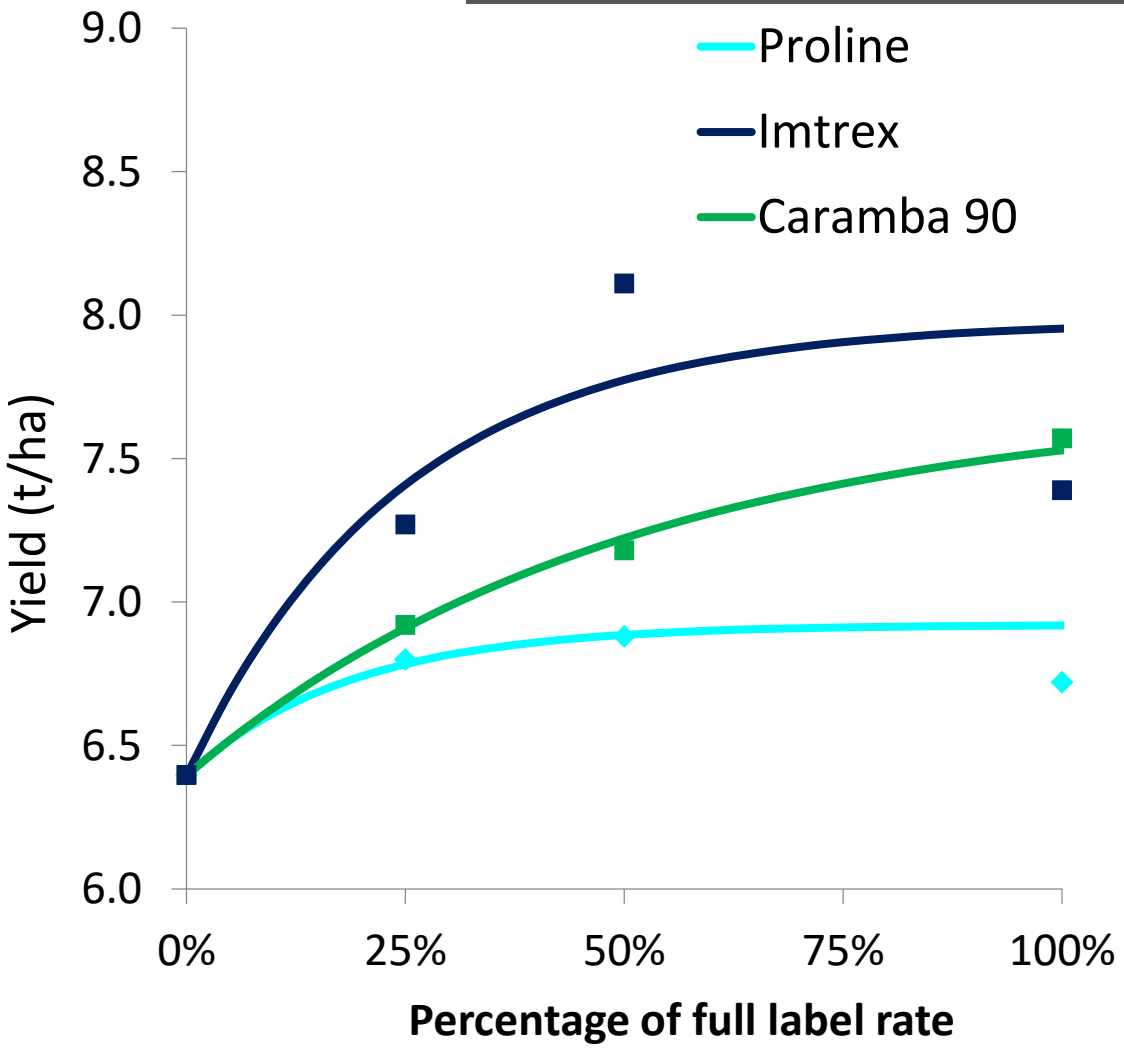


Caramba 90 = metconazole

Brown rust yields 2017–19 (3 trials)

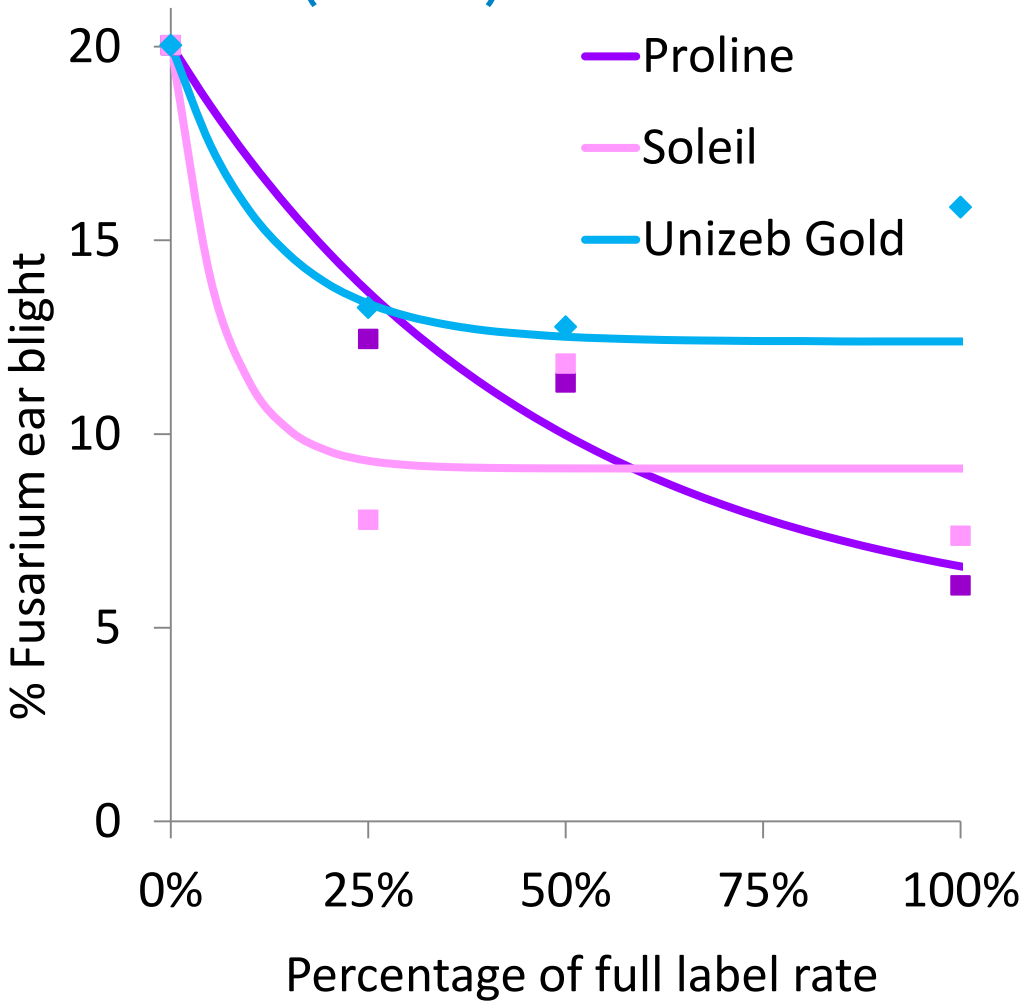
Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease



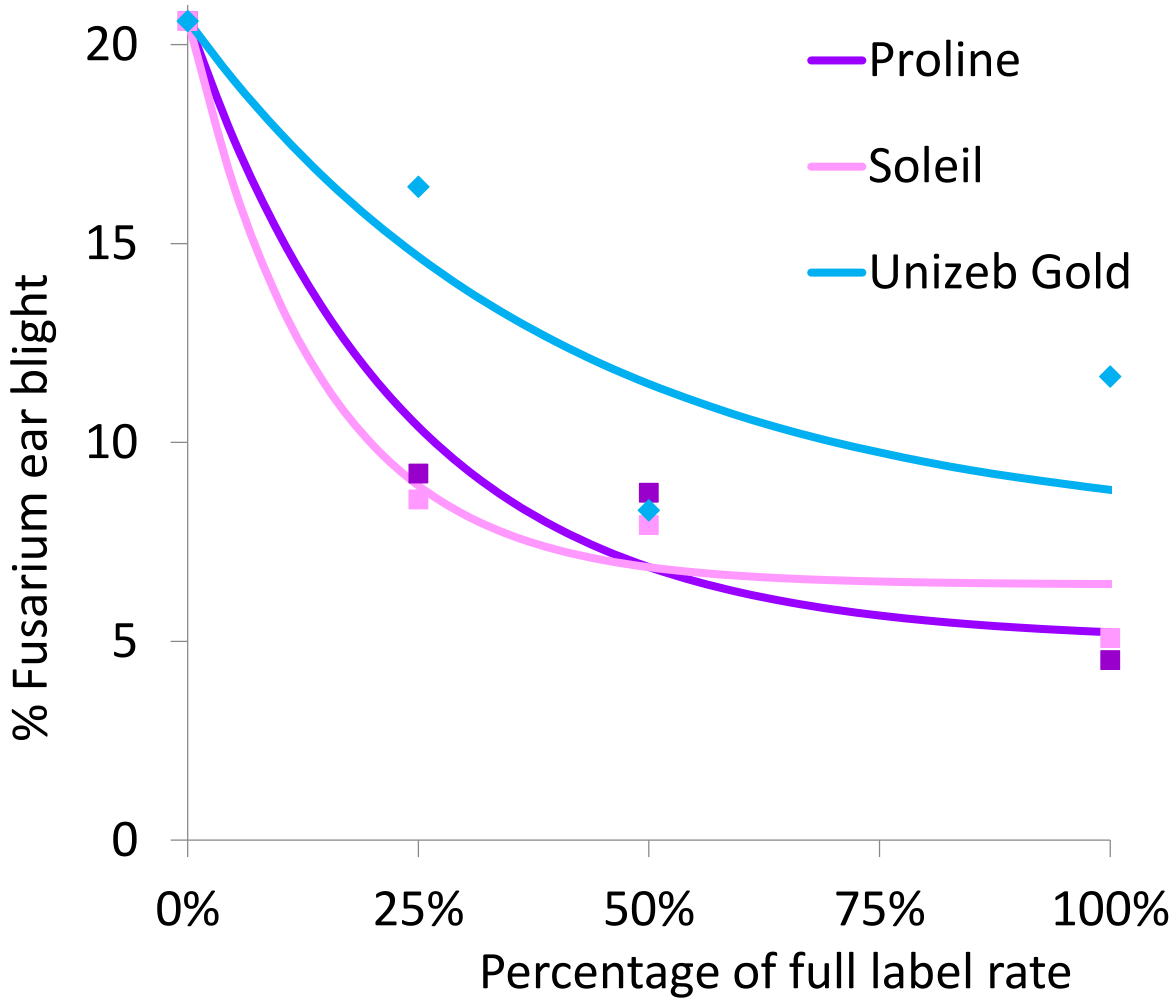


Fusarium trial (inoculated)
Zyatt (near Mansfield, Nottinghamshire)

2019 (1 trial)

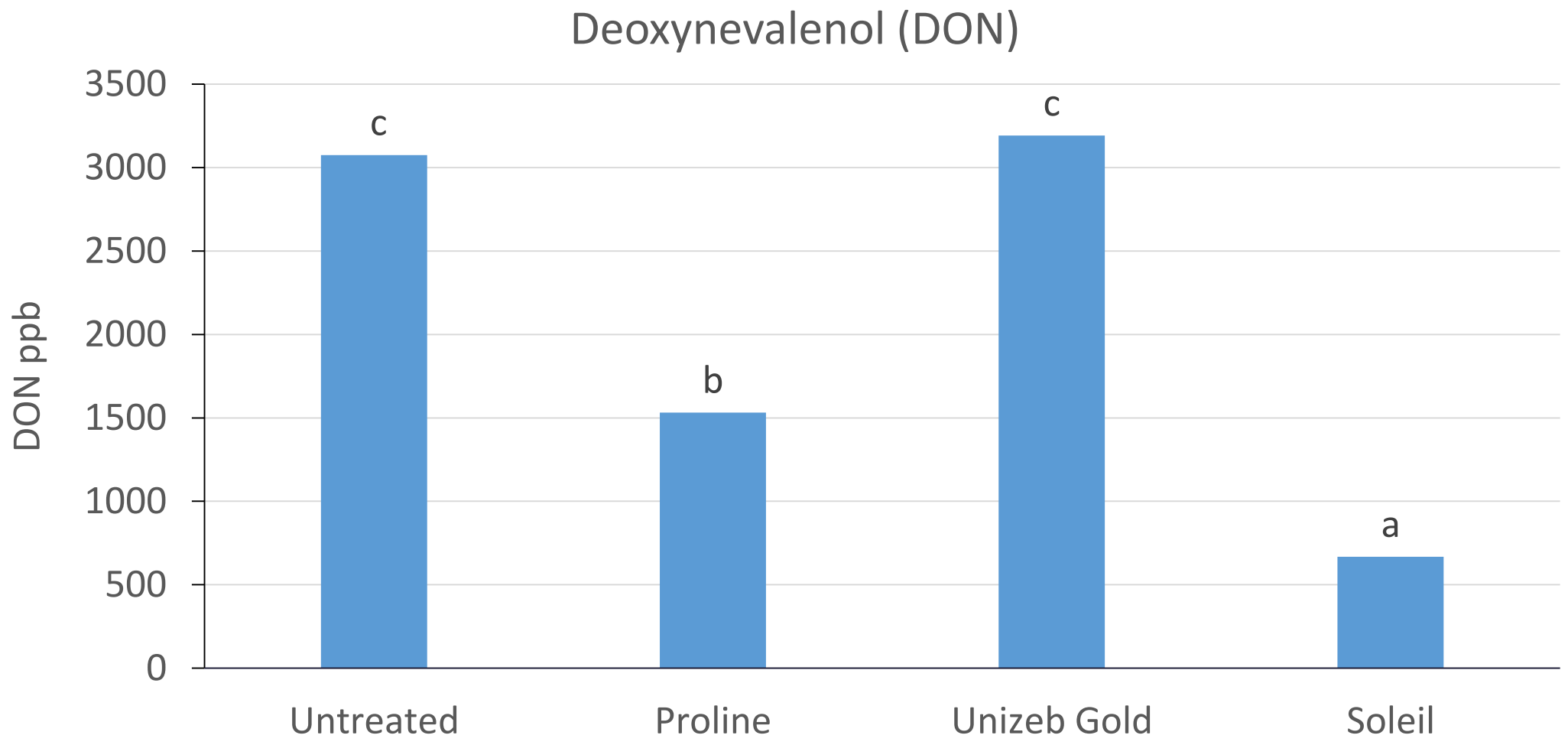


2018–19 (2 trials)



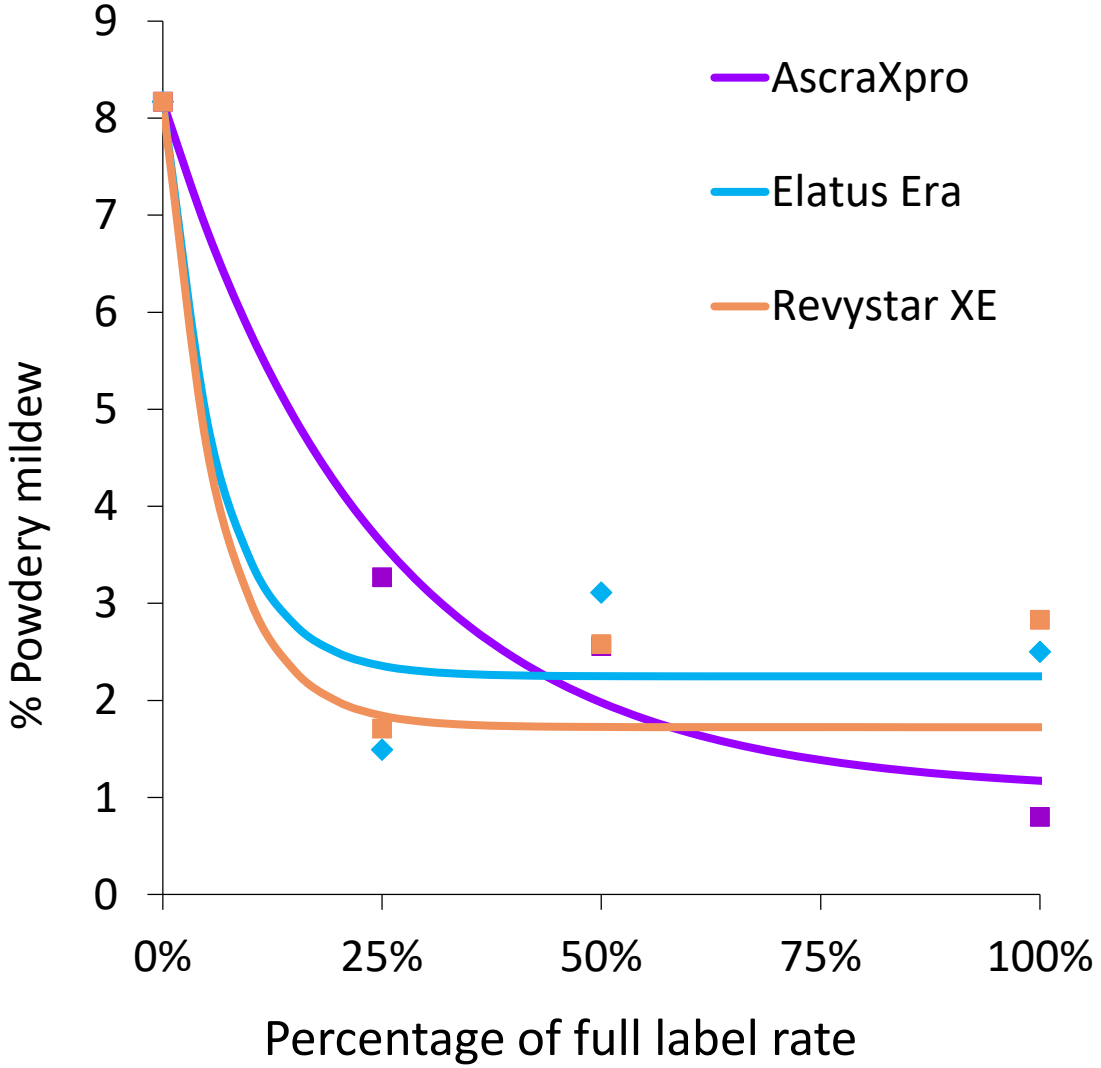
Soleil = tebuconazole + bromuconazole, Unizeb Gold = Mancozeb

Mycotoxin control 2019

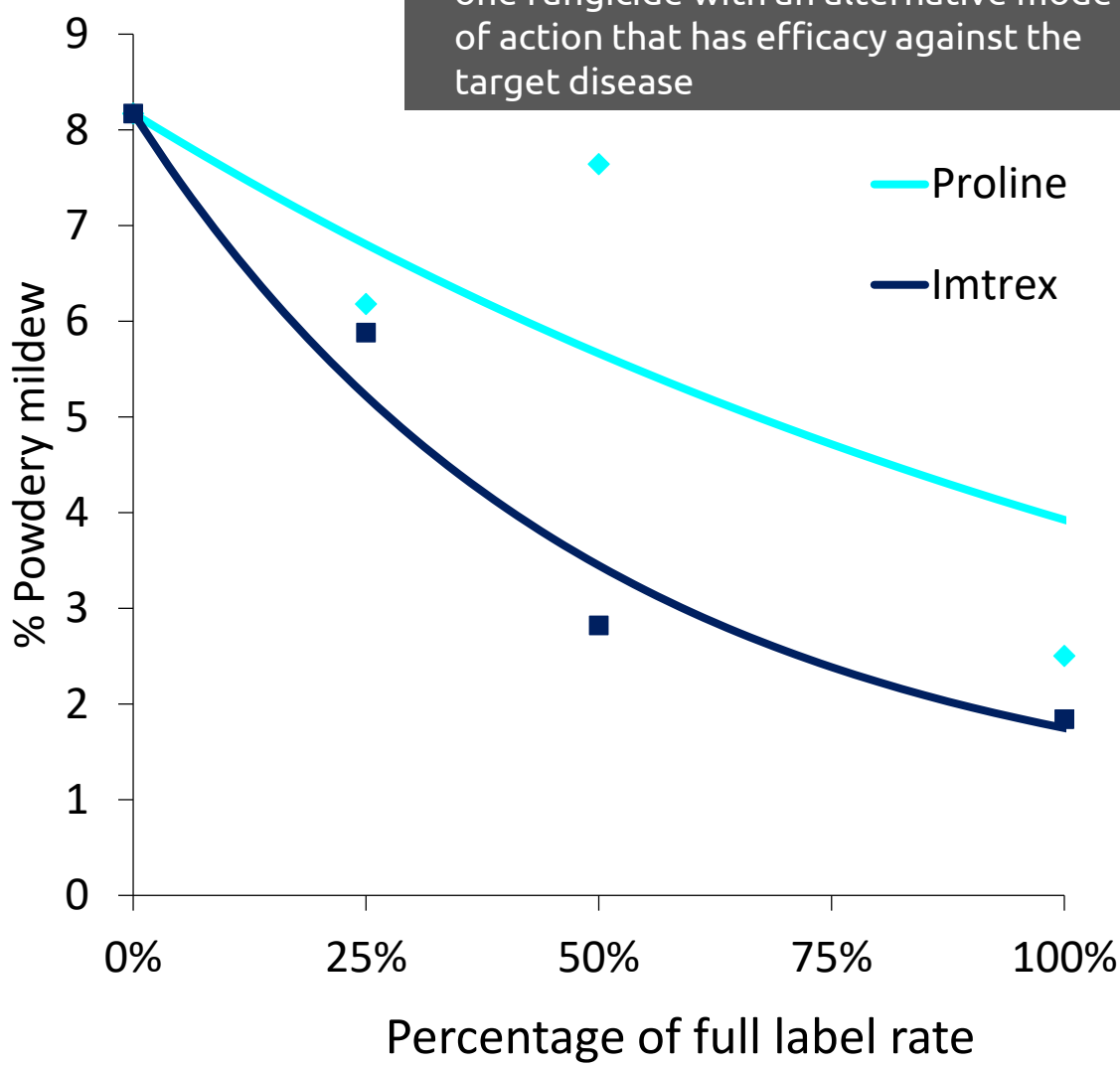


Maximum legal limit of DON in wheat for human consumption = 1250ppb

Wheat powdery mildew 2019 (2 trials)



Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease



Wheat summary 2019

Septoria tritici

- Revystar XE very effective with a yield response up to full dose
- Ascra ahead of Elatus Era in 2019
- Solo SDHI Imtrex ~60% protectant control, prothioconazole ~ 45%

Rusts

- Elatus Era highest yield on yellow rust, matched by Revystar XE on brown rust

Fusarium

- Soleil and Proline effective, Soleil better DON reduction in 2019
- Unizeb Gold adding activity on visual head blight symptoms

Mildew

- All SDHI/azoles tested showed good levels of control

Fungicide performance 2019 update for barley

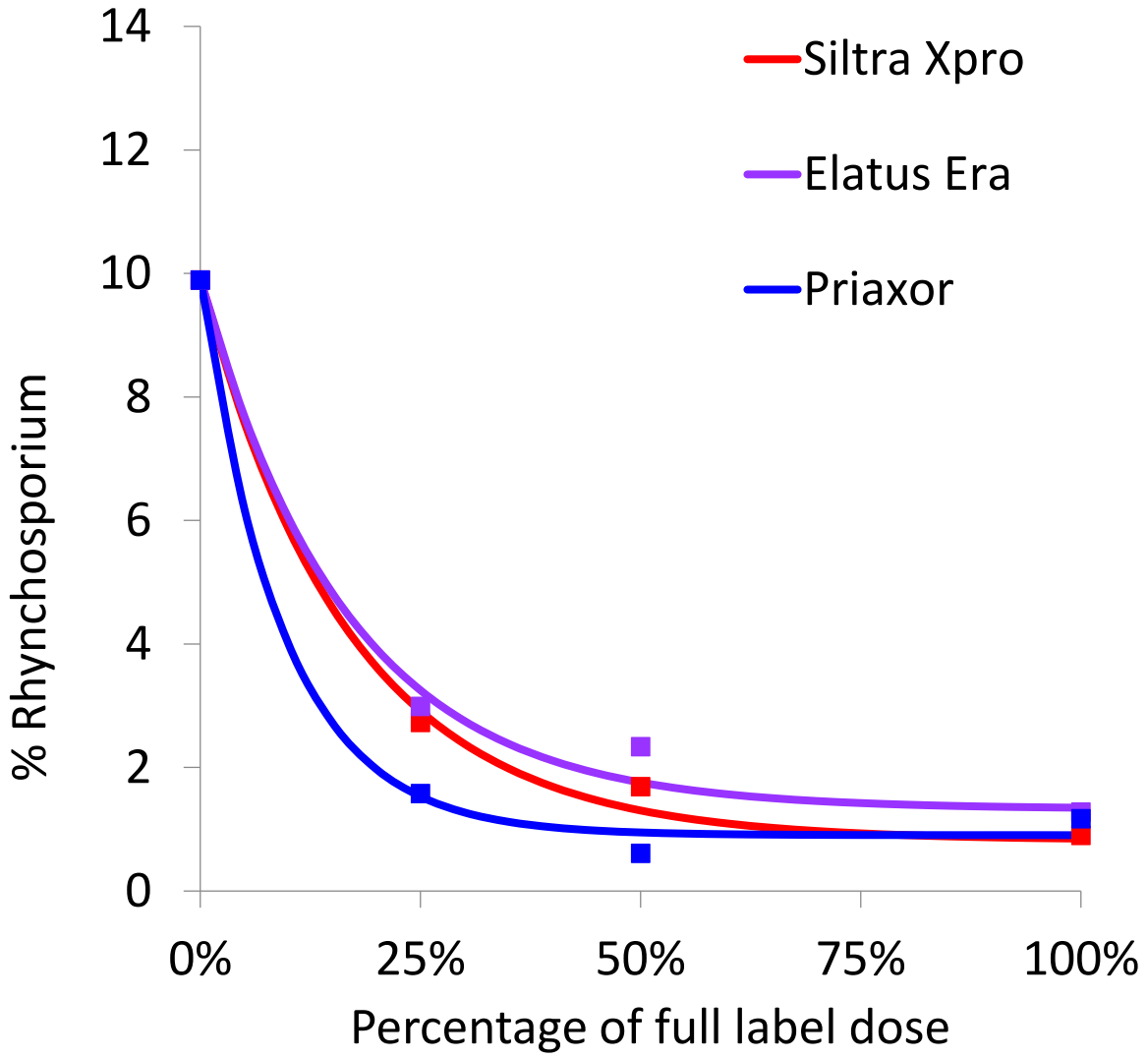
Barley disease data in harvest year 2019

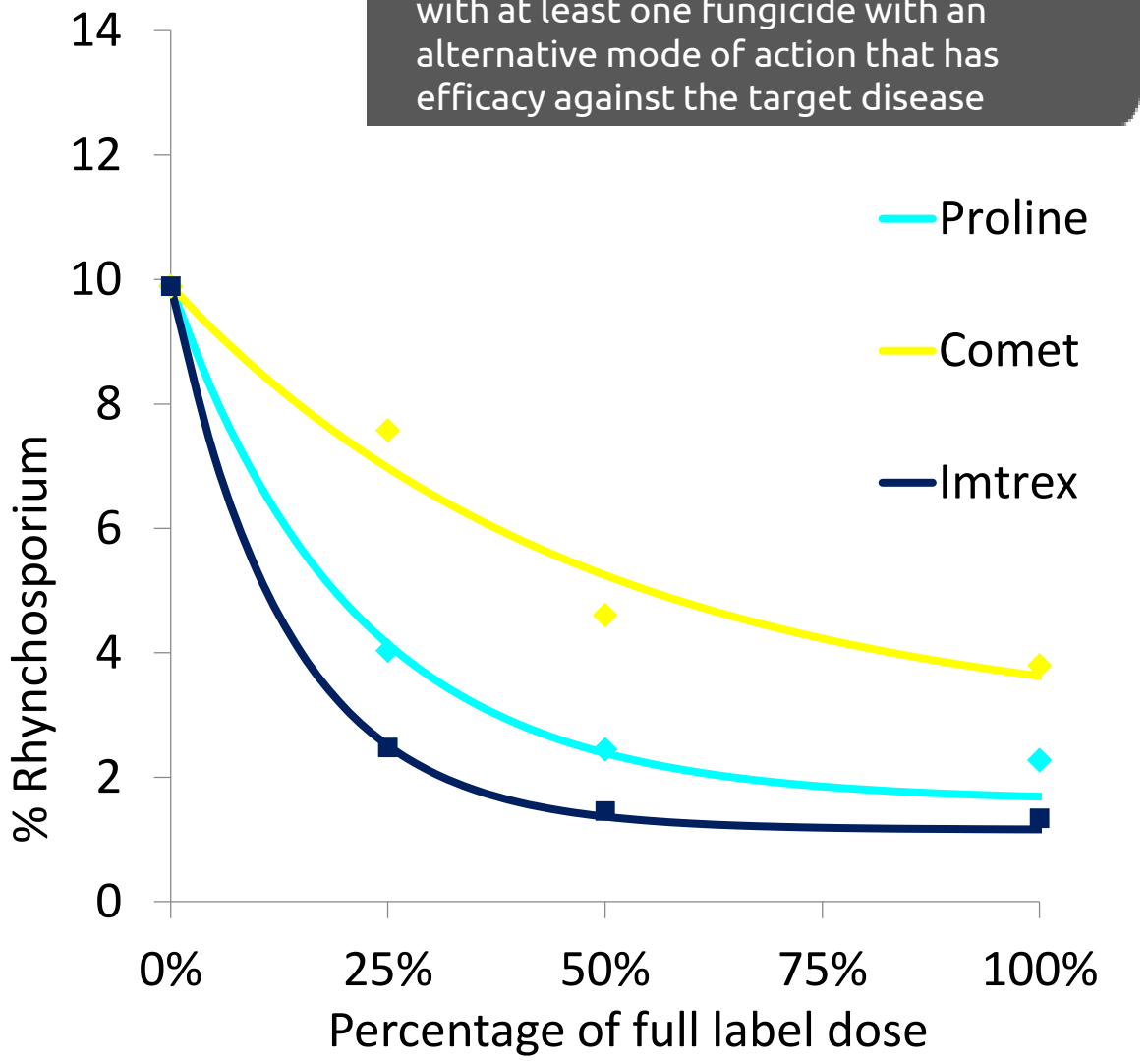
Site (Organisation)	Target disease	Variety	Rhyncho	Net Blotch	Ramularia	Mildew	Tan spot
Lanark (SRUC)	Rhyncho	KWS Tower	✓				✓
Cardigan (ADAS)	Rhyncho	KWS Cassia	✓			✓	
Carlow, Ireland (Teagasc)	Rhyncho	KWS Cassia	✓			✓	
Morley, Norfolk (NIAB)	Net blotch	Flagon		✓			
Midlothian (SRUC)	Ramularia	Laureate (SB)			✓		✓
Carlow, Ireland (Teagasc)	Ramularia	Pixel (WB)			✓		

Rhynchosporium 2017–19 (8 trials)

(protectant activity)

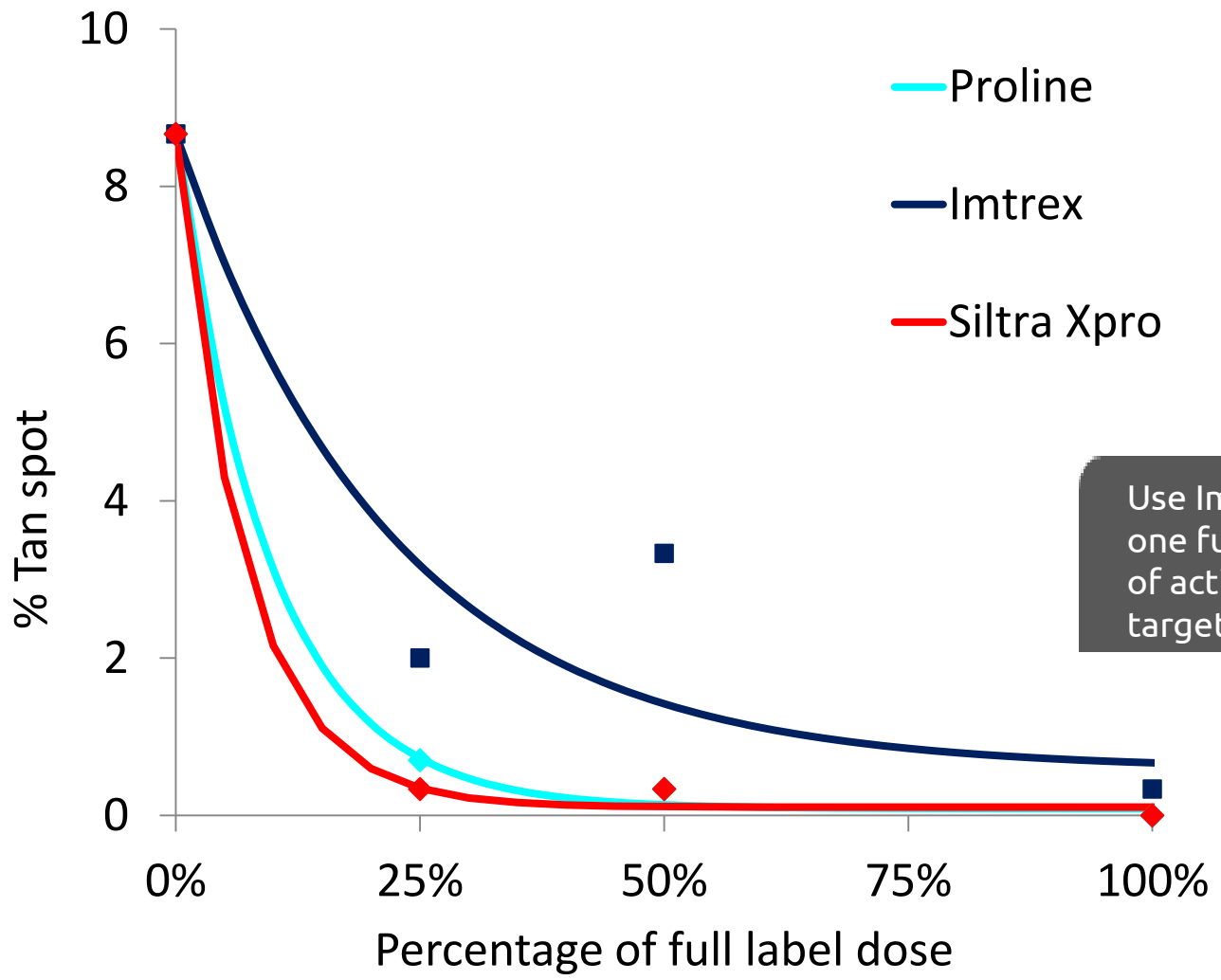
Use Imtrex and Vertisan only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease





Priaxor = fluxapyroxad + pyraclostrobin

Winter barley tan spot 2019 (1 trial)

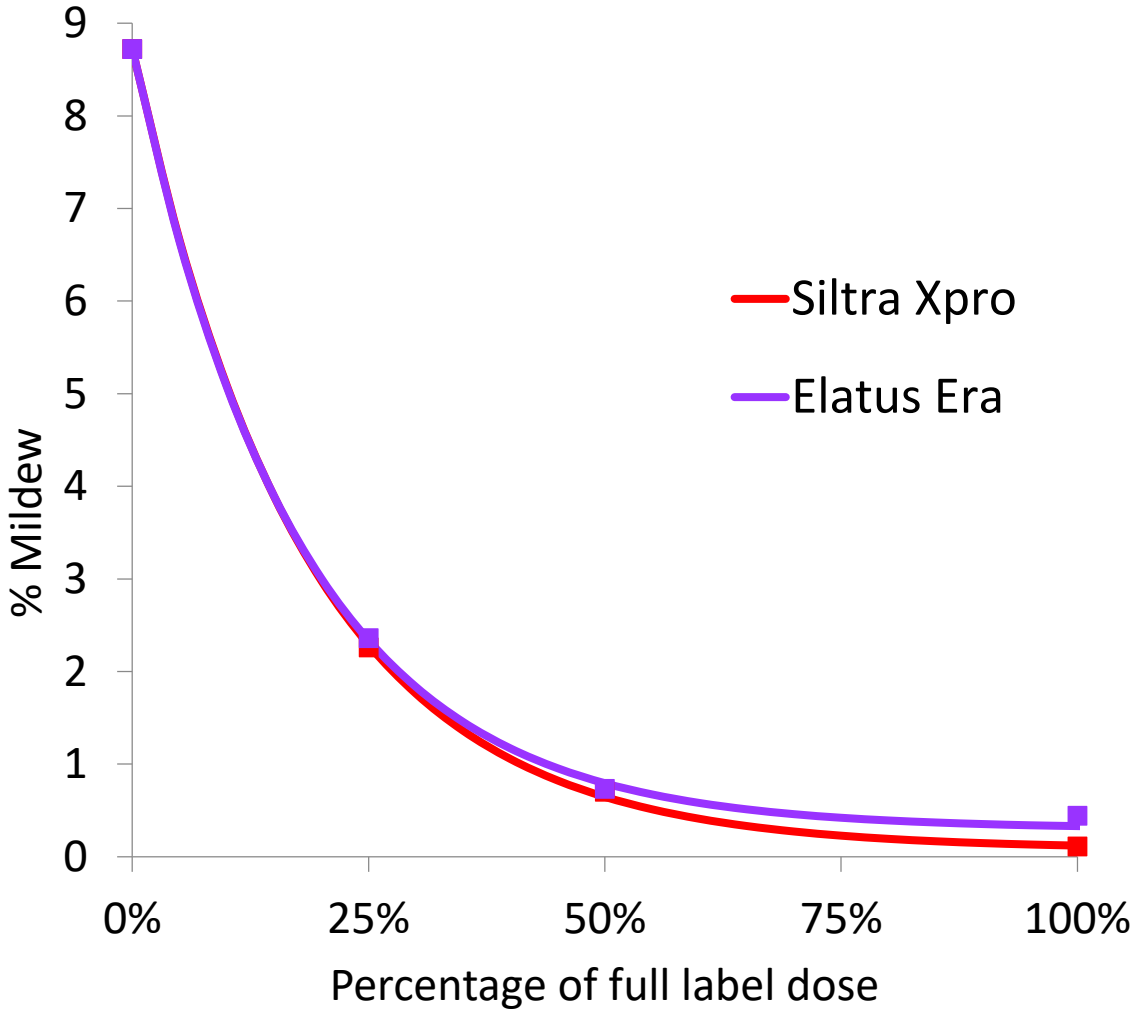


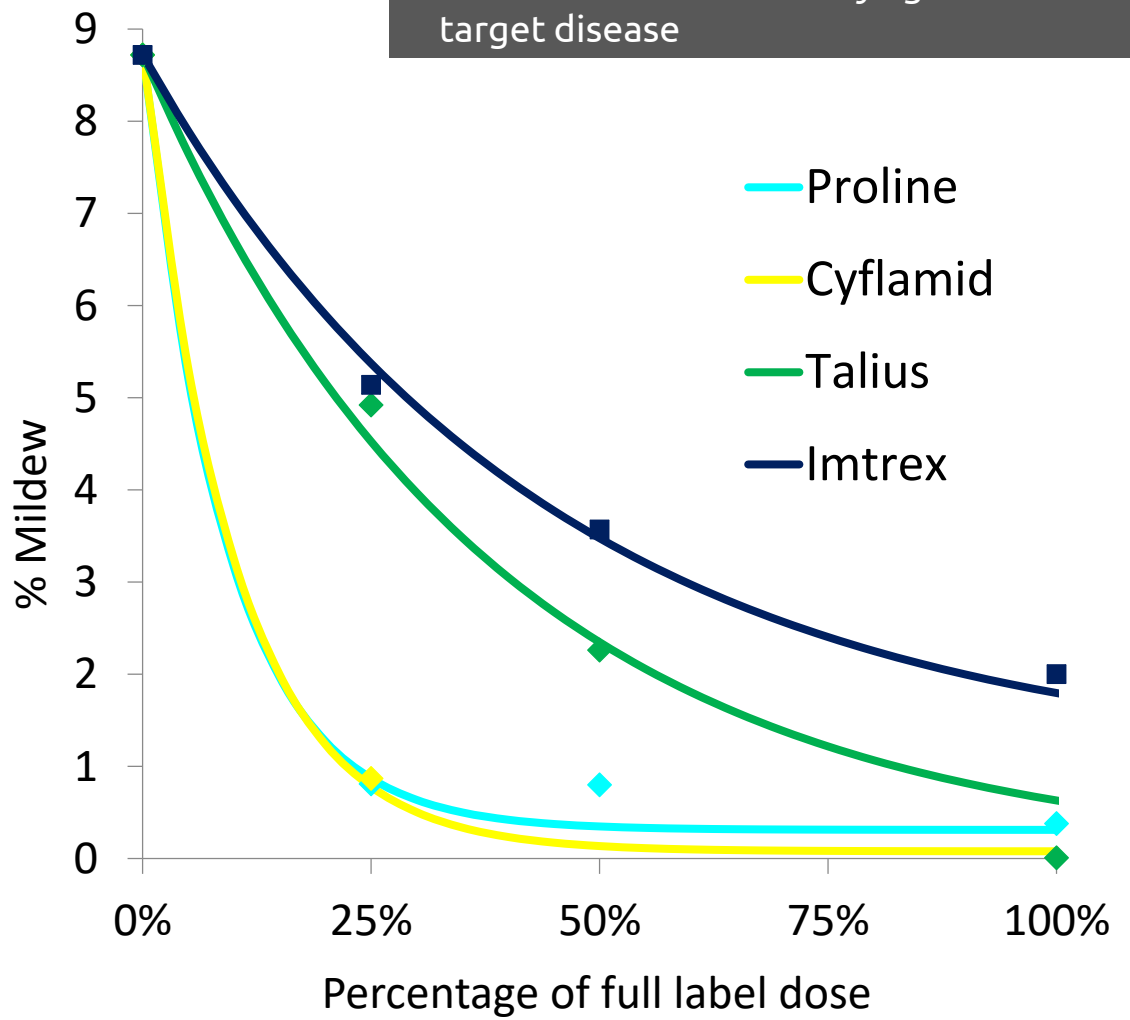
Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease

Barley powdery mildew 2017–19 (6 trials)

(protectant activity)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease

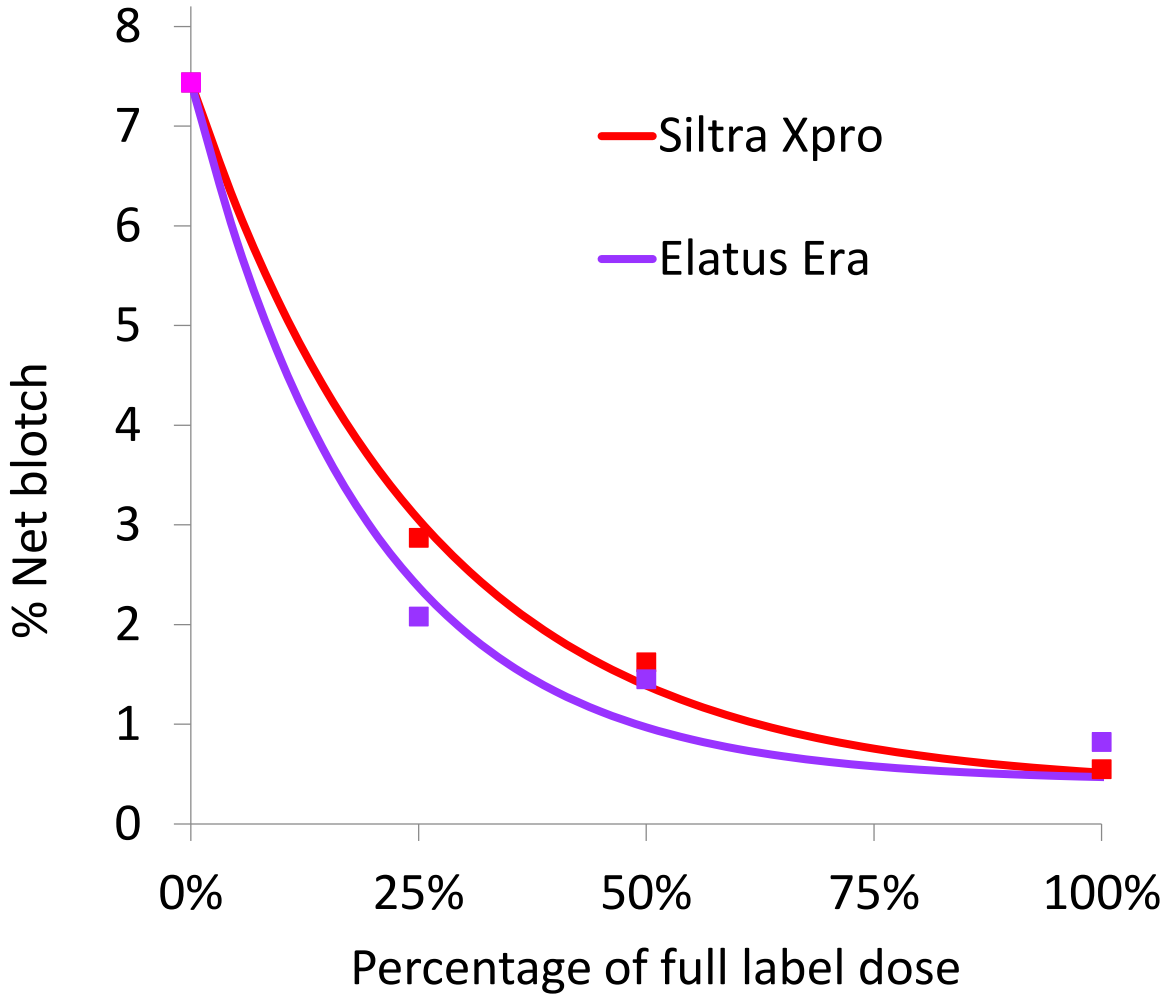


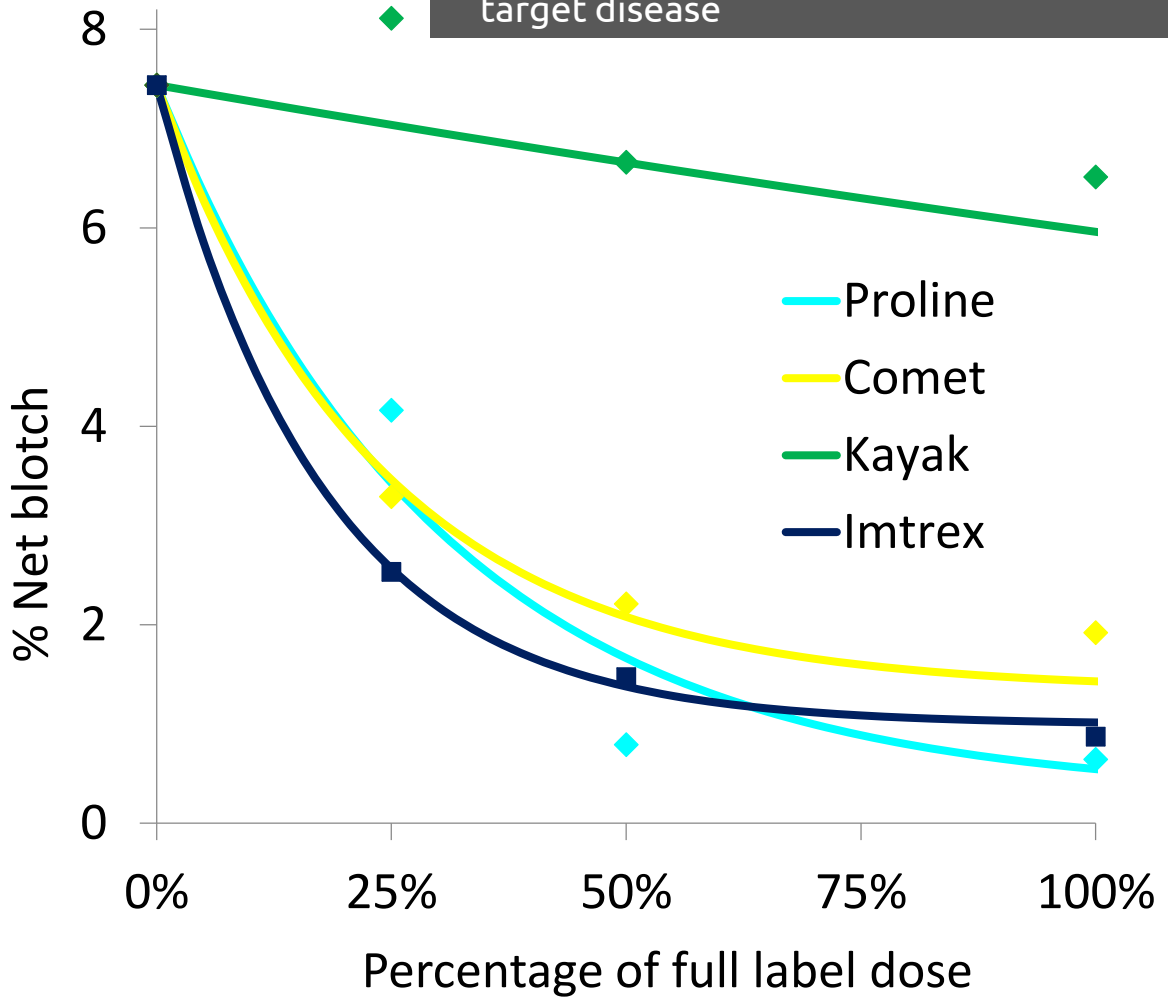


Net blotch 2017–19 (4 trials)

(protectant activity)

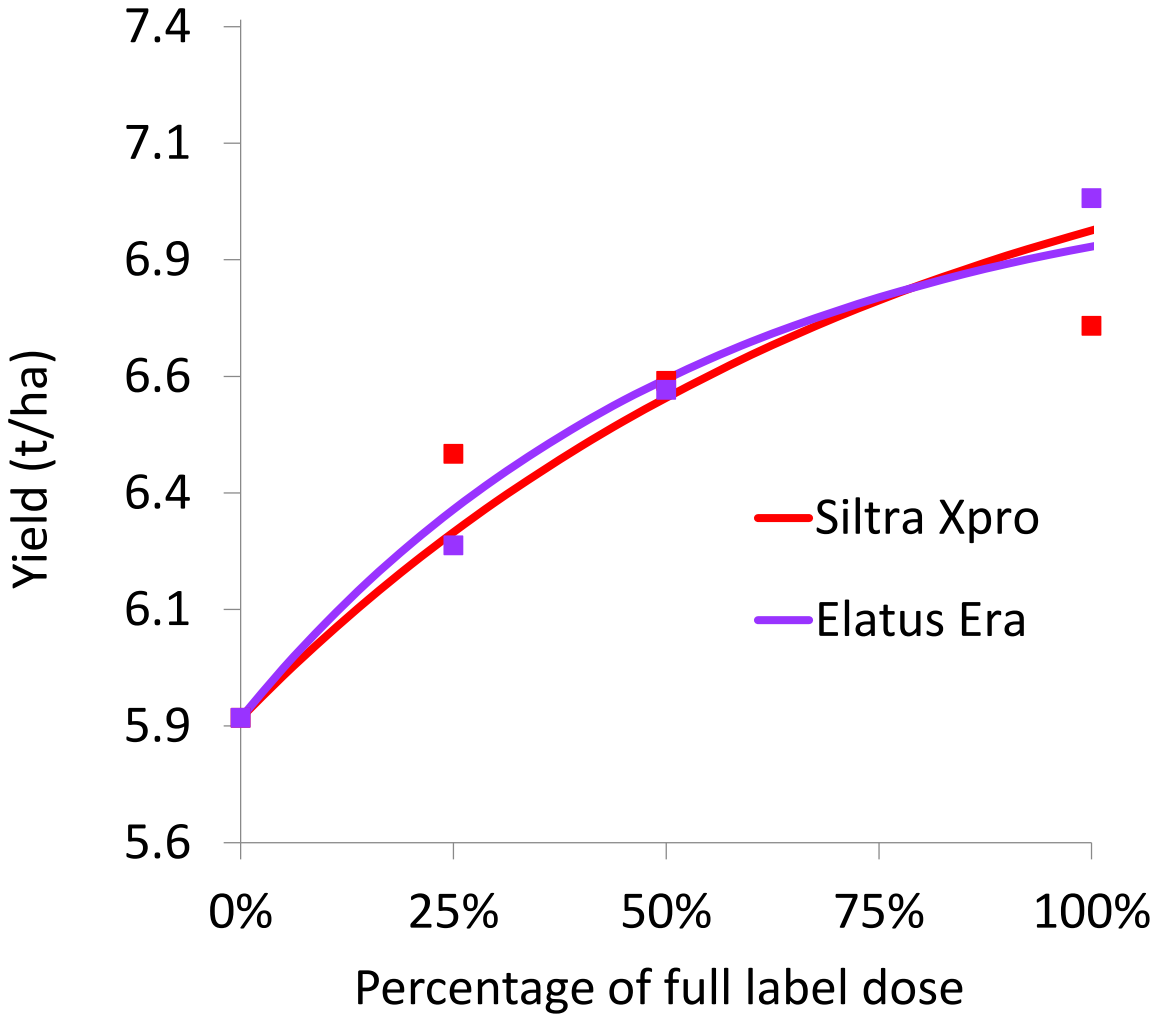
Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease

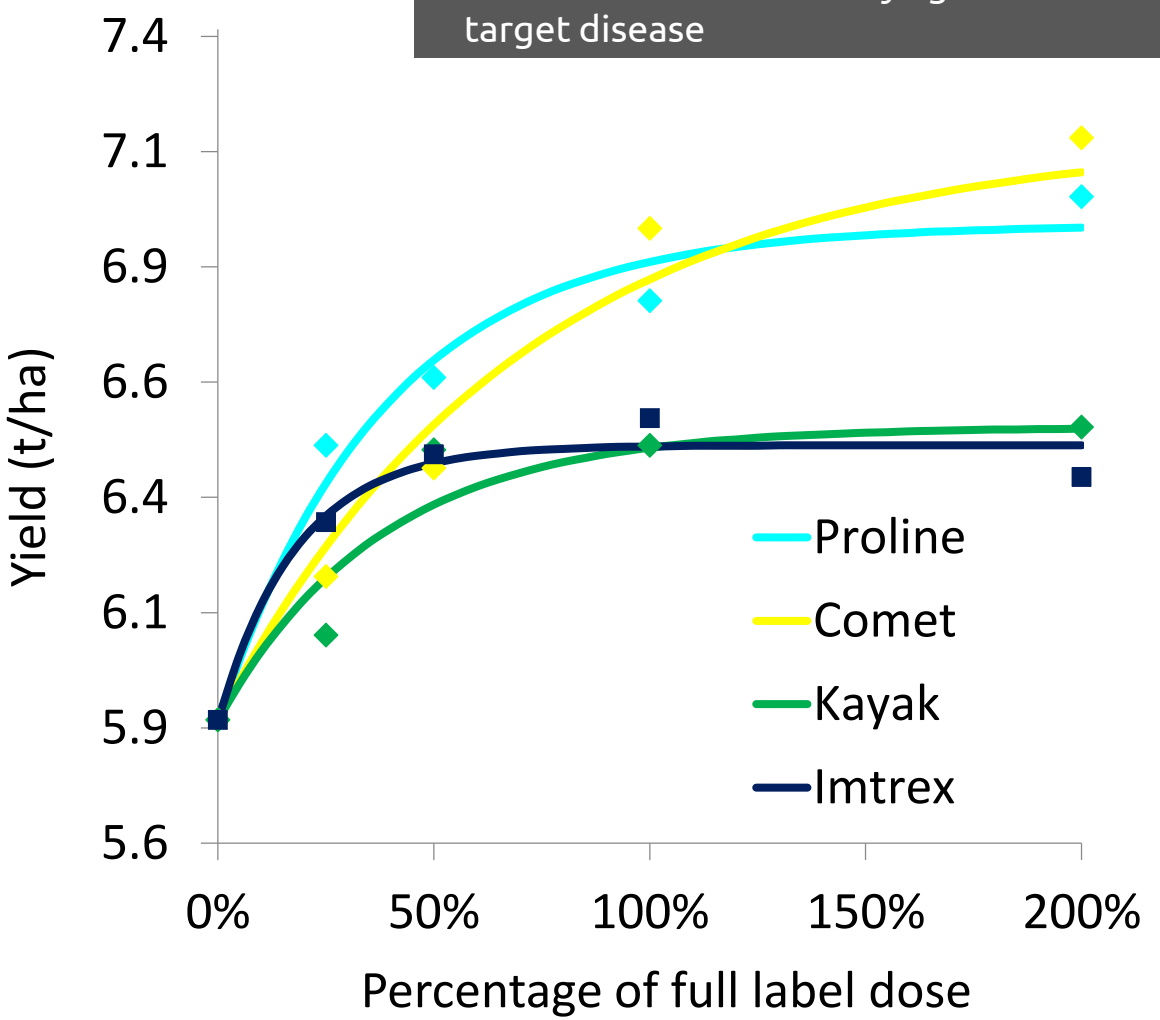




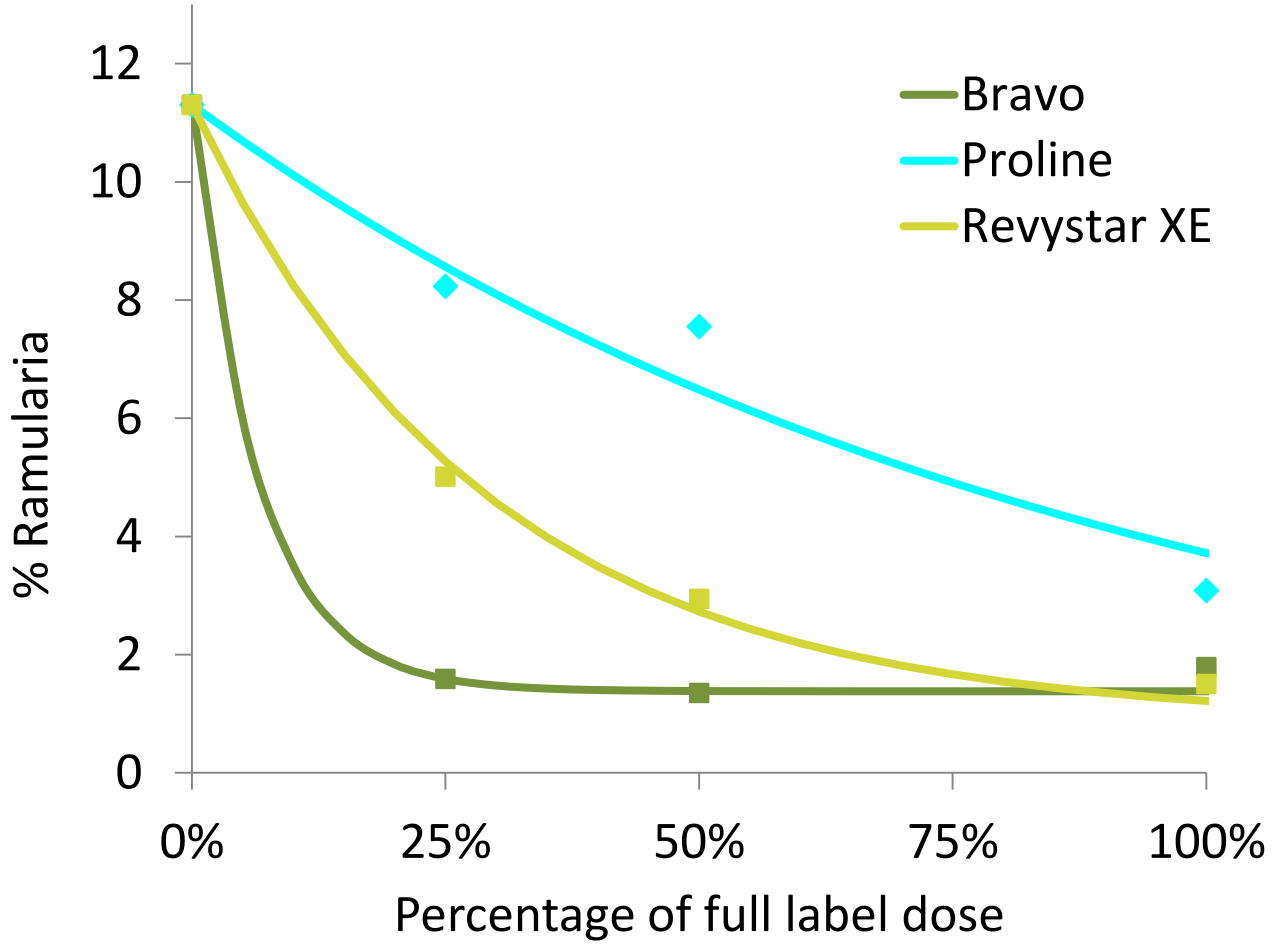
Net blotch yields 2017–19 (5 trials)

Use Imtrex only in mixture with at least one fungicide with an alternative mode of action that has efficacy against the target disease





Ramularia 2019 (2 sites)



Barley summary 2019

- Rhynchosporium and net blotch – fluxapyroxad- or prothioconazole-based products lead (higher doses required for net blotch control)
- Mildew – prothioconazole-based products and Cyflamid most effective
- Tan spot – very good efficacy Proline and Siltra at low rates (Imtrex useful activity)
- Ramularia:
    - Revystar XE promising.
    - Resistance appears patchy – some activity from prothioconazole
    - Loss of CTL in 2020 will impact

Fungicide performance 2019 update for oilseed rape

Two new products, with existing actives, for OSR

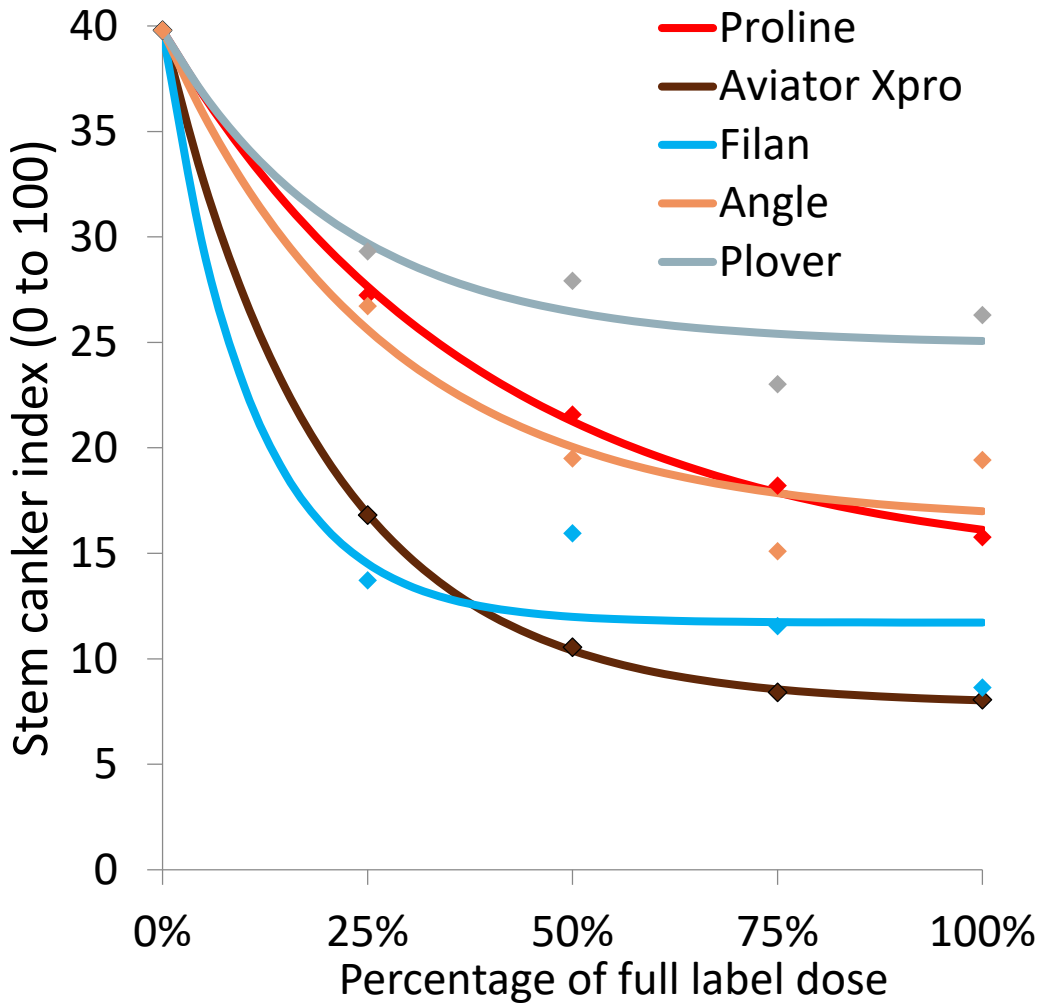
Aviator Xpro

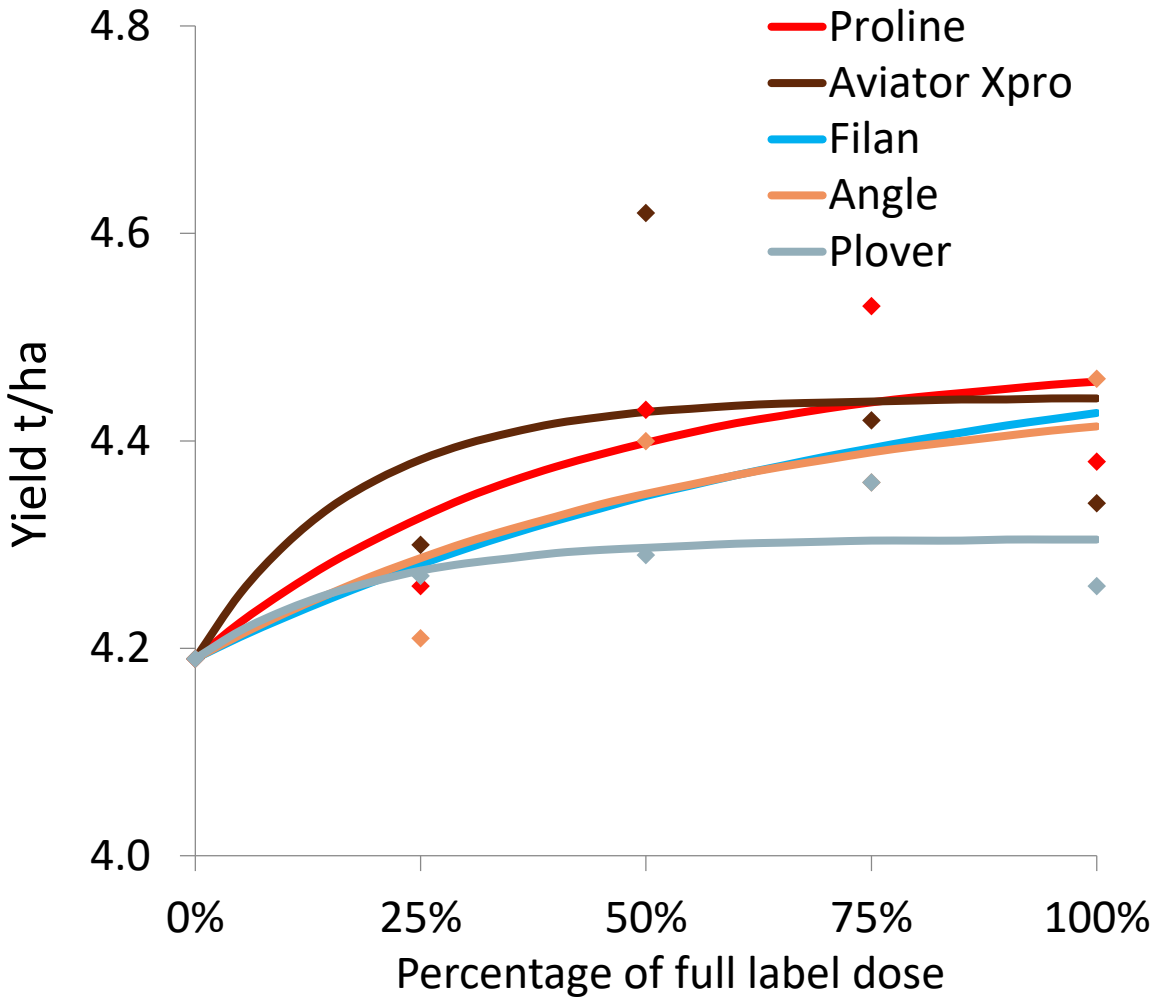
- 75g/l bixafen + 160g/l prothioconazole
- Maximum individual dose 1.0 l/ha
- Maximum of two applications per crop
- Can be applied up to 56 days before harvest
- Approved for control of:
    - Light leaf spot
    - Phoma stem canker
    - Sclerotinia control

Angle

- 125g/l azoxystrobin + 125g/l difenoconazole
- Maximum individual dose 1.0 l/ha
- Maximum of two applications per crop
- Can be applied up to and including end of flowering
- Approved for:
    - Phoma stem canker reduction
    - Sclerotinia control (moderate control)

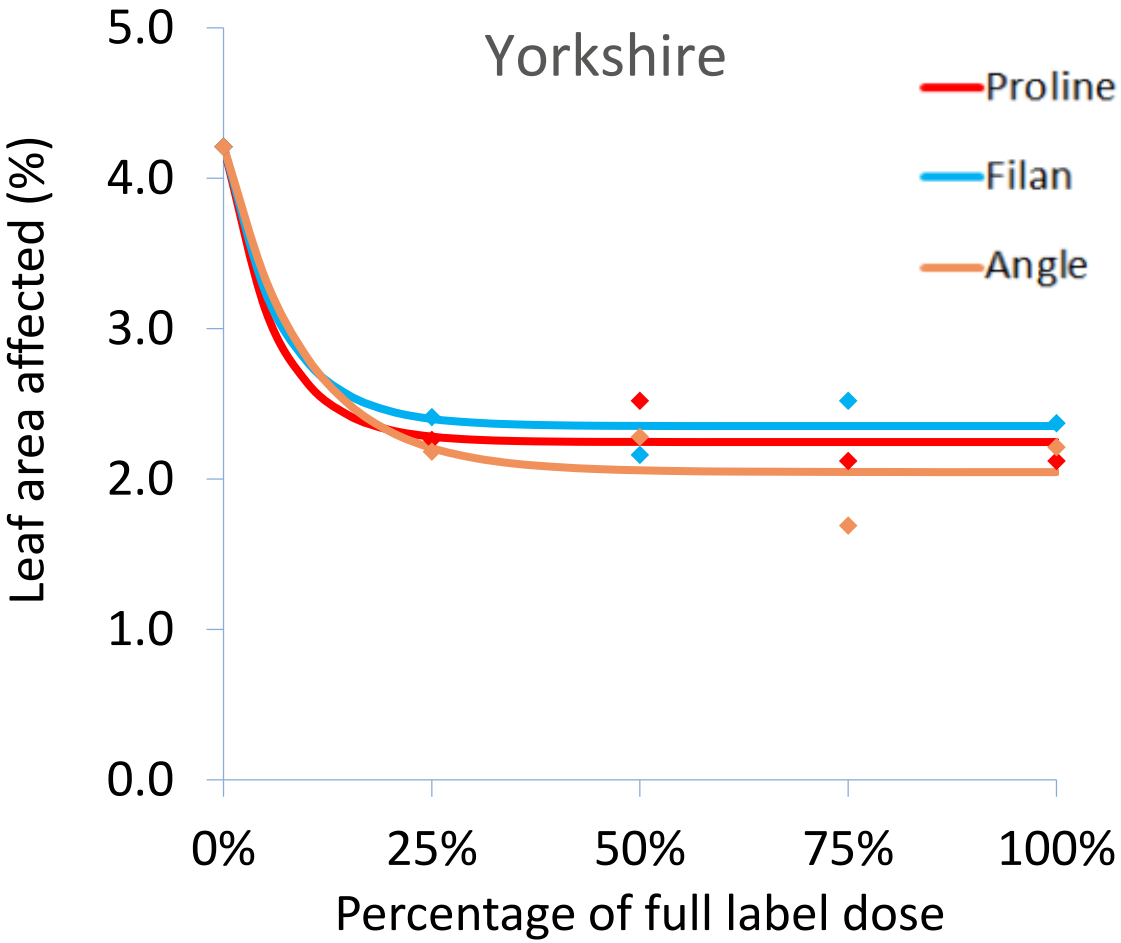
Phoma stem canker 2018–19 (4 trials)

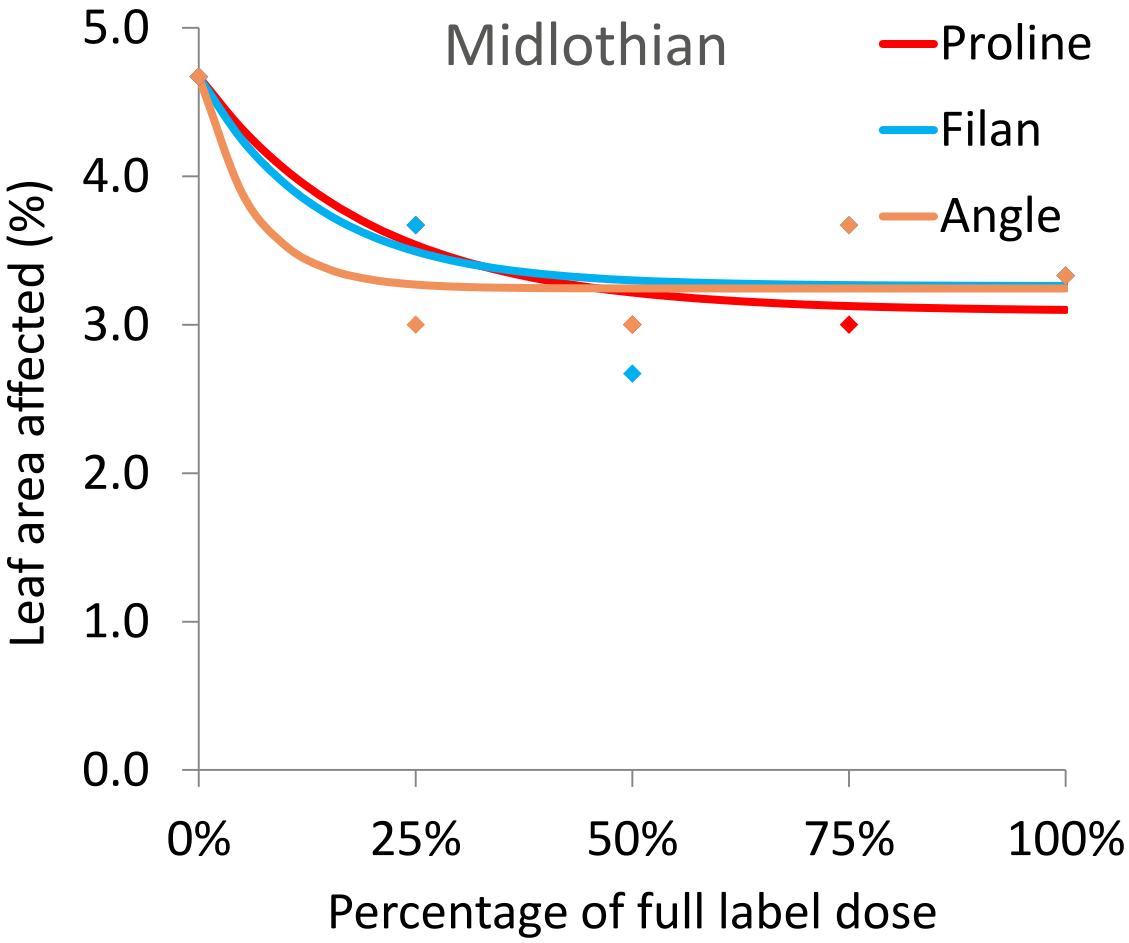




Four trials at Rosemaund, Herefordshire and Terrington, Norfolk.

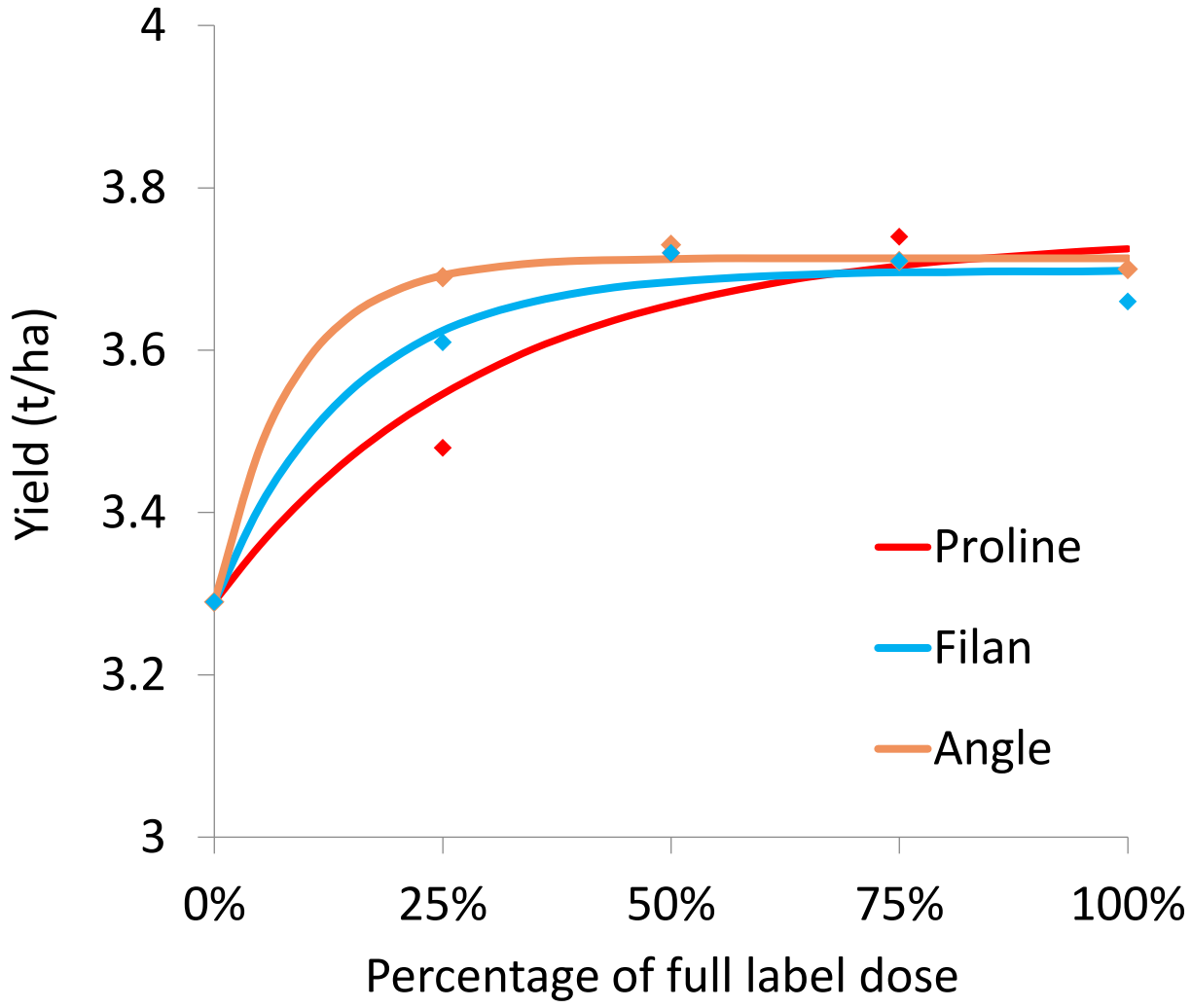
Light leaf spot control 2019
(March assessments)



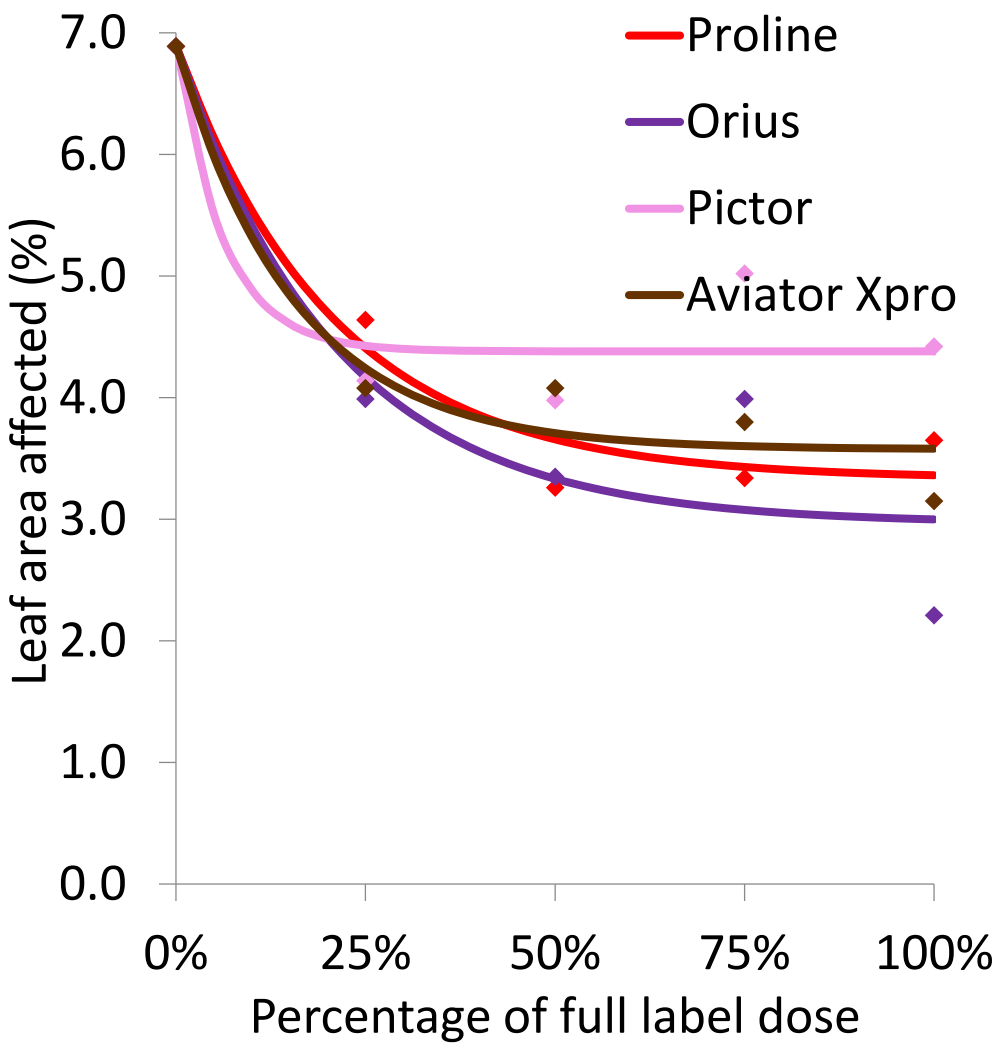


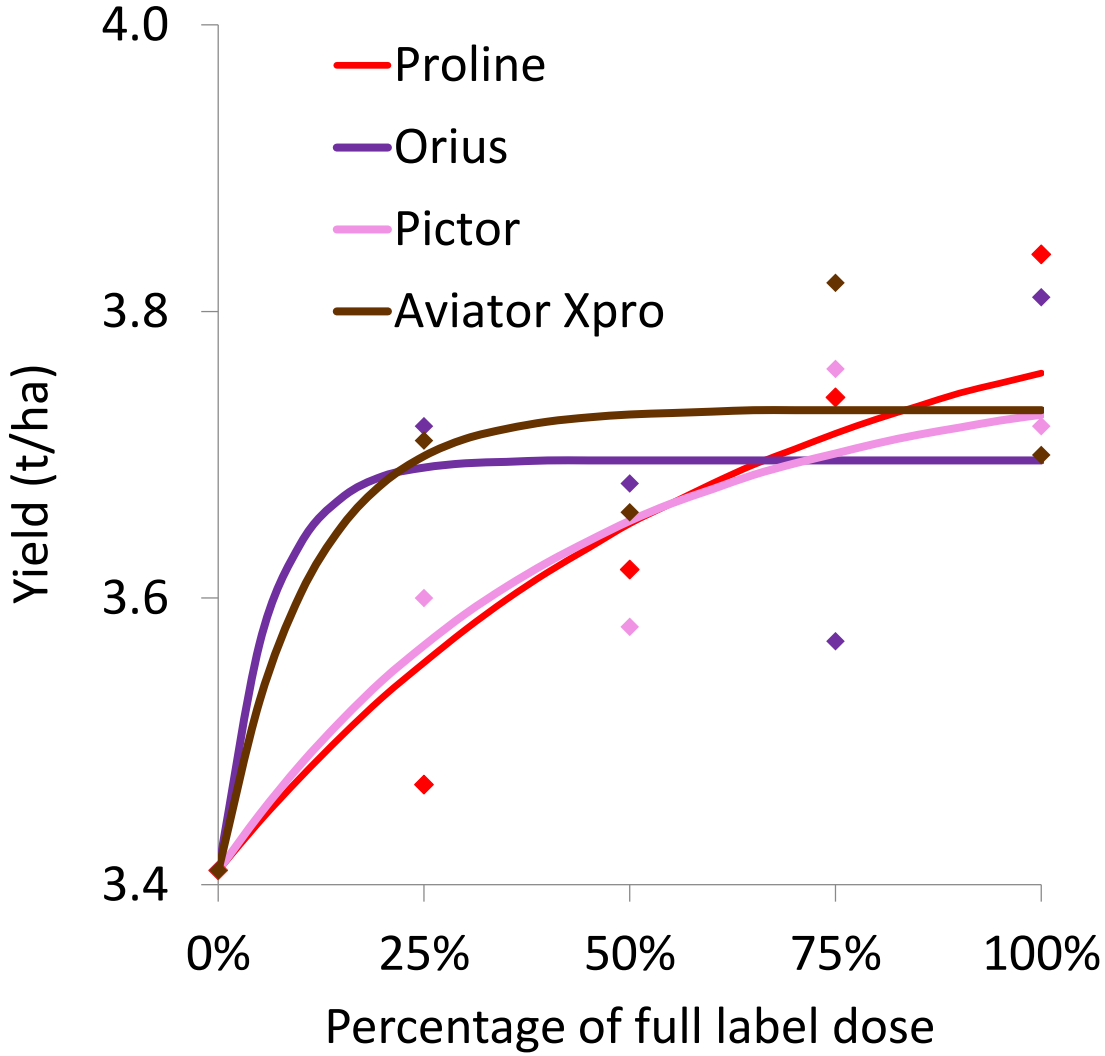
Note: Labels for Filan and Angle do not include control of light leaf spot

Light leaf spot yields 2019 (2 trials)



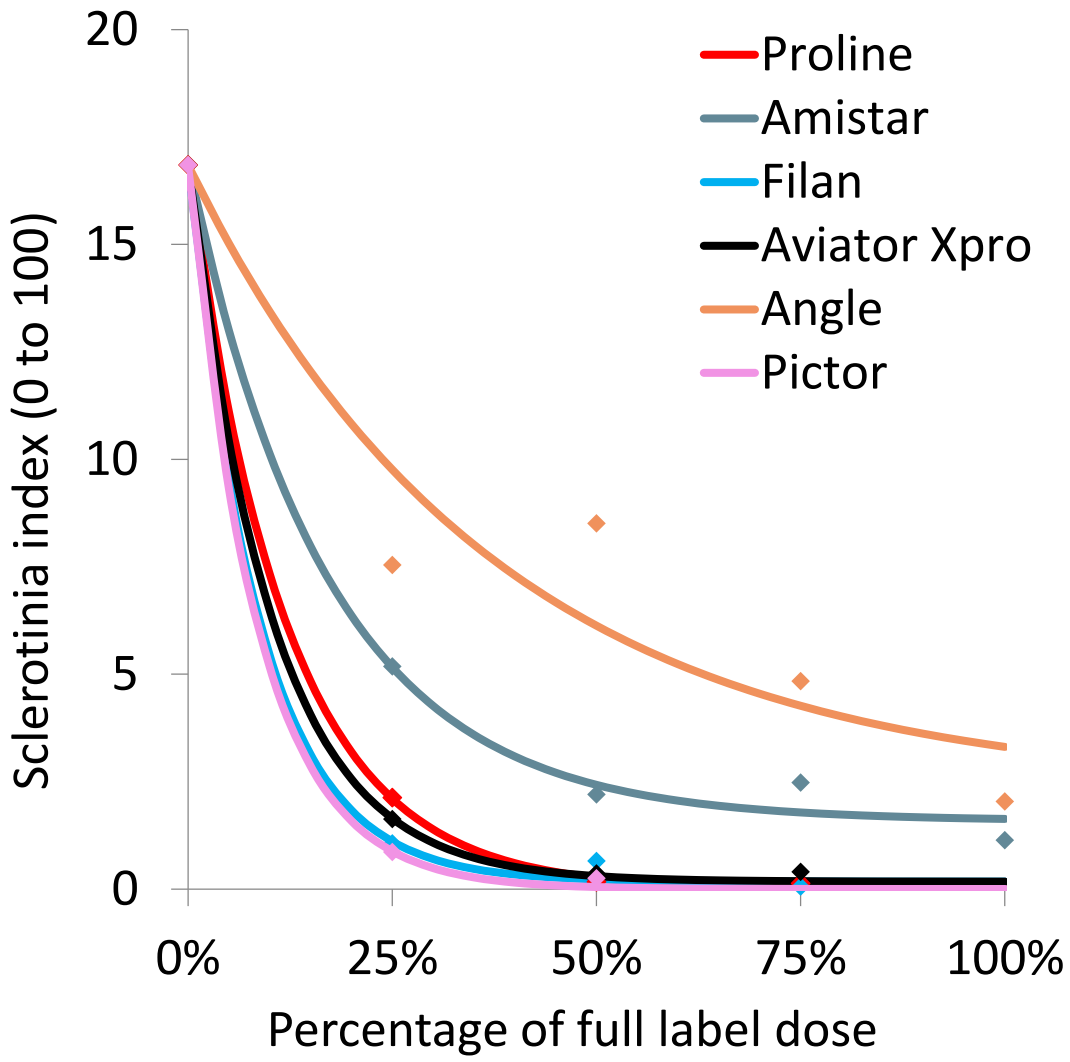
Light leaf spot: disease and yield 2015–16 (5 trials)

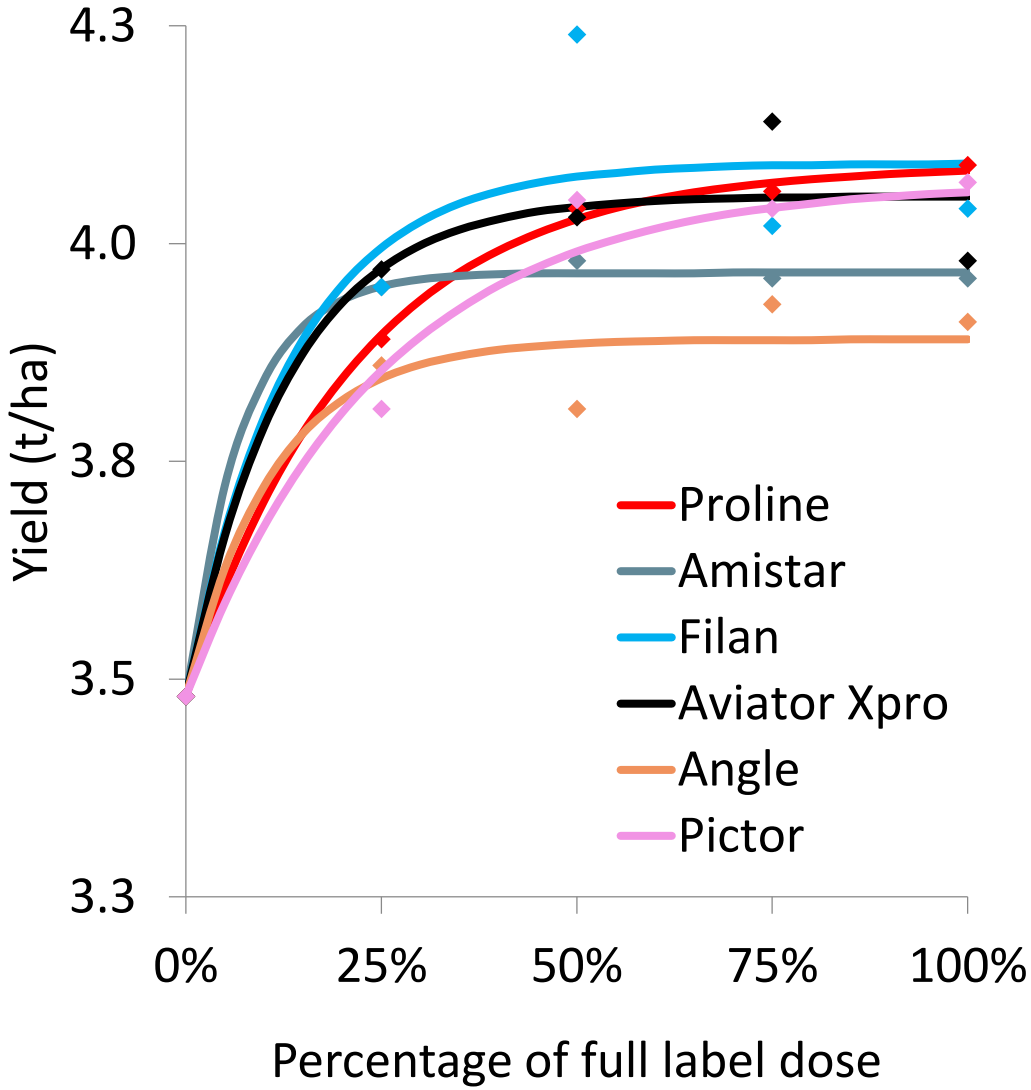




Trials based in Yorkshire and Midlothian

Sclerotinia stem rot 2015–17 (4 trials)





Trials in Ceredigion and Herefordshire, single applications

OSR summary 2019

Phoma stem canker

- Azoles, SDHIs and strobilurins all have efficacy
- Two applications providing effective control

Light leaf spot

- Early sown crops more at risk
- Significant yield benefits (~0.4t/ha) from control in 2019

Sclerotinia stem rot

- Products containing prothioconazole or boscalid lead
- Azoxystrobin also effective

Acknowledgements

Catherine Harries, AHDB
Stuart Knight, NIAB
Faye Ritchie, ADAS
Fiona Burnett, SRUC
Simon Edwards, Harper Adams University
Bart Fraaije, Rothamsted Research
Steven Kildea, Teagasc

Funding from AHDB and Teagasc


‘Inspiring our farmers, growers and industry to succeed in a rapidly changing world’

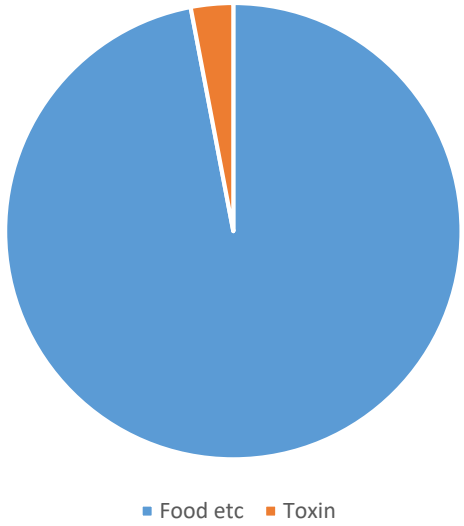
Slugs – Recent History

- Slugs are a persistent, but unpredictable problem
- Metaldehyde in water at times exceeds 0.1ppb
- Metaldehyde Stewardship Group
- Catchment Management: e.g. Anglian Waters, Severn Trent Water
- Research on new pellet formulations
- Metaldehyde withdrawal
  - 31 December 2020: Deadline for the sale and distribution of metaldehyde slug pellets
  - 31 December 2021: Deadline for the disposal, storage and use up of existing stocks

https://www.getpelletwise.co.uk/2016/09/09/farm-level-measures-under-the-spotlight/ accessed 16/3/18

New Pellets

- Slug pellets are mostly food
- Can we bind metaldehyde more effectively?



fera

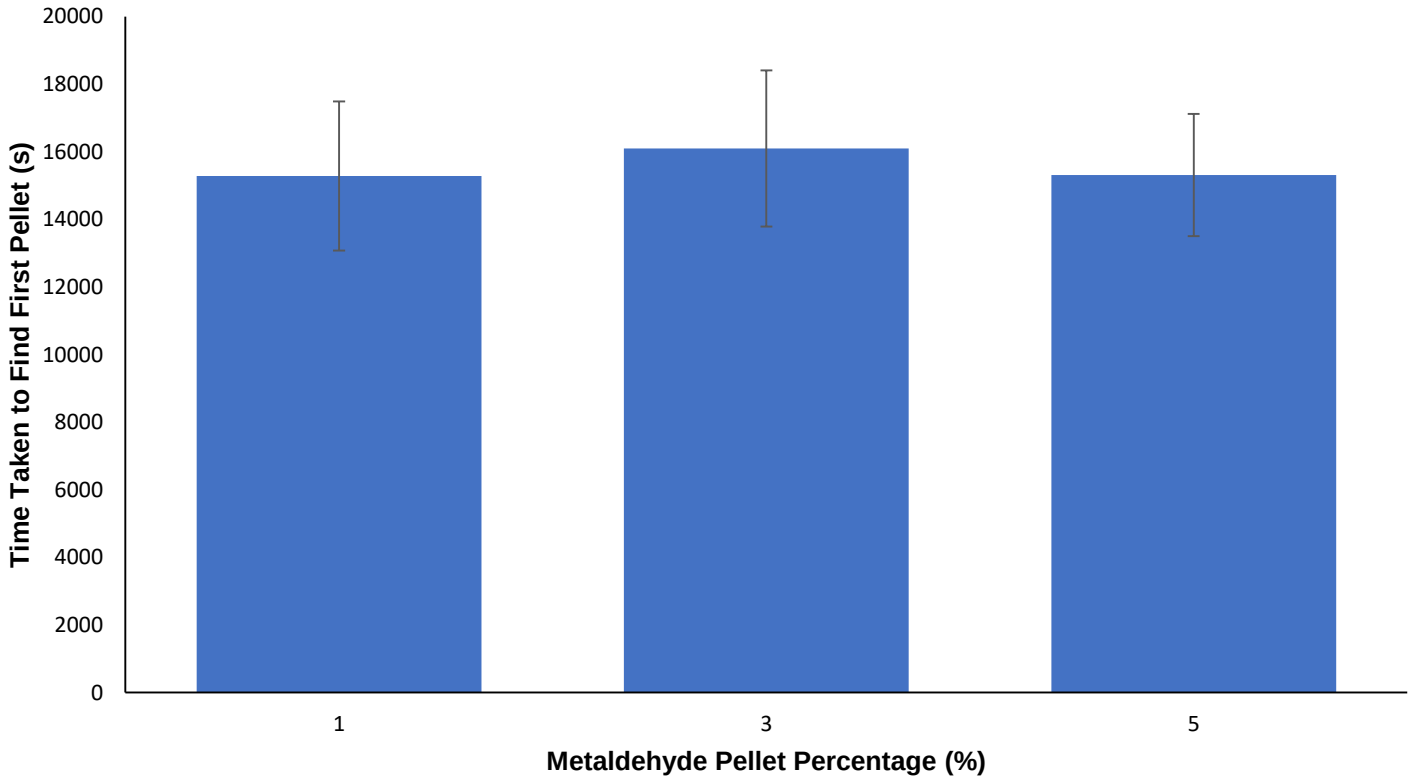
UKWIR
UK Water Industry Research

LUCIDEON
insight creating advantage

Lonza

New Pellets

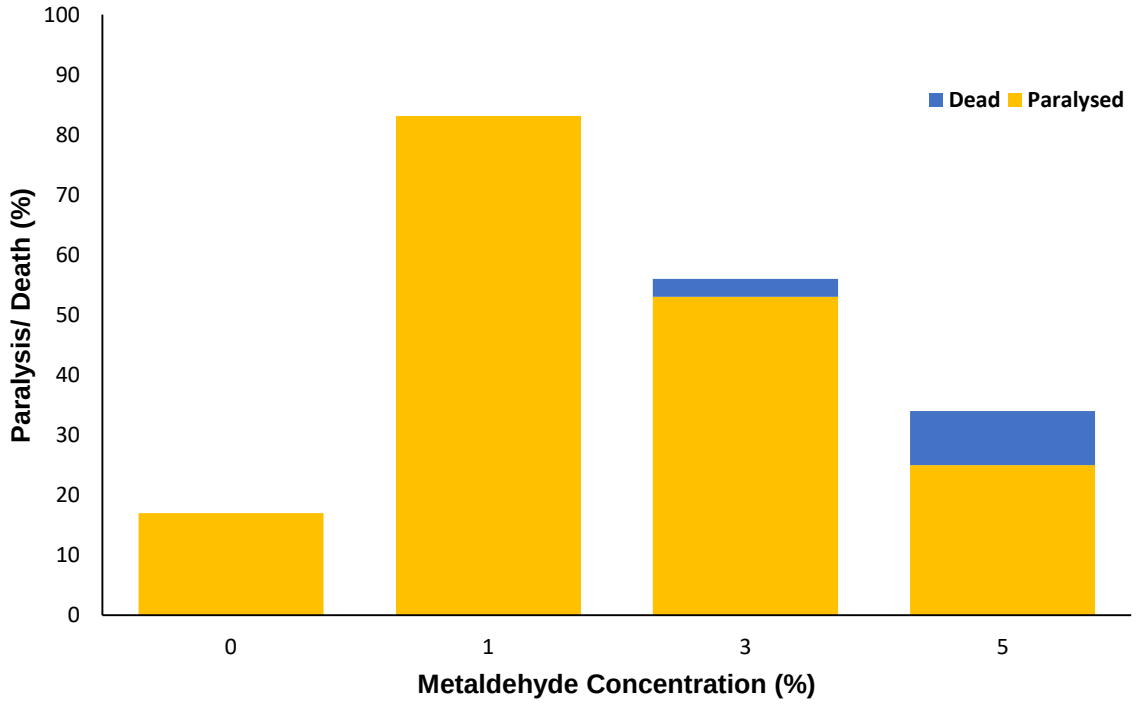
- Does concentration of metaldehyde affect pellet finding?



Time taken (mean + SE) for 32 slugs to find pellets of either 1, 3 or 5% metaldehyde during 14 hours exposure.

New Pellets

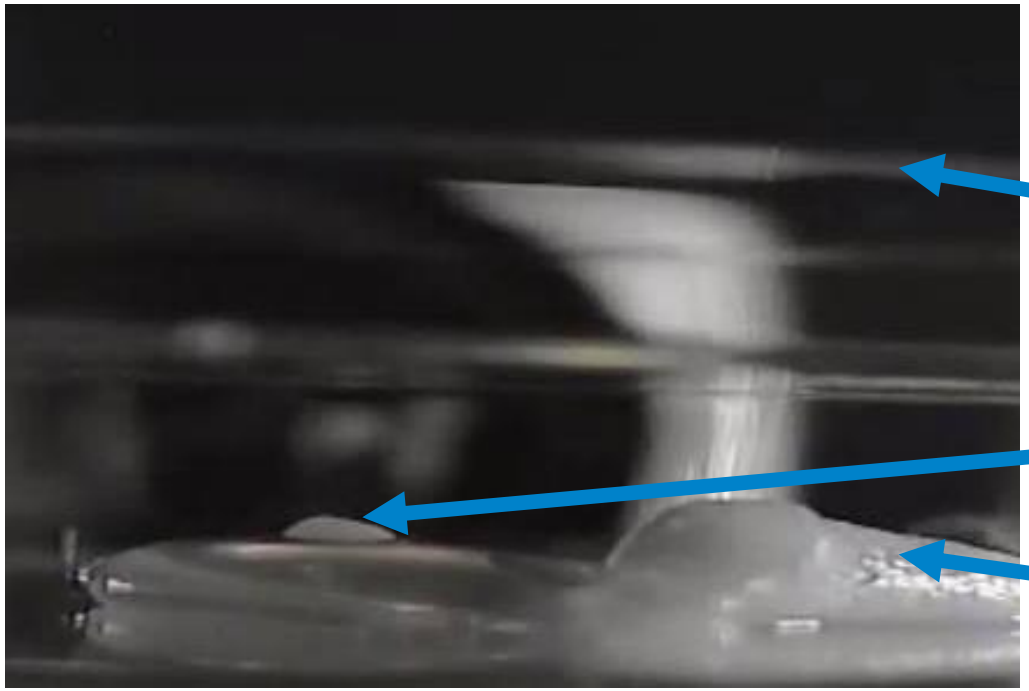
- Does concentration of metaldehyde affect poisoning?

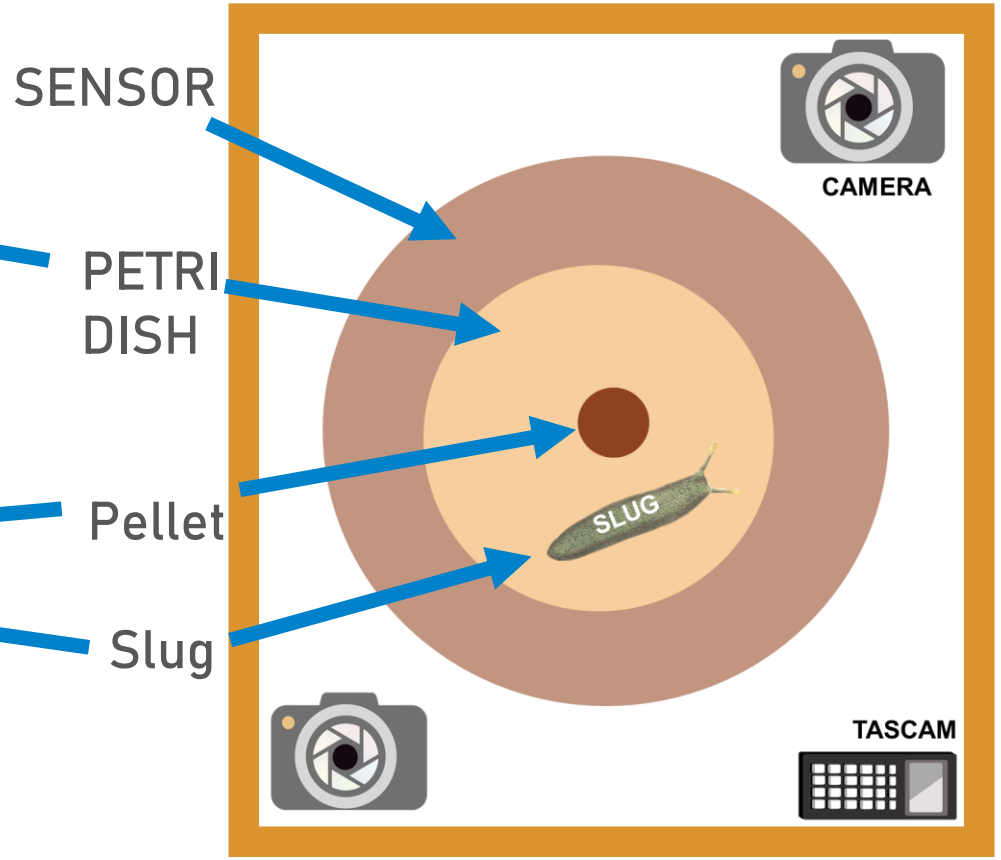


Percentage of slugs either dead or paralysed after 14 hours' exposure to 0, 1, 3 or 5% metaldehyde pellets

New Pellets

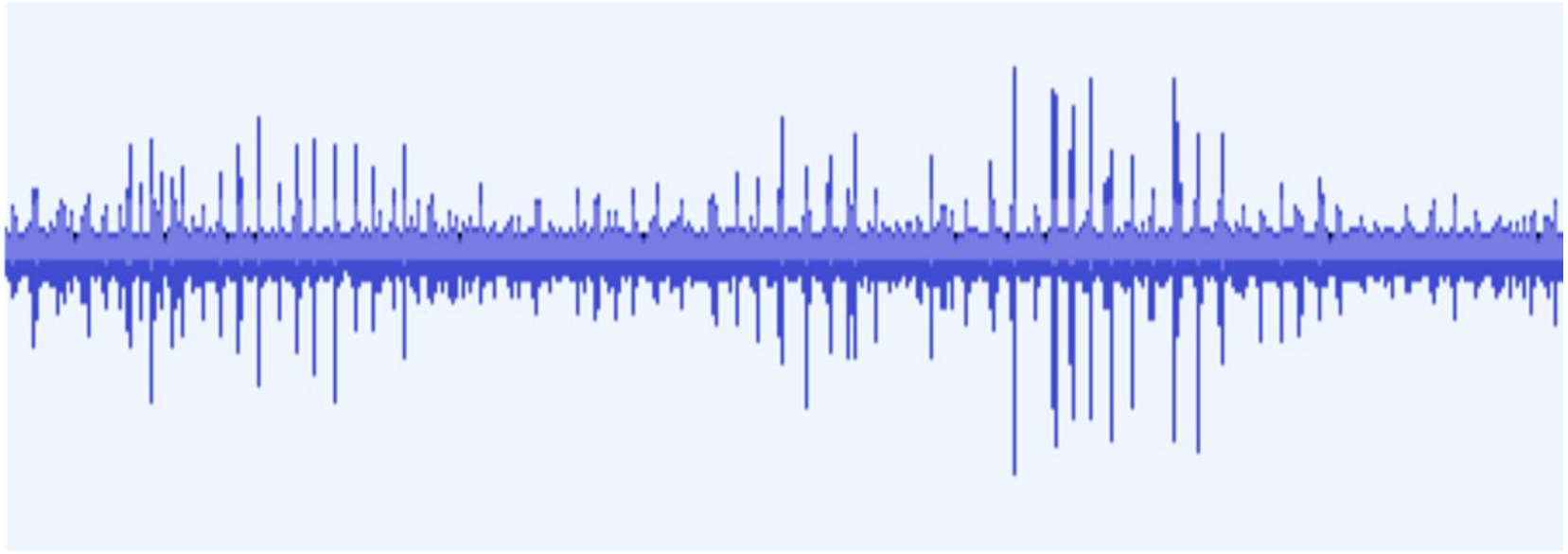
- How much feeding?





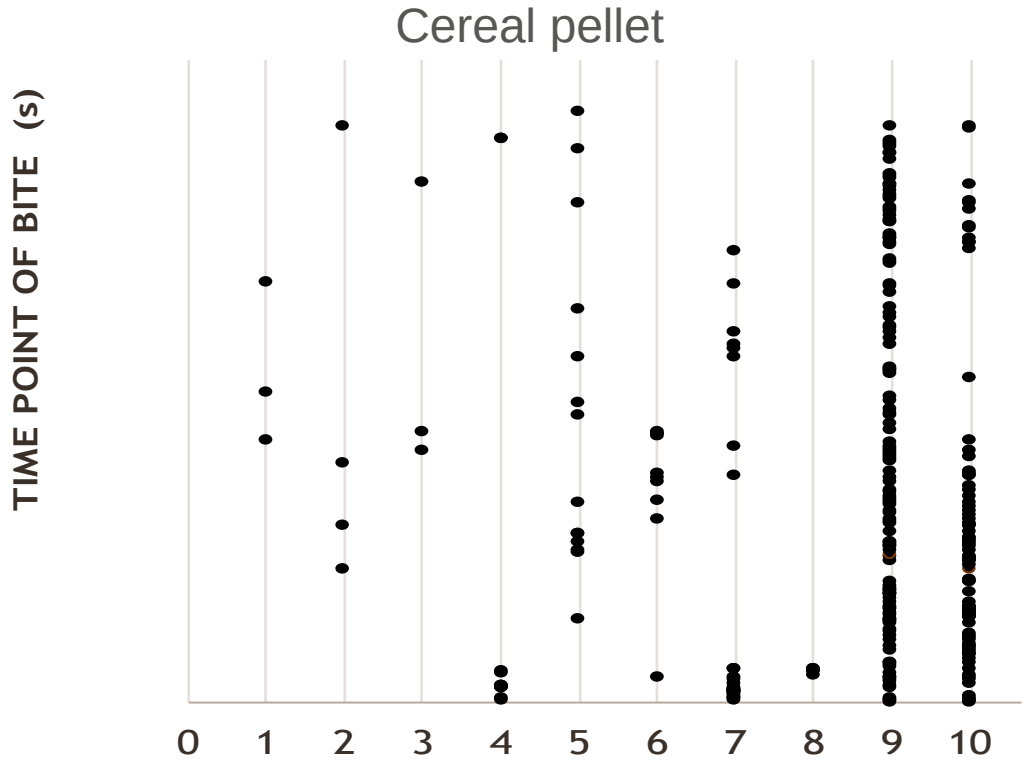
New Pellets

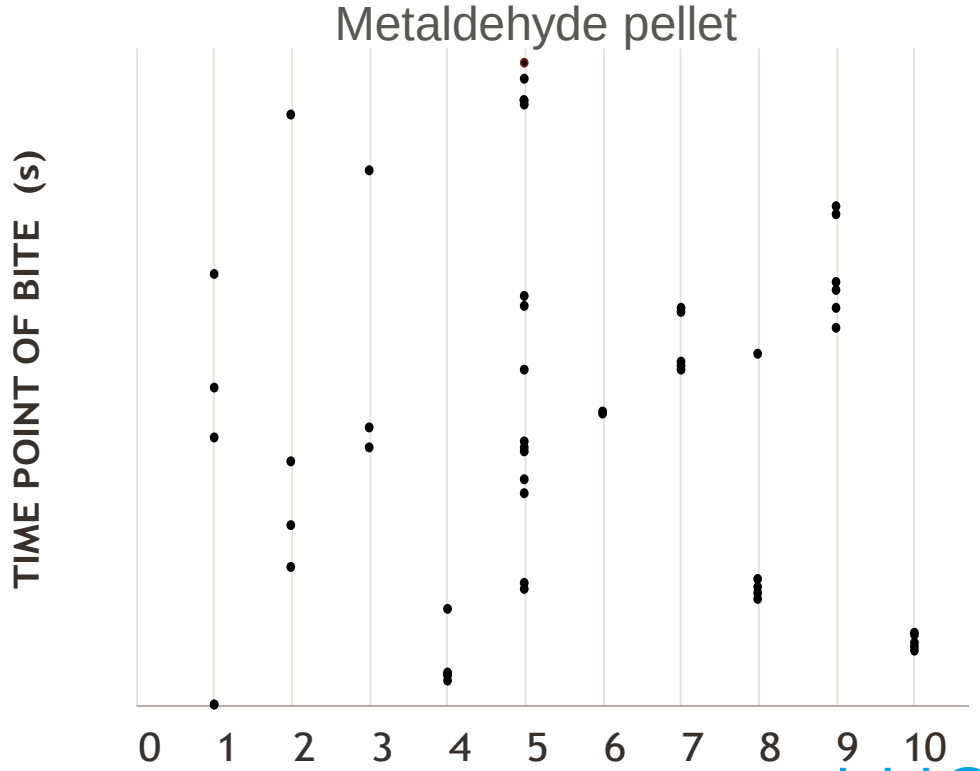
- How much feeding?



New Pellets

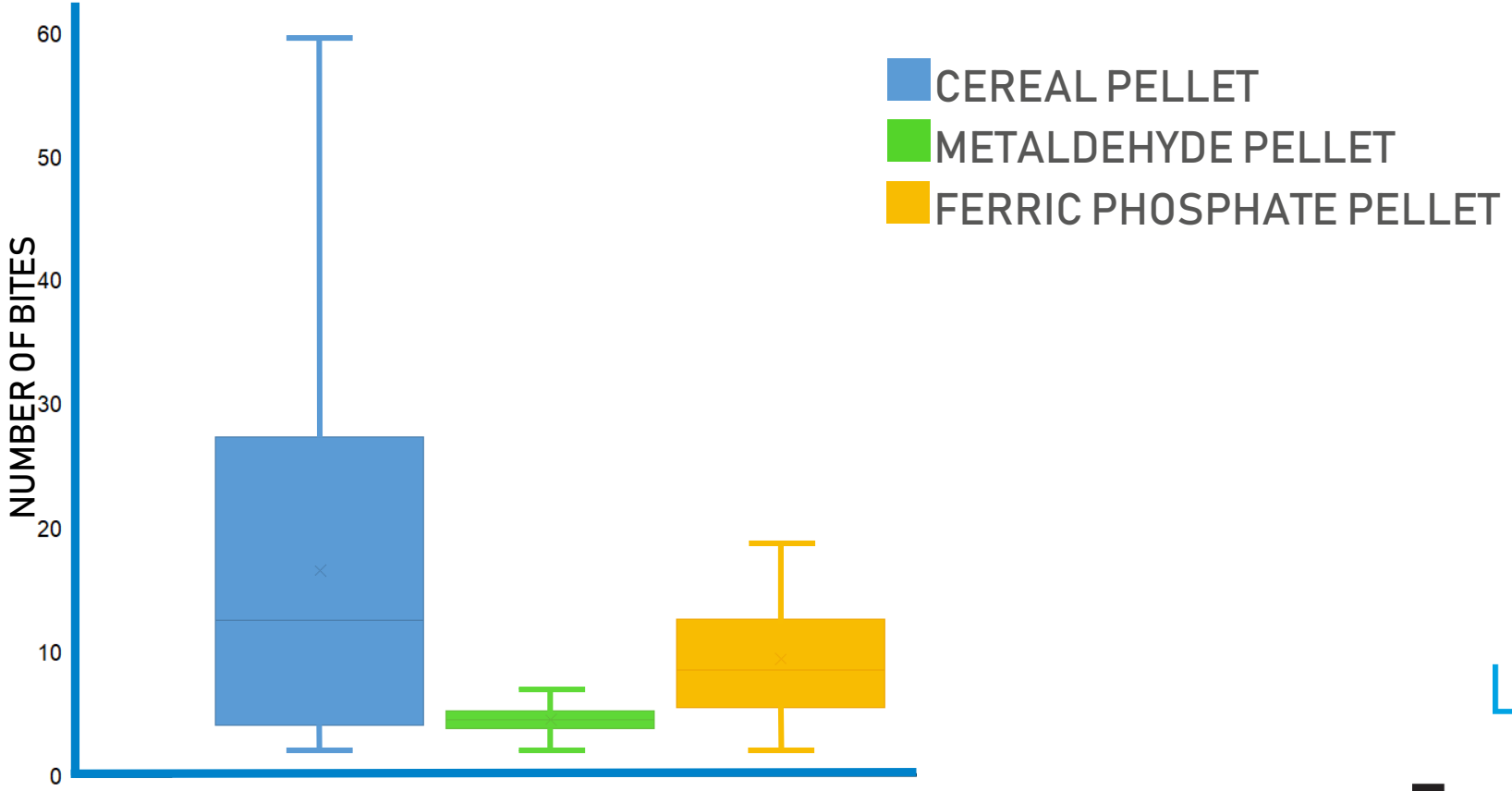
- How much feeding?



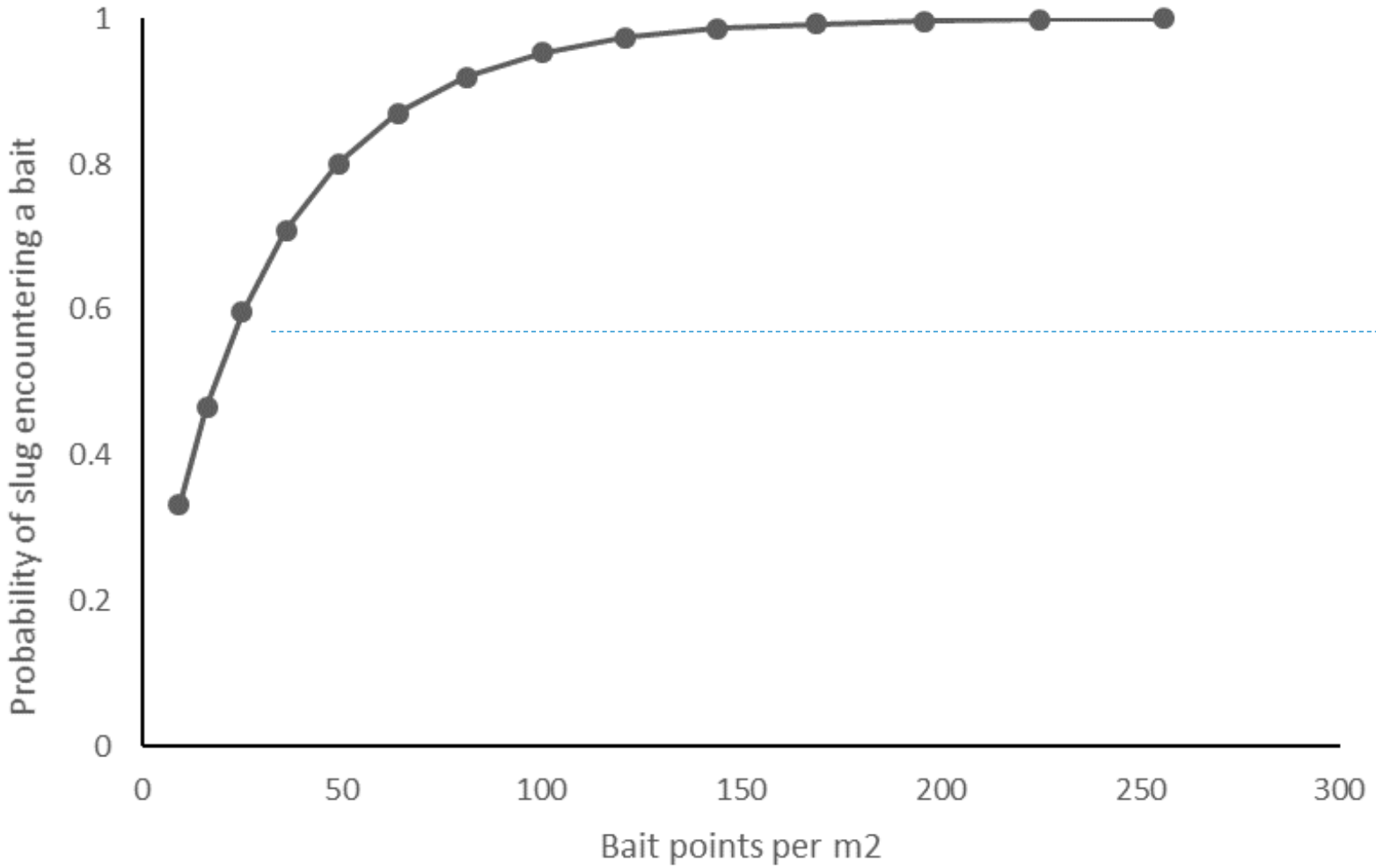


New Pellets

- How much feeding?



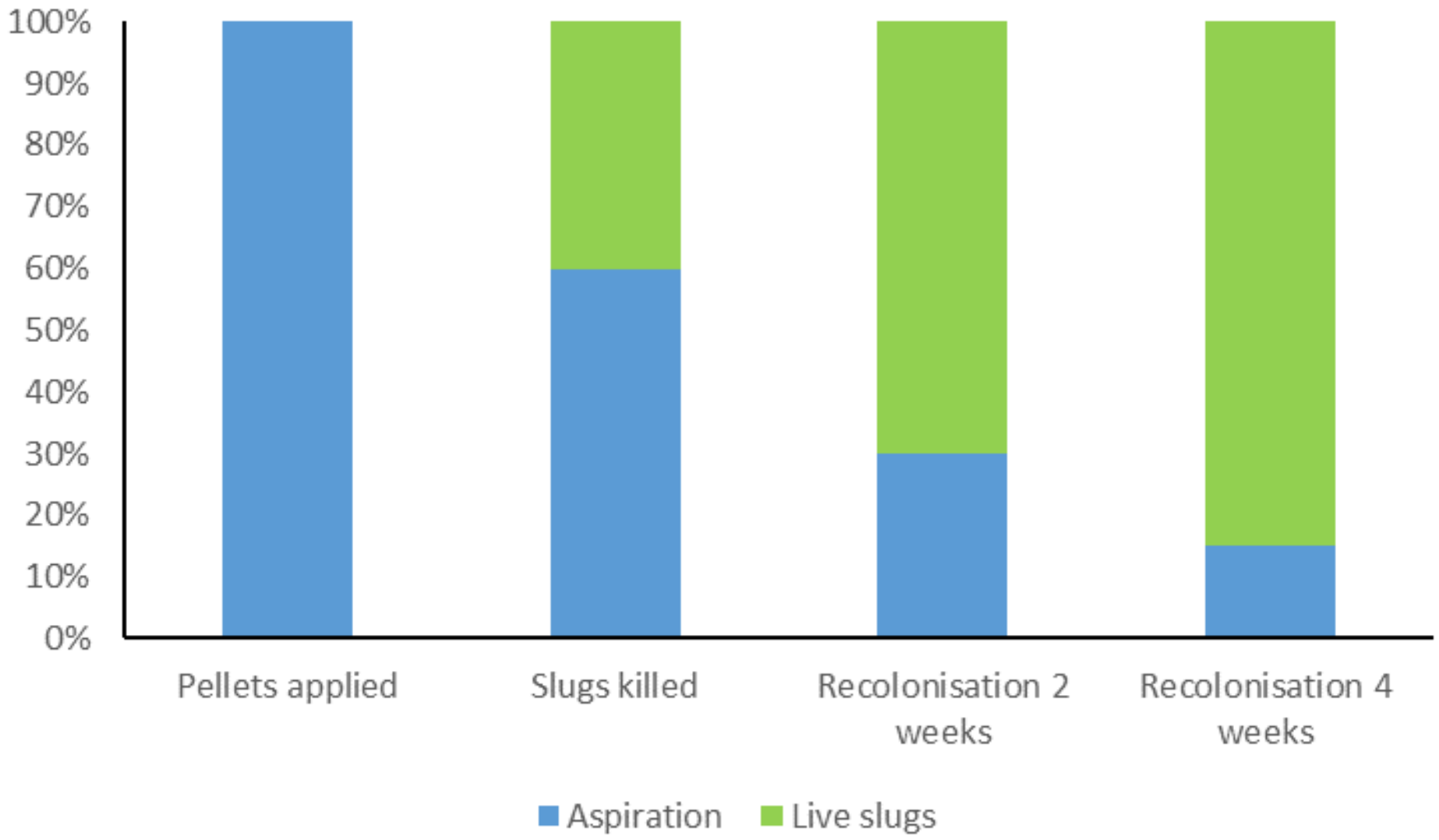
Finding Pellets



Probability of encountering a bait in six hours

Probability of mortality after 14 days

Probable Impact of Pellets

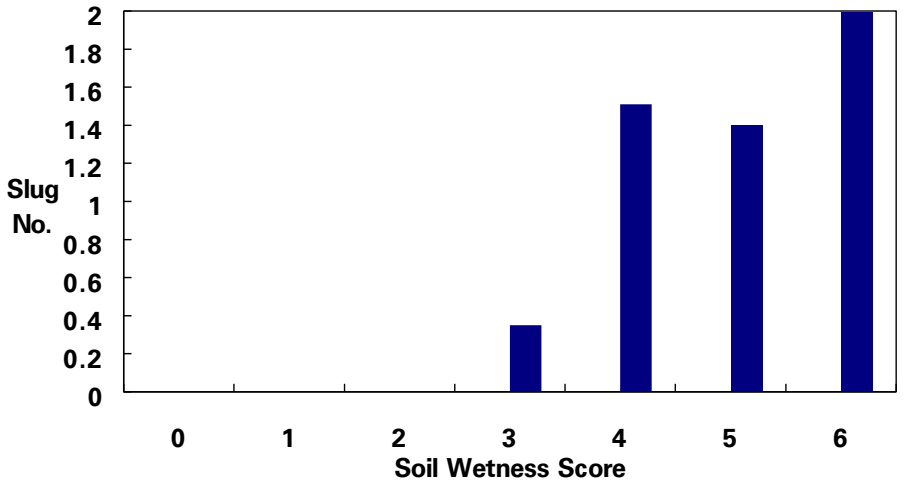


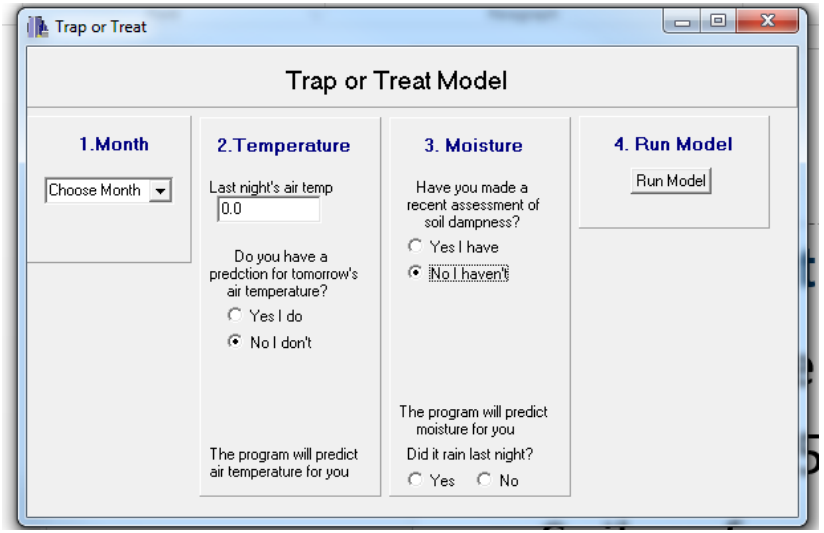
Where next - IPM

- Avoidance – Risk factors
- Previous crop
- Cultivation
- Encourage predators such as ground beetles

IPM – monitoring/ forecasting

- Long term forecasting not reliable
- Monitor, especially just before risk period
- Good understanding of conditions when slugs are active, causing damage: Trap or Treat
  - Soil surface moist
  - Temperature above 5º C





CERTIS SLUGWATCH

IPM - thresholds

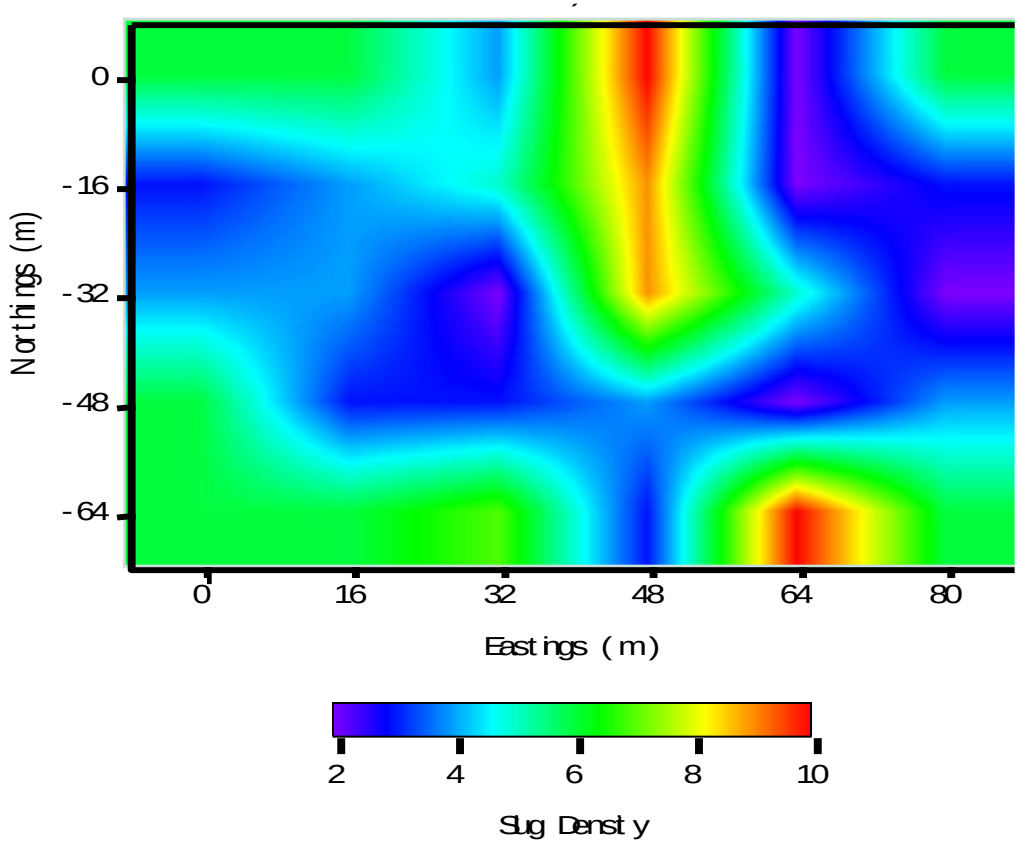
Crop	Threshold (average number of slugs/trap)
Winter cereal	4
Oilseed rape (standing cereals)	4
Oilseed rape (cereal stubble)	1
Potatoes	1
Field vegetables	1

IPM – management options

- Sustainable non-chemical methods
- Cultivation
- Encourage predators such as ground beetles
- Specific applications
- Bait pellets
- Be aware of their limitations

IPM – management options

- Keeping interventions at levels that are necessary
- Reduced doses
- Treating hotspots
- Resistance?
- Very unlikely



Distribution of *Deroceras reticulatum* in June 1997 in winter wheat (from LARS)

Slug Pests - Conclusions

- Slugs are difficult to manage
- IPM involves
- crop rotation
- cultivations
- if necessary (after monitoring) use of molluscicides
- Molluscicides should be used
- when weather is suitable
- shortly before crop is at risk

Thanks

- Funders

Defra / AHDB / Arable/Horticulture LINK / Perry Foundation / Agrochemical Industry and other collaborators

- PhD students & Research Associates

- Especially
- UKWIR
- Lucideon
- Amy Campbell
- Samantha de Silva


‘Inspiring our farmers, growers and industry to succeed in a rapidly changing world’

The consequences of a total ban on neonicotinoid seed treatments for BYDV control in cereals: a return to IPM principles?

Alan M. Dewar
Dewar Crop Protection Ltd.
www.dewarcropprotection.co.uk


We're All
DOOMED

Sustainable Use Directive principles on Integrated Pest Management

1. Achieving prevention and suppression of harmful organisms
2. Monitoring of harmful organisms
3. Decisions made based on monitoring and thresholds
4. Non-chemical methods
5. Pesticide Selection
6. Reduced Use
7. Anti-resistance strategies
8. Evaluation

Source: http://www.europarl.europa.eu/RegData/etudes/STUD/2018/627113/EPRS_STU(2018)627113_EN.pdf

SUD 1. Achieving prevention and suppression of harmful organisms

- What are the harmful organisms?
  - BYDV infection is caused by several strains (some would say ‘species’) of a luteovirus that are all transmitted by…
  - Aphids, and ONLY aphids
  - Most common strains in UK include PAV, MAV and RPV
  - The latter strain has been classed as a polerovirus within the Luteoviridae

Pest of cereals in the UK

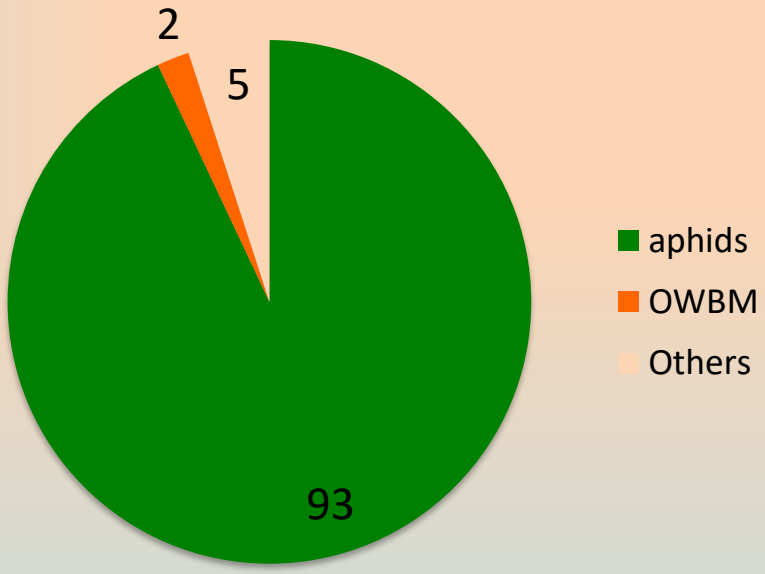
pest	species	Time of year
Grain aphids	*Sitobion avenae*	Autumn, BYDV, summer
Rose-grain aphids	*Metopolophium dirhodum*	summer
Bird-cherry aphids	*Rhopalosiphum padi*	Autumn, BYDV
Wheat bulb fly	*Delia coarctata*	winter
Gout fly	*Chlorops pumilionis*	Autumn, spring
Wheat orange blossom midge	*Sitodiplosis mosellana*	spring, summer
Saddle gall midge	*Haplodiplosis marginata*	summer

Likely to be affected by neonicotinoid ban

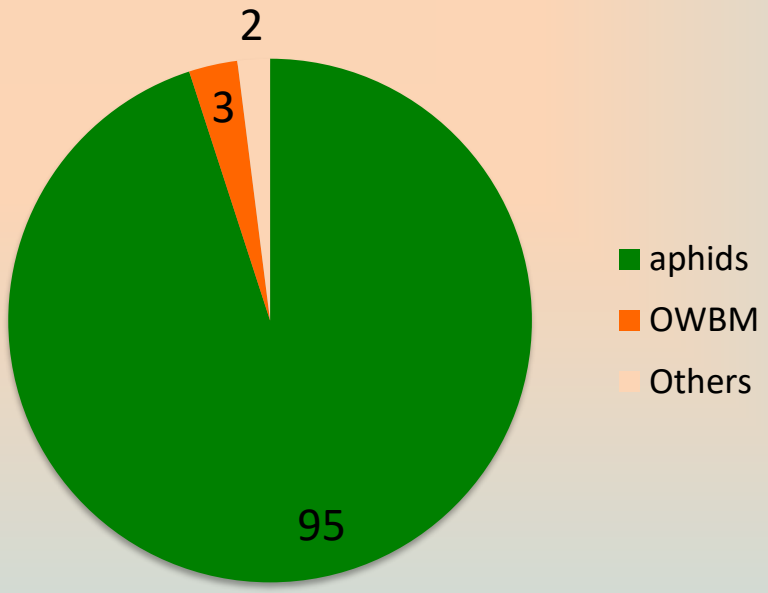
From Dewar *et al*., AHDB Research Review No. 86 (2016)

Target pests for insecticides in wheat in the UK

2016



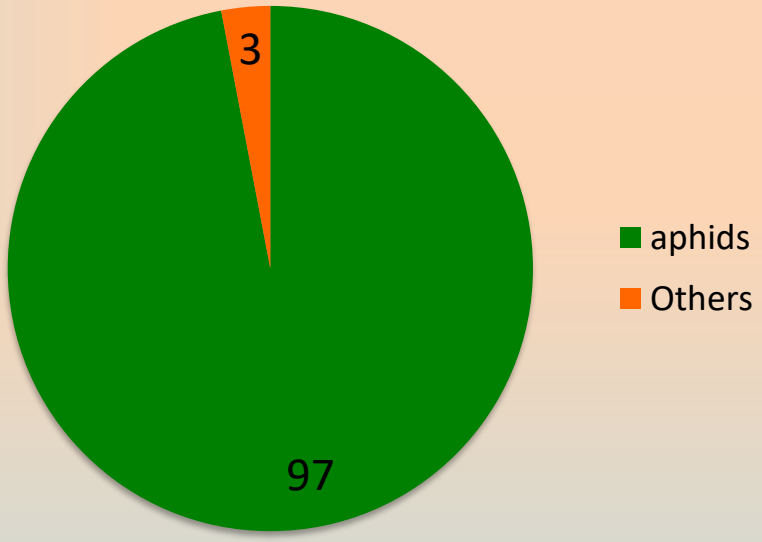
2018



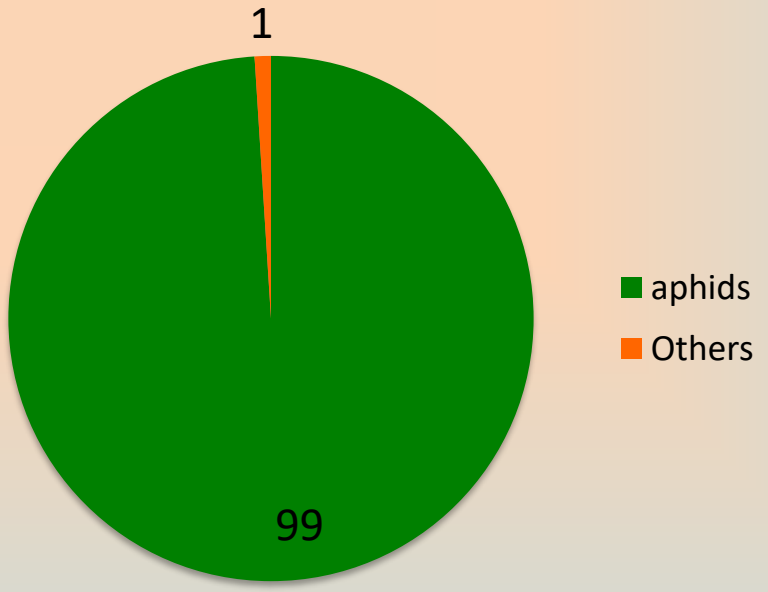
Source: Pesticide Usage Surveys in Arable Crops: Garthwaite *et al*., 2018 and 2019

Target pests for insecticides in winter barley in the UK

2016



2018



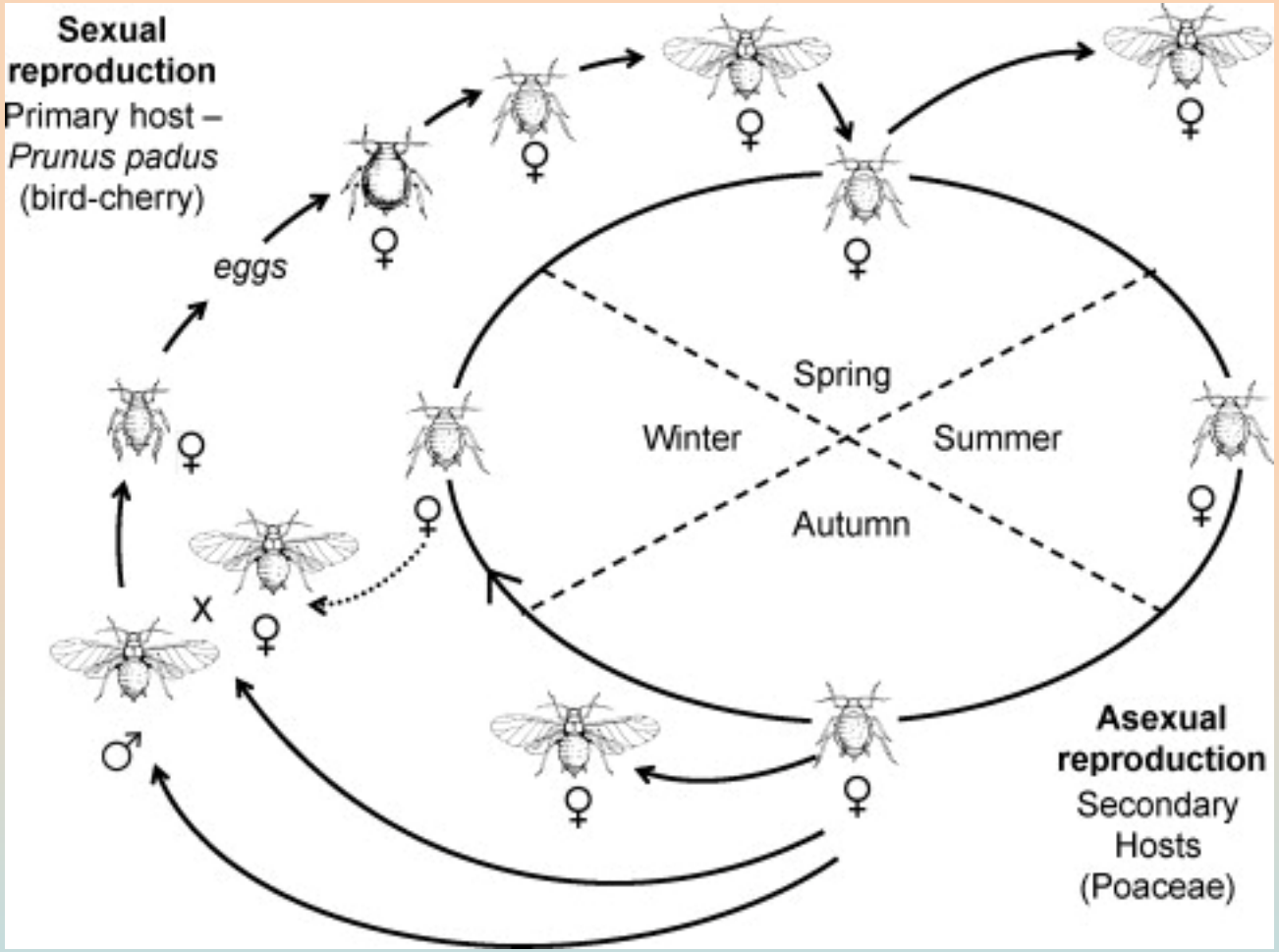
Source: Pesticide Usage Surveys in Arable Crops: Garthwaite *et al*., 2018 and 2019

The bird cherry-oat aphid, *Rhopalosiphum padi*

- Important pest on wheat, barley and oats
- Transmits BYDV - PAV and RPV strains
- Formerly good control with Deter seed treatment
- Continuing good control with pyrethroids

But….
A pyrethropid resistant/tolerant clone of *R padi* has recently been recorded in Ireland, so watch this space

Life cycle of *R. padi*



It is the asexual forms which are the main vectors of BYDV in cereals

The grain aphid, *Sitobion avenae*

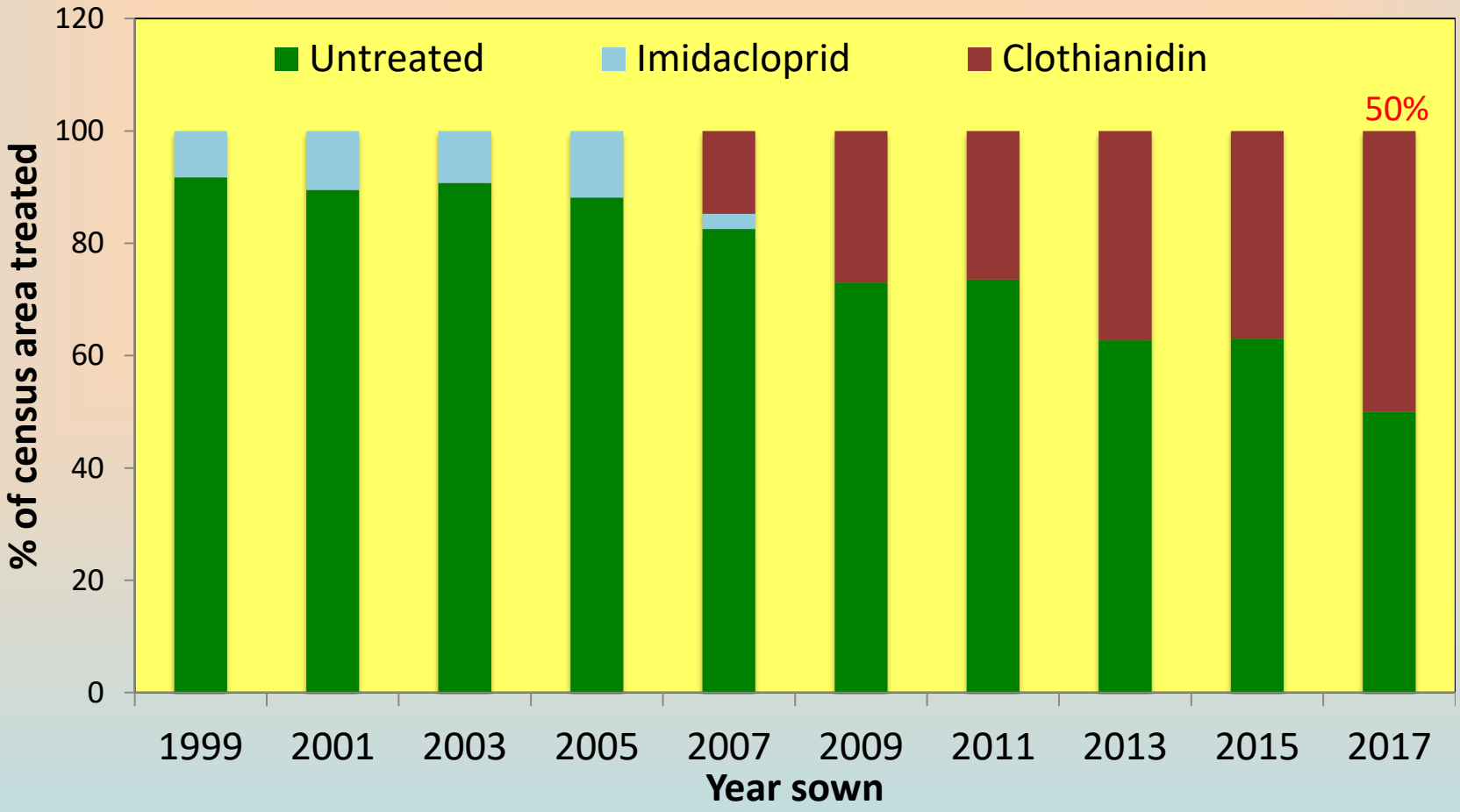
- Important pest on wheat, barley and oats
- Can reduce grain yield
- Transmits BYDV - MAV and PAV strains
- Previous good control with Deter and pyrethroids
- Control failures reported in summer 2011 and springs of 2012 and 2016

Epidemics are occurring more often in the autumn due to global warming, causing BYDV infection in following spring

These epidemics have often been associated with the presence of grain aphids, NOT bird cherry aphids

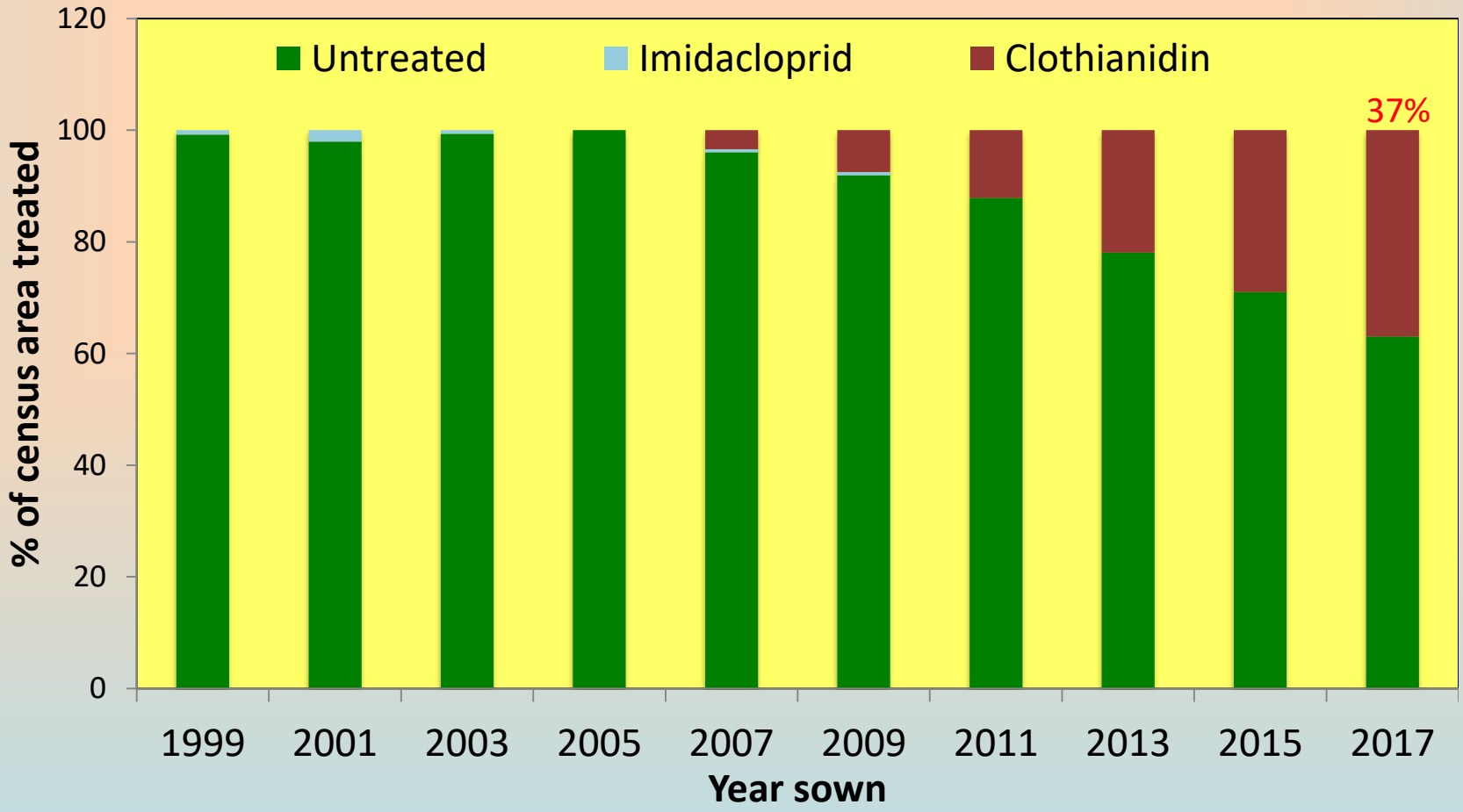
Crops near Elveden and Lakenheath in 2012

Use of neonicotinoid seed treatments in winter and spring wheat in GB: 1999-2018



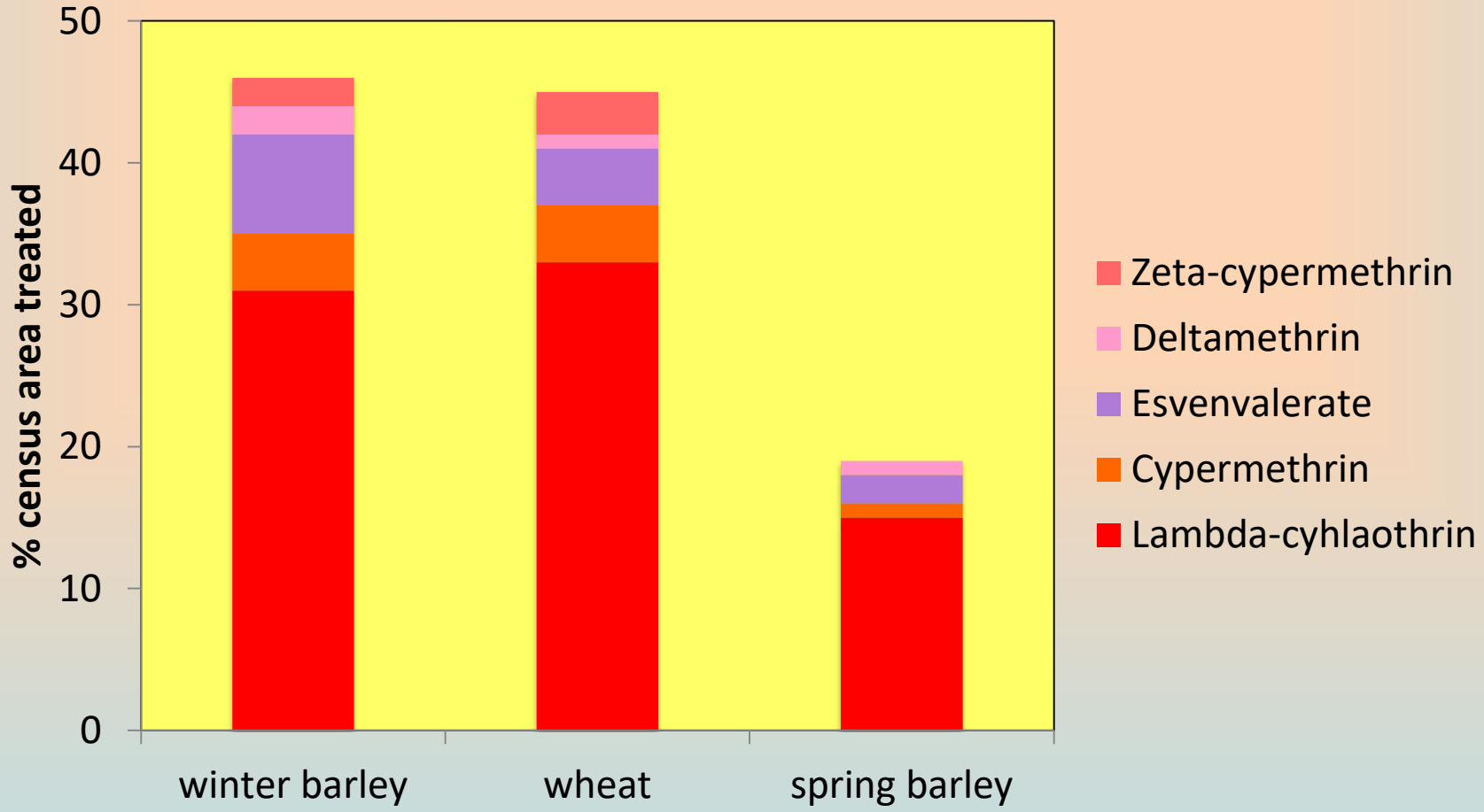
Source:
Pesticide Usage Survey Reports: Garthwaite *et al*., 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015 , 2018, 2019

Use of neonicotinoid seed treatments in winter barley in GB: 2000-2018



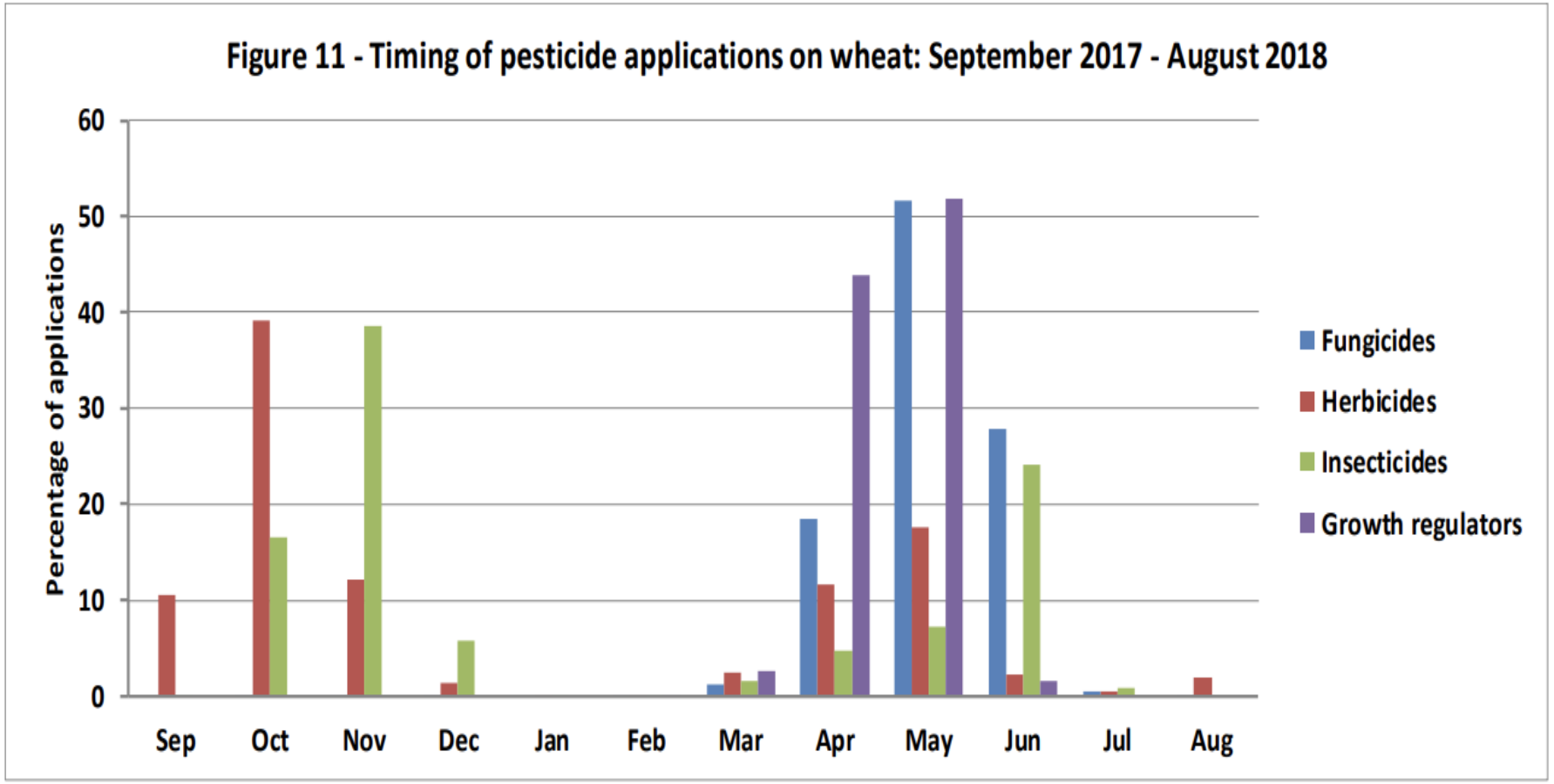
Source:
Pesticide Usage Survey Reports: Garthwaite *et al*., 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2018, 2019

Use of insecticides in cereals in the UK in 2018: the top 5 are all pyrethroids



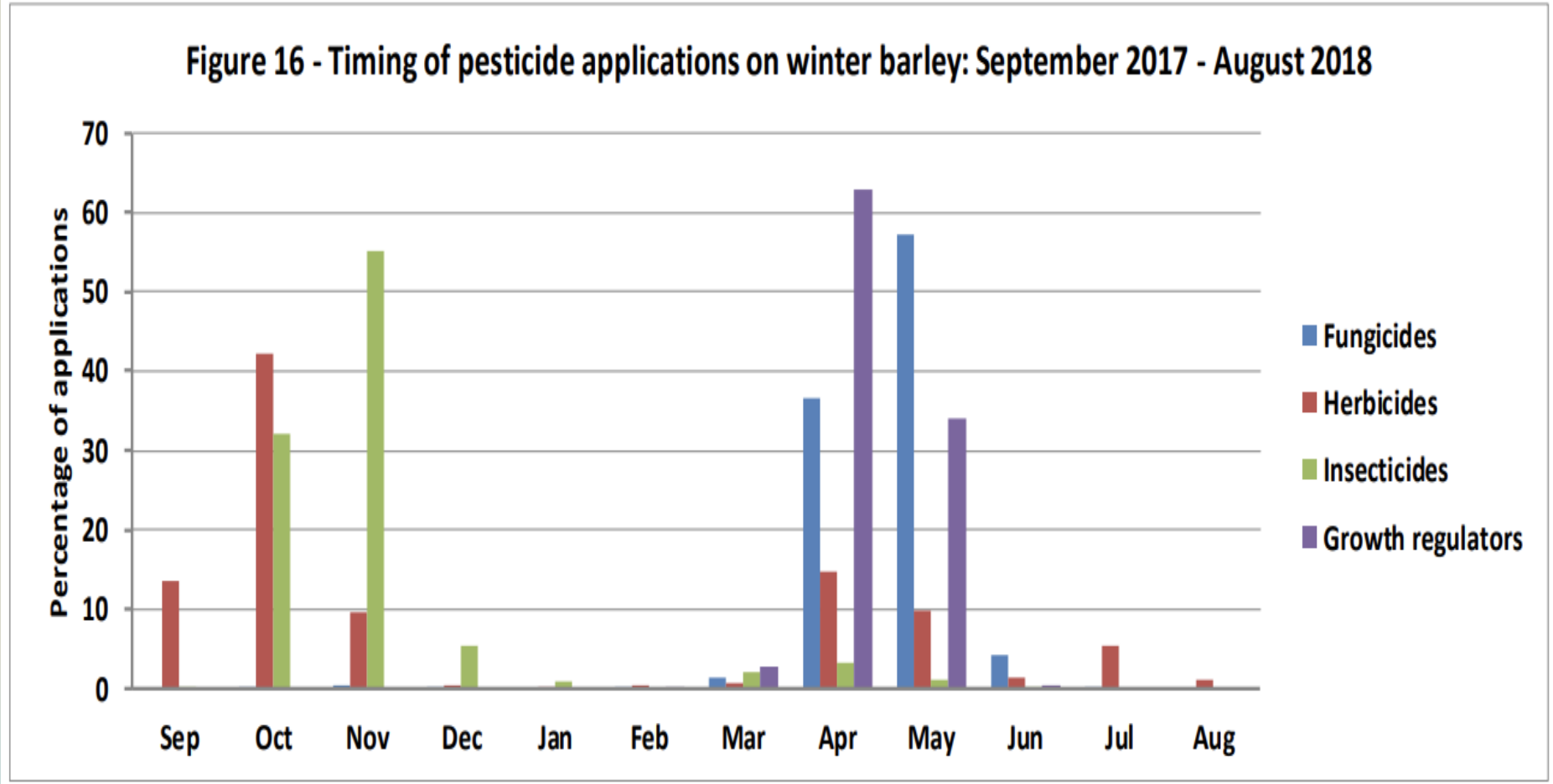
Source: Pesticide Usage Survey, Report 284: Garthwaite *et al*., 2019

Target pests for insecticides in winter wheat in the UK 2017-2018



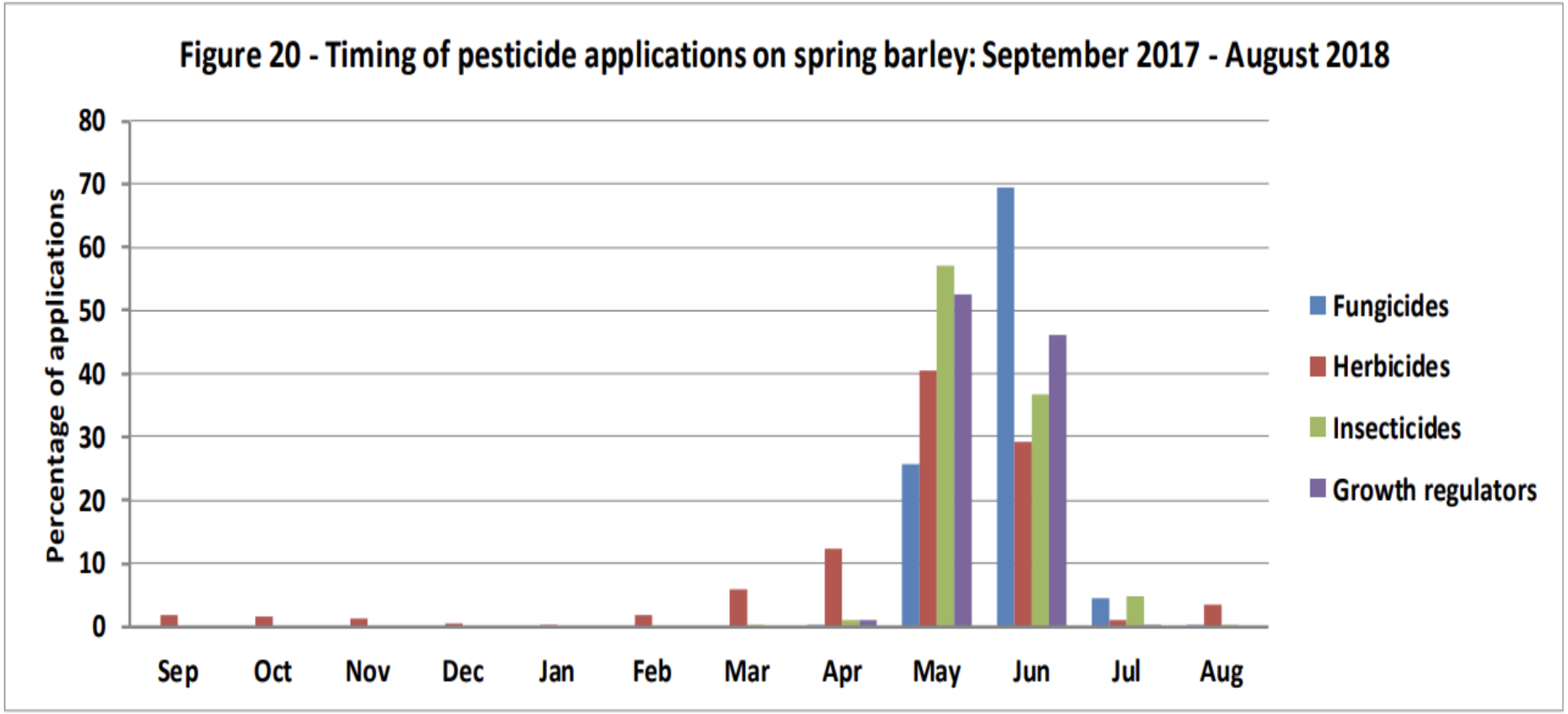
Source: Pesticide Usage Survey in Arable Crops, 284: Garthwaite *et al*., 2019

Target pests for insecticides in winter barley in the UK 2017-2018



Source: Pesticide Usage Survey in Arable Crops, 284: Garthwaite *et al*., 2019

Target pests for insecticides in spring barley in the UK 2017-2018



87% of insecticides in spring barley are applied to control aphids

Source: Pesticide Usage Surveys in Arable Crops, 284: Garthwaite *et al*., 2019

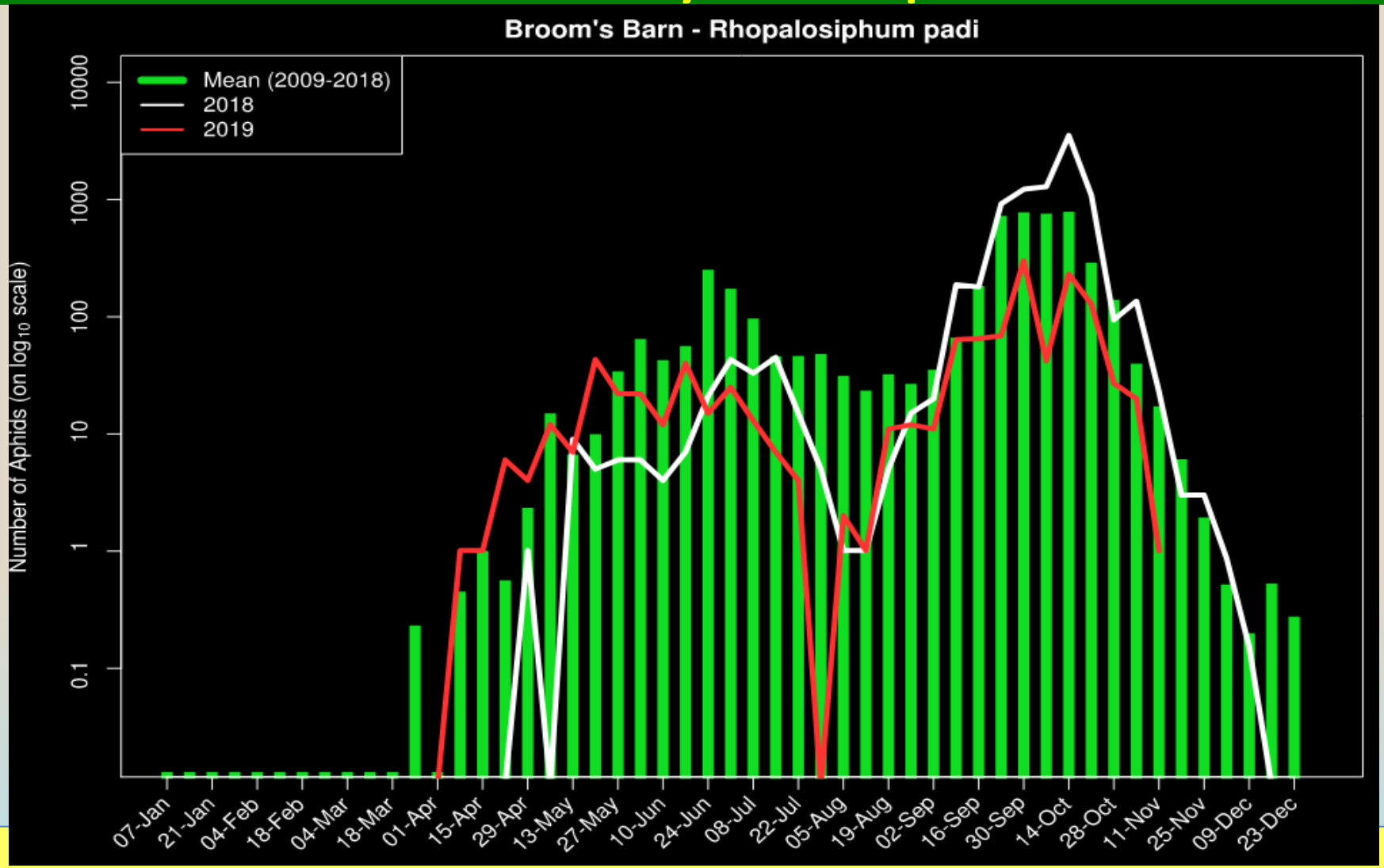
SUD 2. Monitoring of harmful organisms

- Aphids must migrate into cereal fields each autumn
- So their migrations can be monitored
  - By suction traps
  - By sticky traps
  - By water traps
  - By direct observation in crops

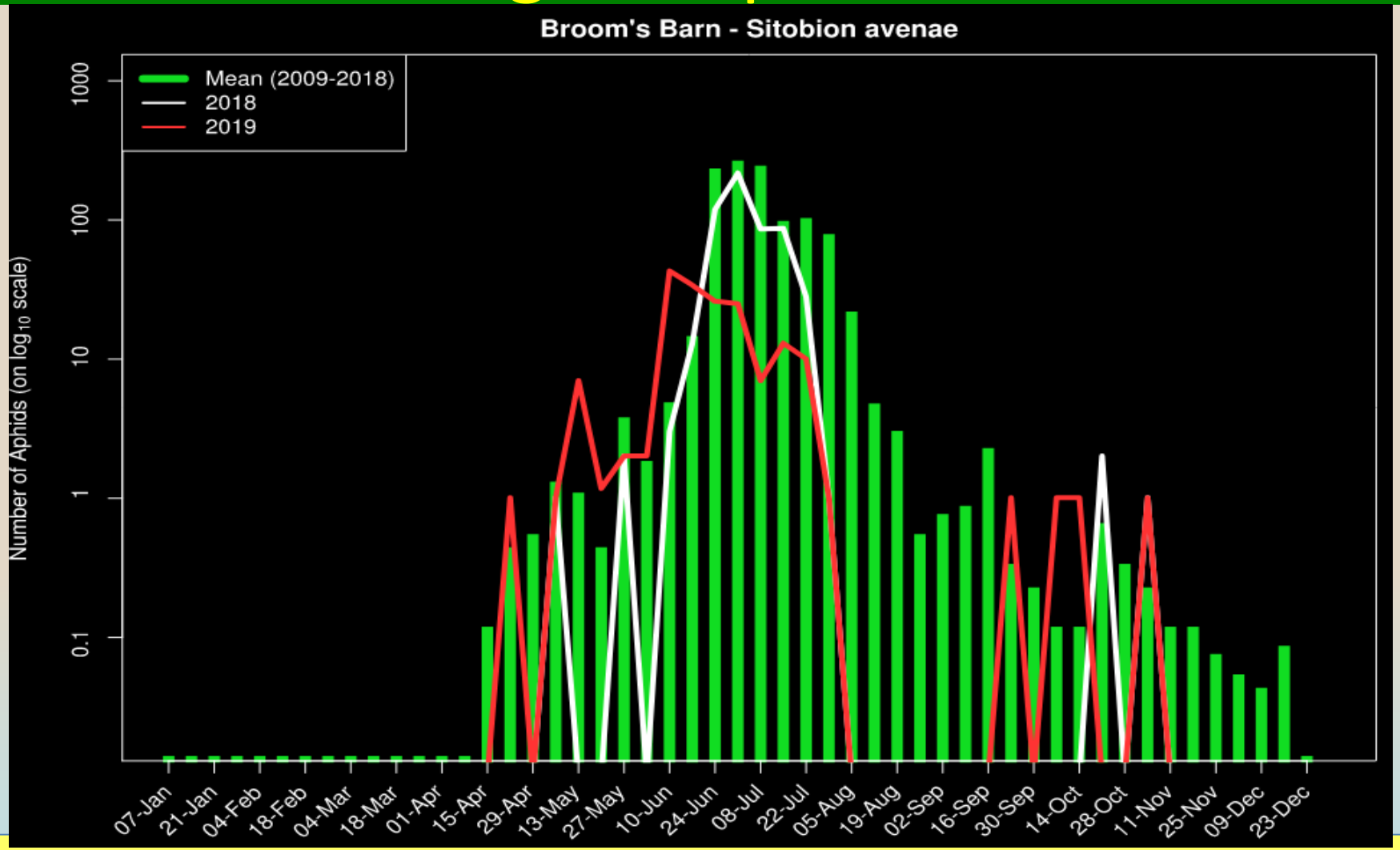
Rothamsted Insect Survey suction trap sites

http://www.rothamsted.ac.uk/insect-survey/STTrapSites.php

Recent migrations of aphids in suction trap: bird cherry oat aphid



Recent migrations of aphids in suction trap: grain aphid



Other traps

Yellow water trap

Insect soup

Sticky trap

These do require the skills of an entomologist

SUD 3. Decisions made based on monitoring and thresholds (1)

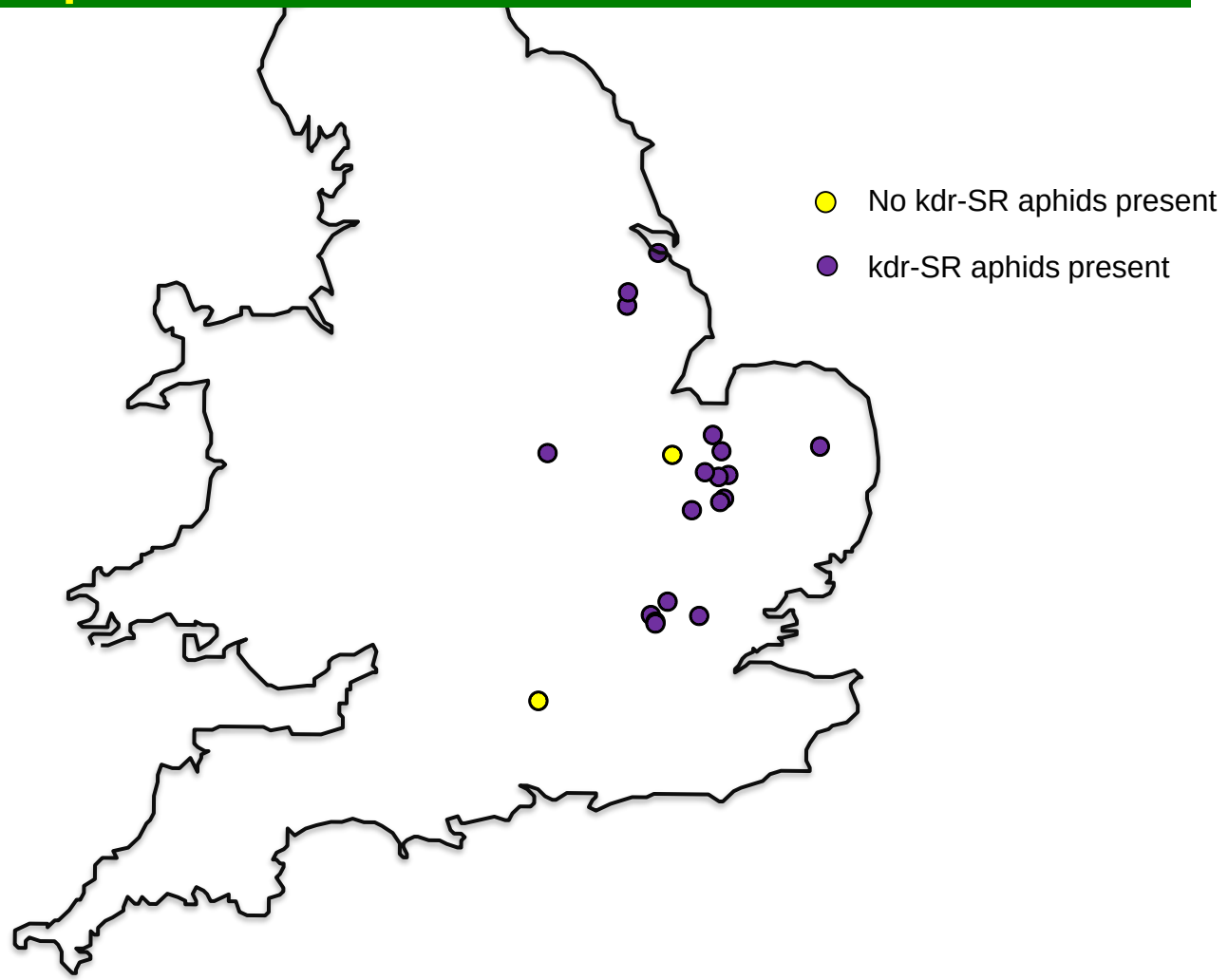
- Thresholds for aphid control with regard to suppressing BYDV are variable, and lack data to underpin their accuracy e.g. 10% of plants infested
- So, in practice, growers and agronomists assume that…
  - the only good aphid is a dead one!
  - therefore, in the absence of seed treatments, sprays are applied when the first aphid is seen.

Can this approach be changed?

SUD 3. Decisions made based on monitoring and thresholds (2)

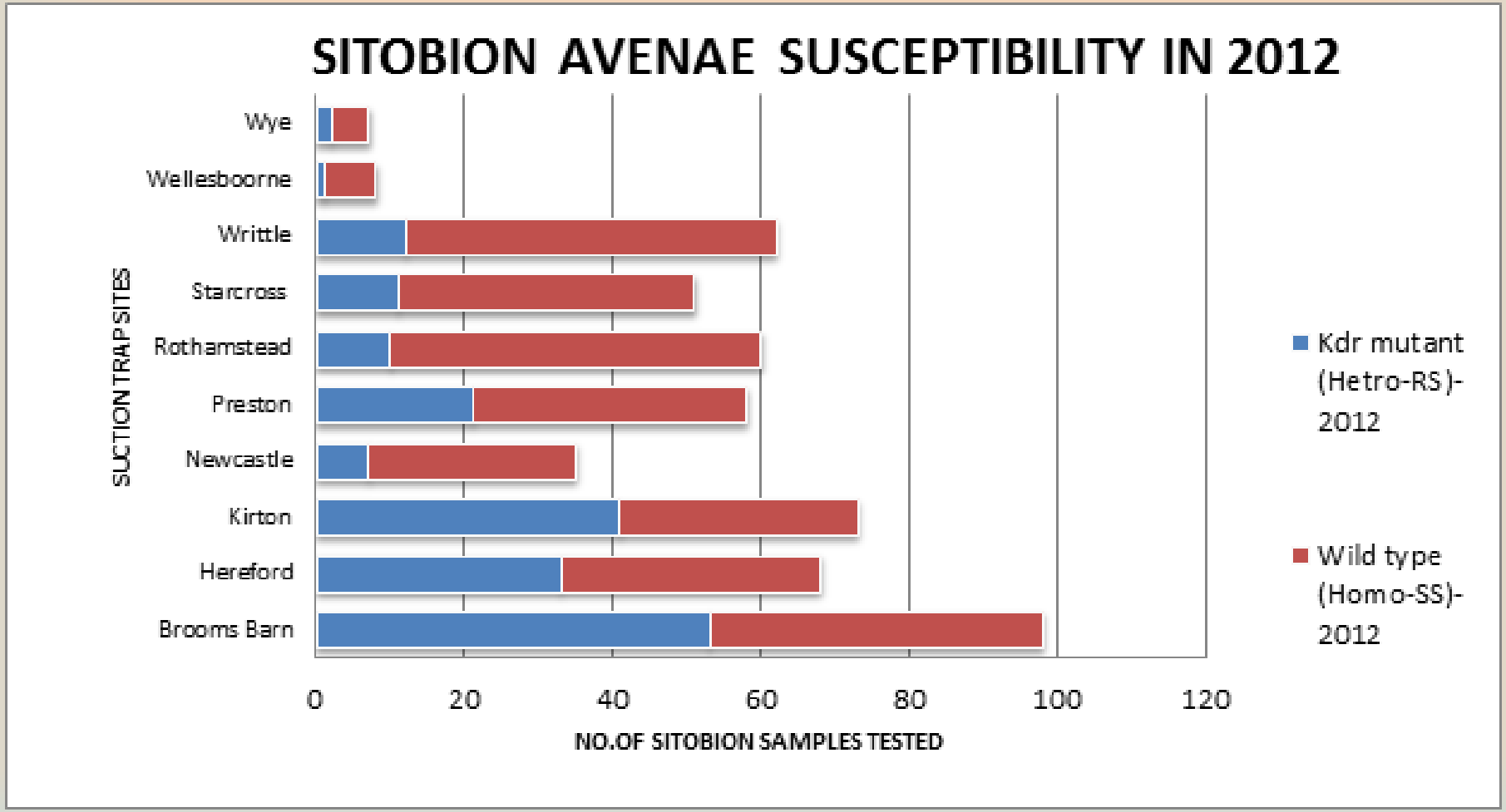
- Needs better information on the threat of virus infection including:
  - Infectivity indices for each region in the country using trap data
  - this in turn requires information on
    - The proportion of those aphids carrying viruses
    - The proportion of those aphids that are resistant to pyrethroids to guide choice of insecticides

Resistance status of *Sitobion avenae* samples collected in 2012



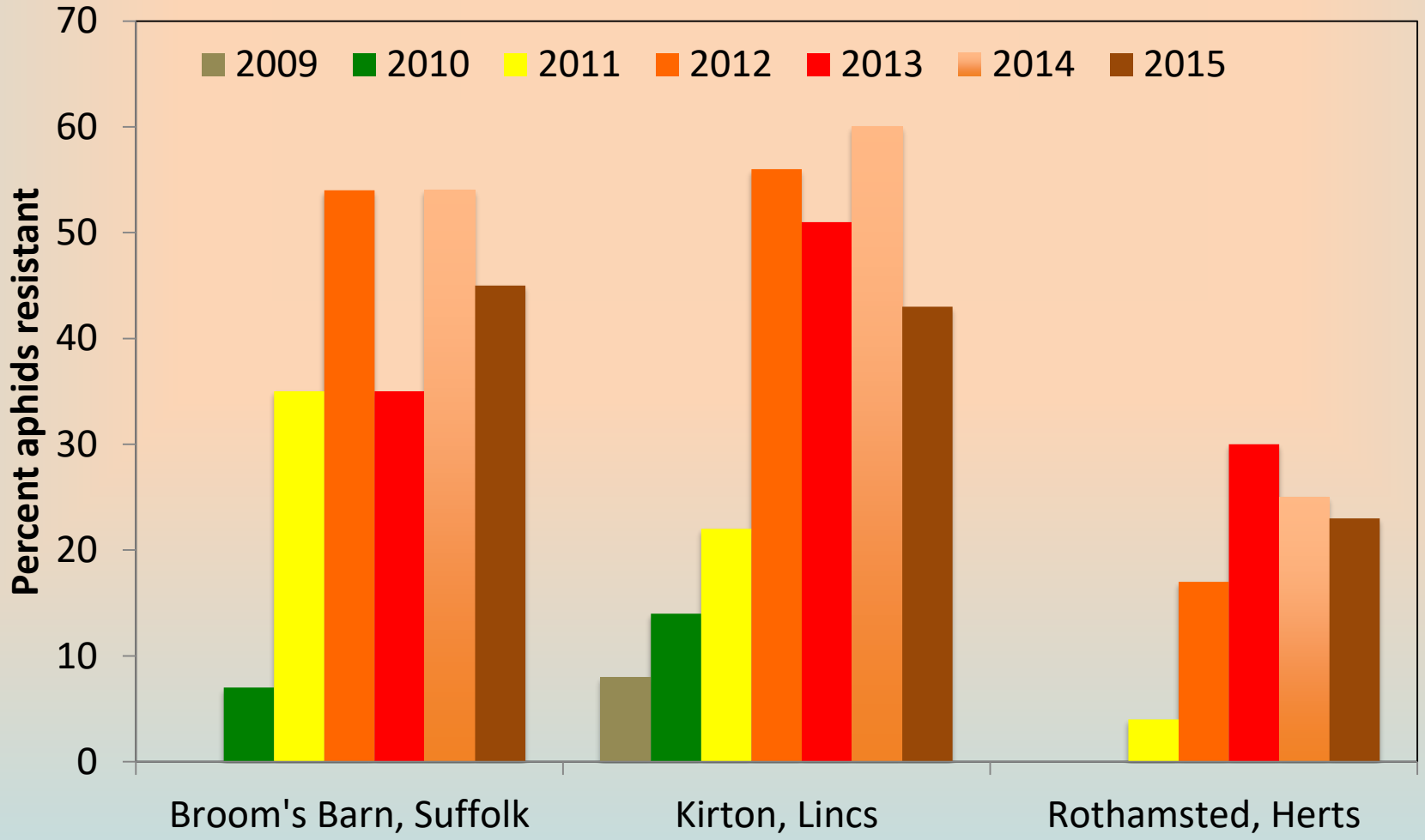
Survey funded by Syngenta Crop Protection

Resistant and susceptible *Sitobion avenae* in RIS suction trap samples in 2012



Source: Steve Foster and Martin Williamson at Rothamsted Research

Frequency of resistant *Sitobion avenae* in Rothamsted Insect Survey suction traps: 2009 - 2015

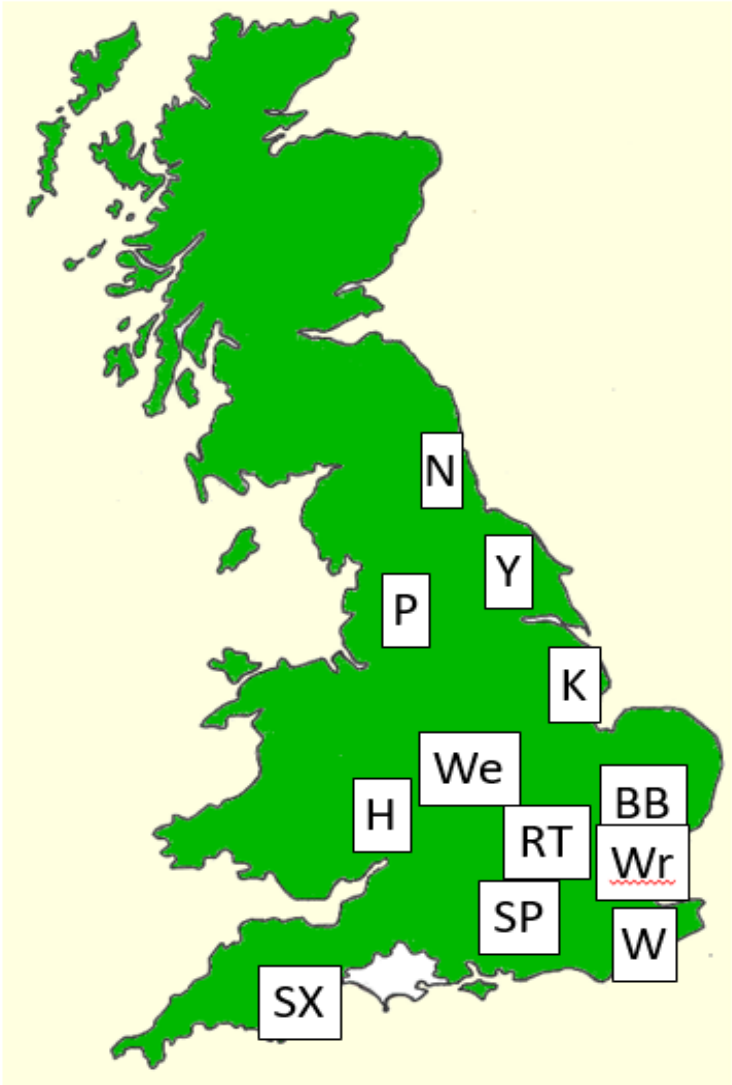


Rothamsted not tested in 2009 and 2010; lack of funding has prevented more recent surveys

BYDV incidence / suction trapped *R. padi* October 2018

Pilot study: <100 aphids tested / trap

Trap	R padi	% BYDV
N	625	18
Y	15808	12
P	15995	15
K	11887	3
BB	8696	13
We	6929	6
H	6445	3
RT	3734	0
Wr	10471	21
SP	2752	4
W	6406	8
SX	3971	8

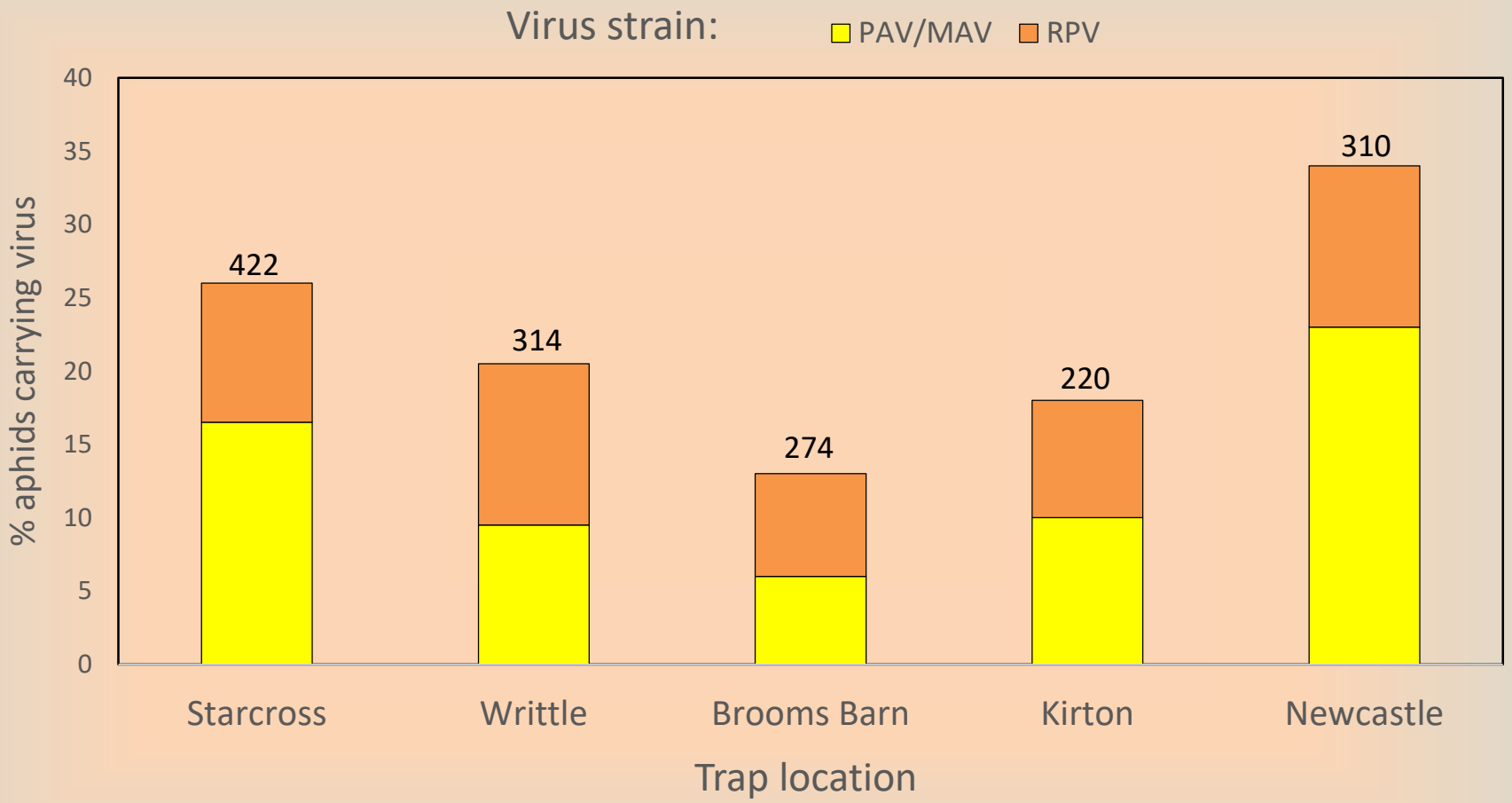


Insect Survey network: Newcastle, York, Kirton, Wellesbourne, Hereford, Rothamsted, Brooms Barn, Writtle, Silwood Park, Wye & Starcross)

ROTHAMSTED RESEARCH

Source: Martin Williamson at Rothamsted Research

Percentage *R. padi* carrying BYDV (PAV and MAV) and CYDV-RPV across five English suction traps in autumn 2019



Number tested above columns

ROTHAMSTED RESEARCH

Source: Martin Williamson at Rothamsted Research

AHDB AGRICULTURE & HORTICULTURE DEVELOPMENT BOARD

SUD 4. Non-chemical methods

- Delaying drilling until immigration threat is reduced or even eliminated e.g. November
  - Encouraged by blackgrass situation
  - Can result in reduced yields
  - Can be caught by inclement weather e.g. in 2019
- Use of BYDV resistant/tolerant varieties
  - No pesticides required at all
  - Can yields match top varieties?

BYDV resistant/tolerant varieties

- Some varieties now coming through development
  - Amistar (KWS) and Rafaela (LG Seeds) in winter barley
  - Wolverine (RAGT) in winter wheat

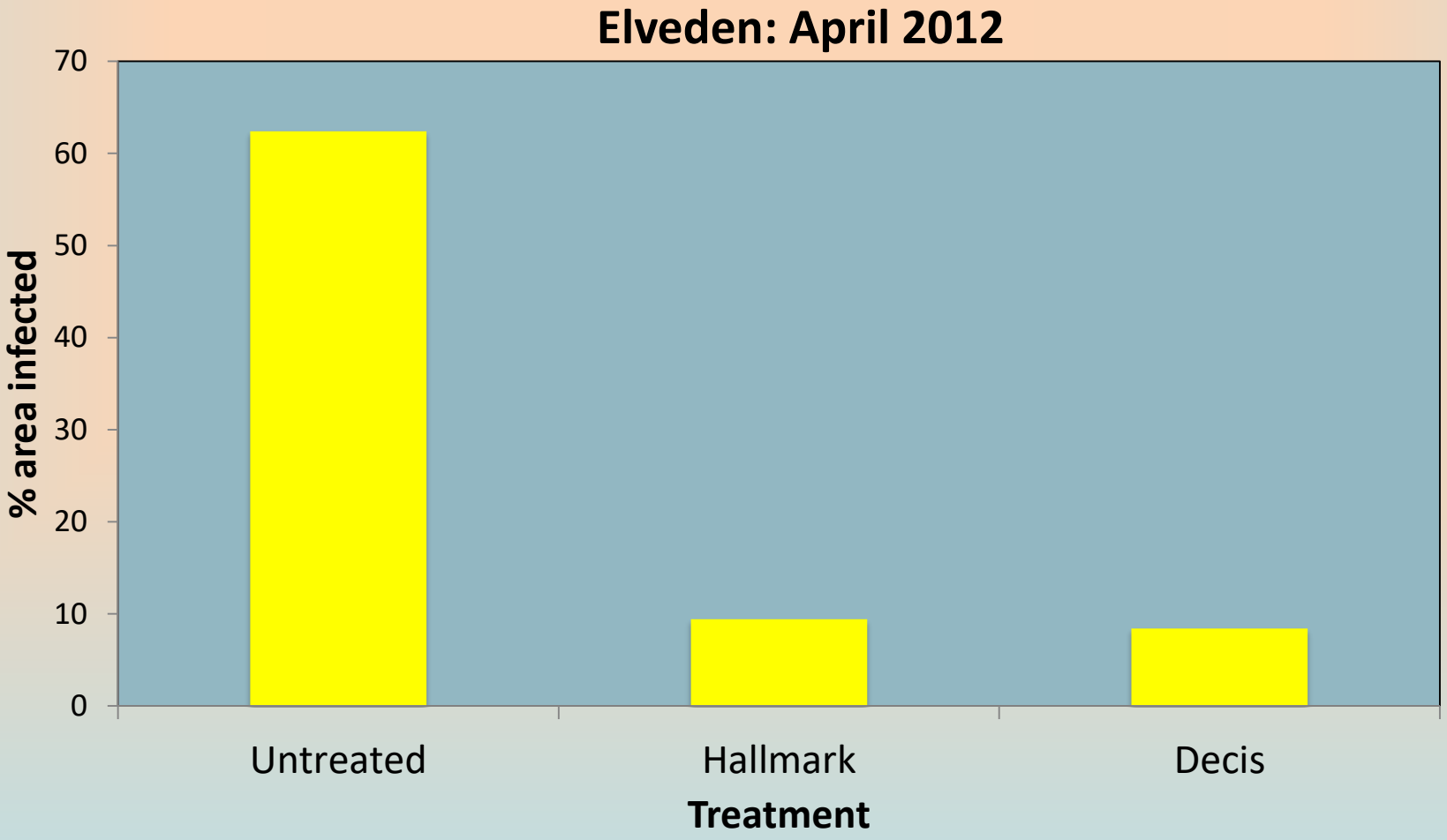
Right photo courtesy of Hugo Ellis of NIAB

SUD 5 Pesticide Selection

- In absence of neonicotinoid seed treatments, there is a huge reliance on one class of chemical
  - Top 5 insecticides used are all pyrethroids

- Nothing else is registered for use in autumn at the moment
  - This must change

Efficacy of insecticides against BYDV in winter barley 2011-2012



Both treatments gave significant control of the vector *R padi*

Effect of pyrethroids on BYDV infection spread by bird-cherry aphids

Untreated

Treated

SUD 6 Reduced Use

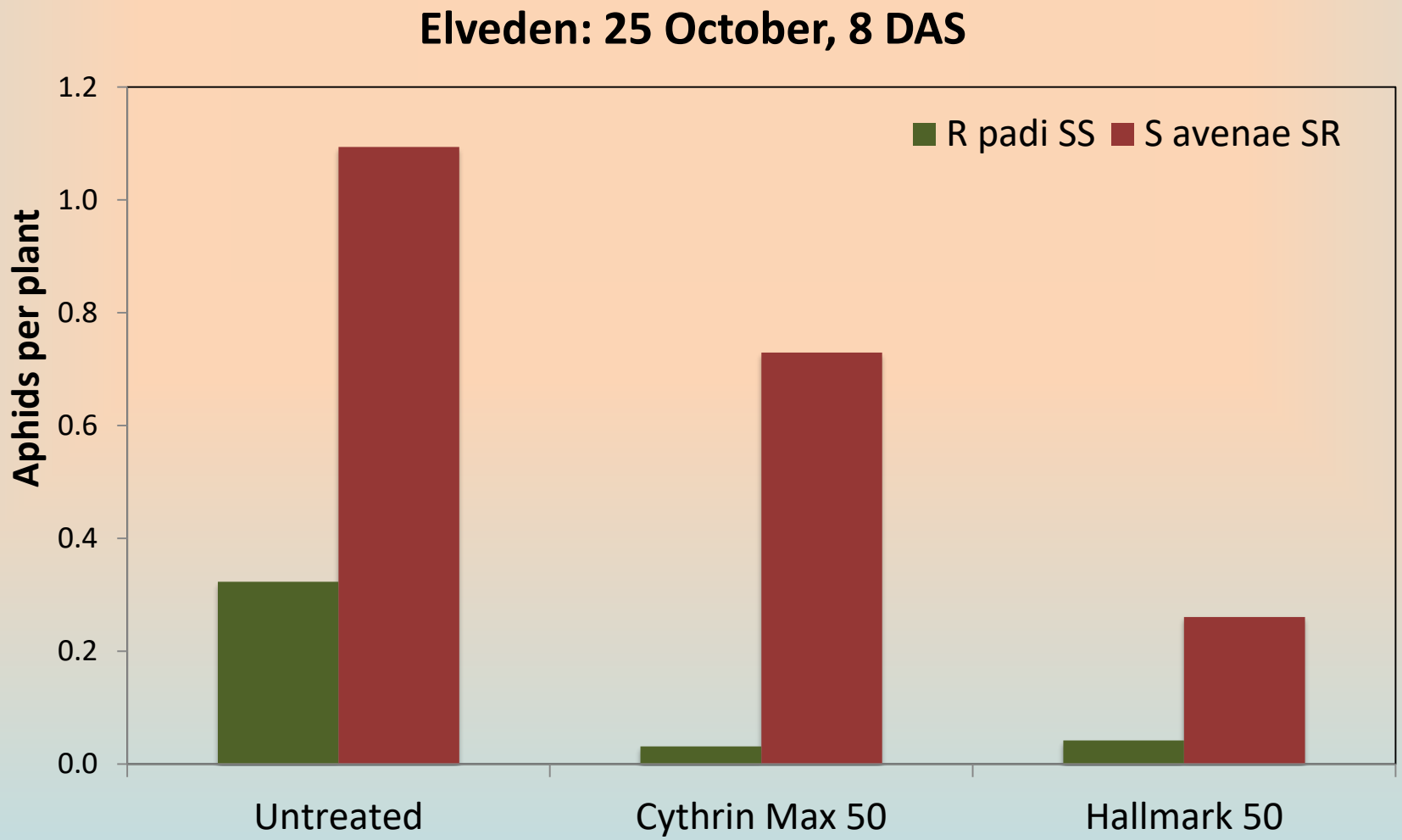
- In absence of effective seed treatments use of pyrethroids is likely **to increase** significantly
  - perhaps **double** the previous use?
  - although perhaps not this year given the inclement weather
- **This is likely to lead to selection for resistance**

SUD 7. Anti-resistance strategies

1. Urgent need for alternative chemistry given resistance situation with *Sitobion avenae* (up to 50% in some regions)

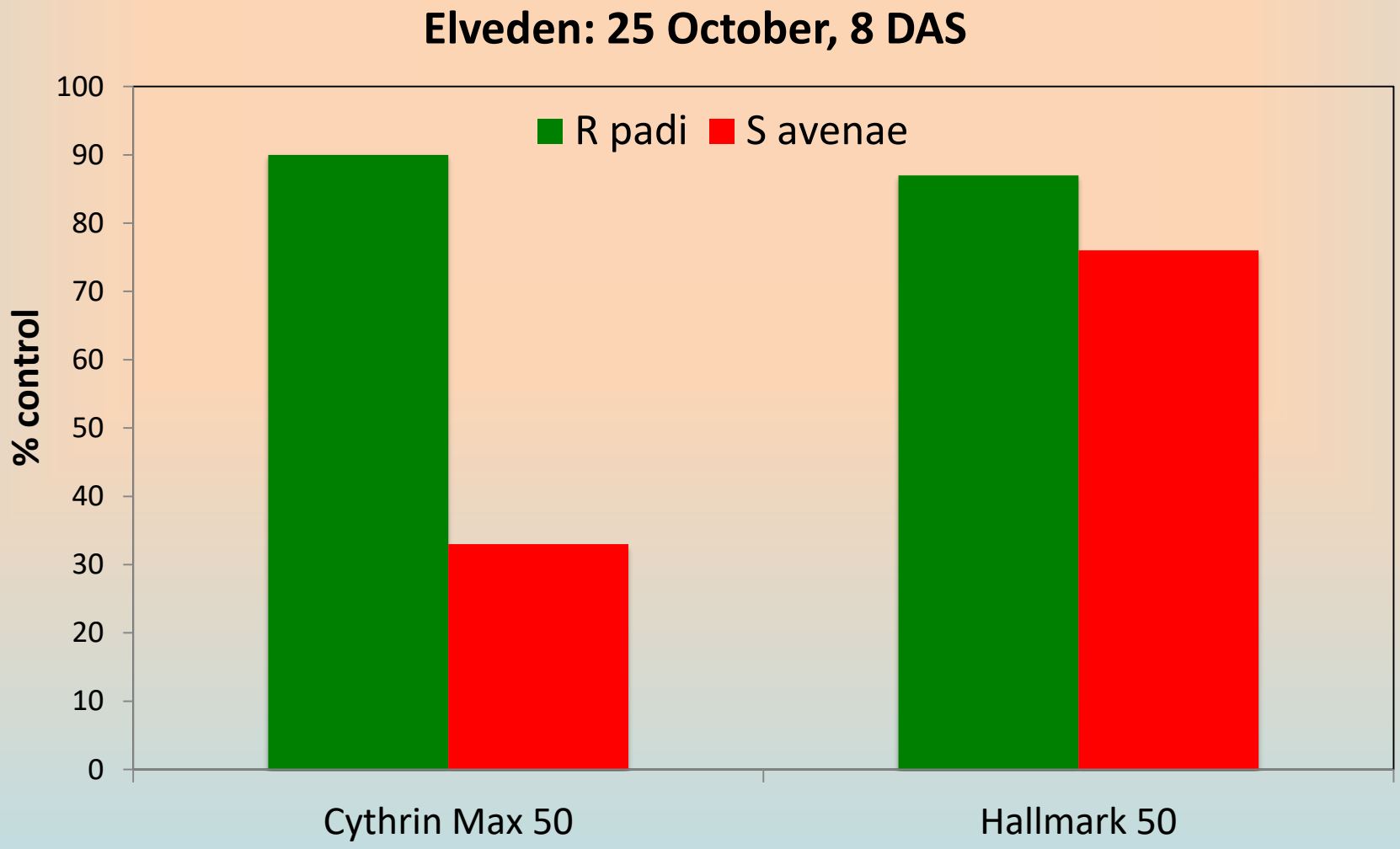
2. And higher risk of selection for resistance in *Rhopalosiphum padi*

Efficacy of insecticides in winter barley against aphids in 2016



aphids inoculated on 14 October; sprays applied on 17 October

Efficacy of insecticides in winter barley against aphids in 2016

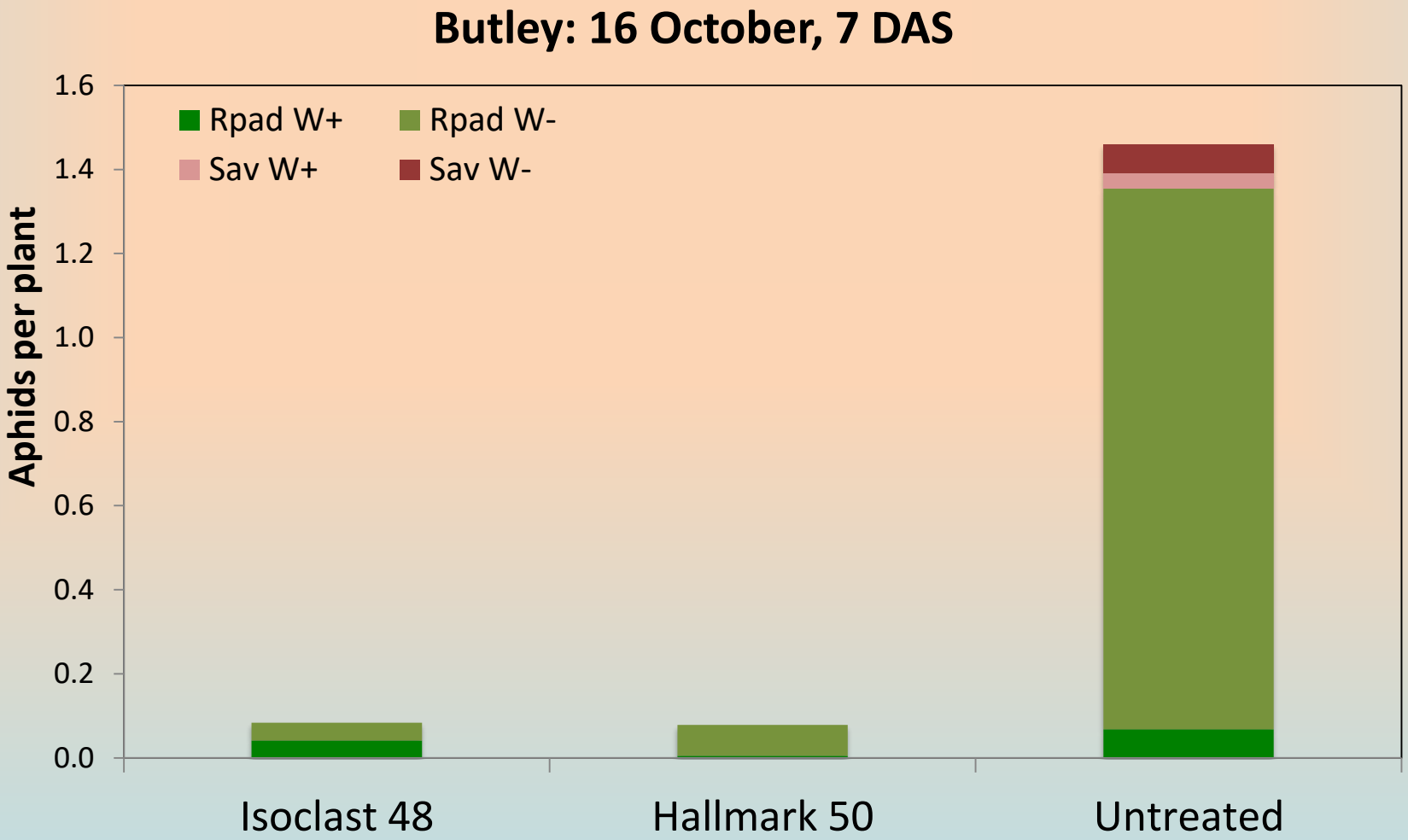


aphids inoculated on 14 October; sprays applied on 17 October:

For example, BYDV epidemic in 2016: Barrow, Suffolk

Associated with grain aphids, *Sitobion avenae,* that were resistant to pyrethroids

Efficacy of insecticides in winter rye against cereal aphids in 2017



sprays applied on 9 October: R pad = *Rhopalosiphum padi*; Sav = *Sitobion avenae*; W+ = winged; W- = wingless

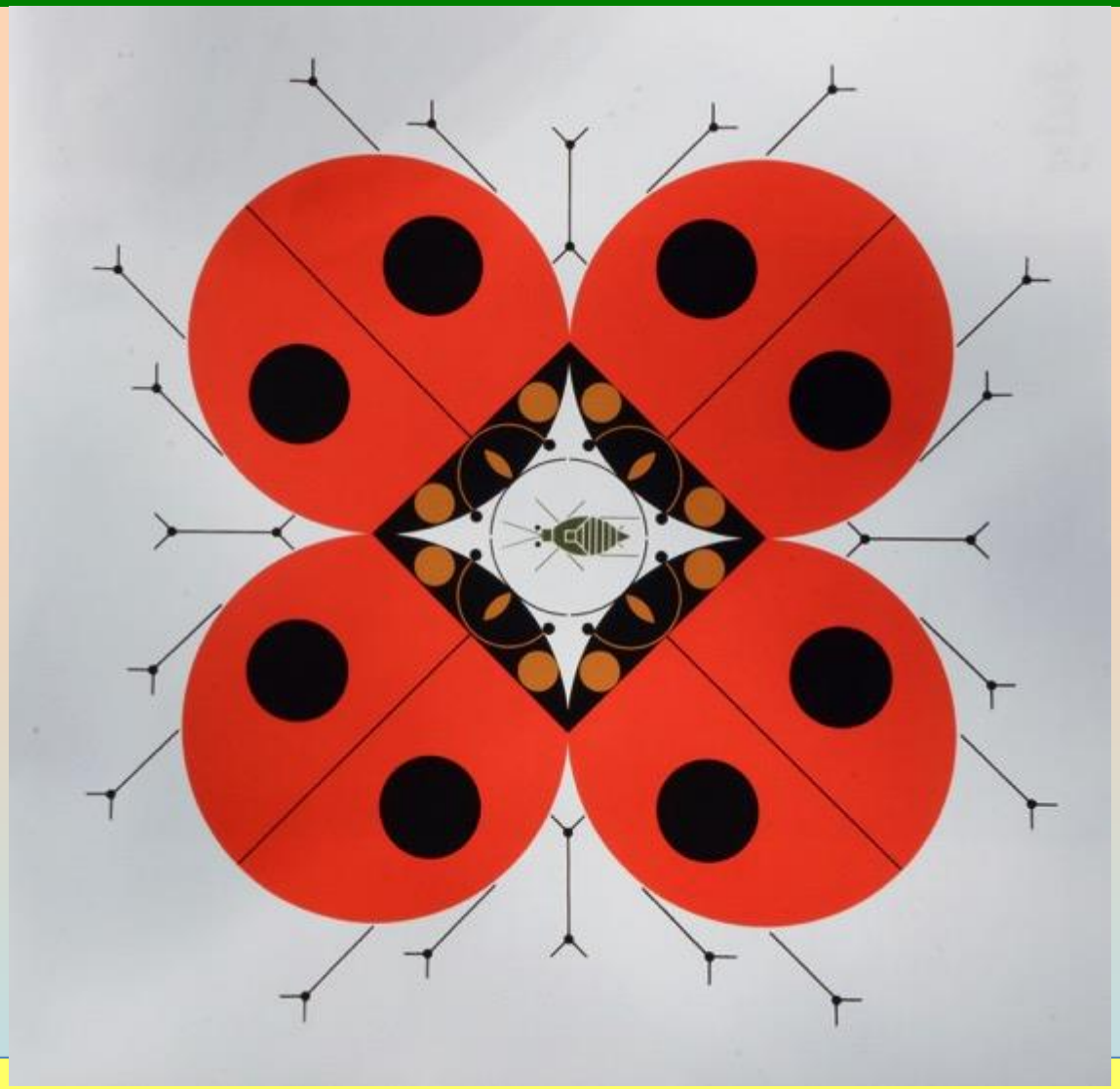
SUD 8 Evaluation

- Surveys of use of pesticides (already done though PUS)
- Surveys of incidence of BYDV across the country
  - Not done regularly at present
  - Could identify regions with higher risk and allow focus of effort there
  - Ideally should be done in untreated crops or part crops

A glimpse of the future

- Infochemicals: cis-jasmone; (E)-beta-farnesene
- RNAi – virus-derived resistance
- Field testing kits for individual aphids
- All varieties carrying resistant tolerance genes e.g. sugar beet situation with Rhizomania
- Biopesticides: neem, oils of cumin, hyssop, costmary, lavender, thyme
- Conservation control: to enhance impact of natural enemies

The ultimate in pest control



The last aphid by Charley Harper: 1922-2007

Good Luck

Agronomists' Conference 2019

PhD: Variable Rate Application

Alex Ansell

CEREALS & OILSEEDS

AHDB CEREALS & OILSEEDS frontier The Douglas Bomford Trust Silsoe Spray Applications Unit

Need for Variable Rate

Cost reduction

- PPPs are the highest variable cost to farmers

£££

Environmental damage

- Overuse can cause runoff into local ecosystems

Disease Resistance

- Under dosing can lead to resistance

Major barriers to VRA

Technology

Spray deposition understanding

In-field variability understanding

Current label recommendations

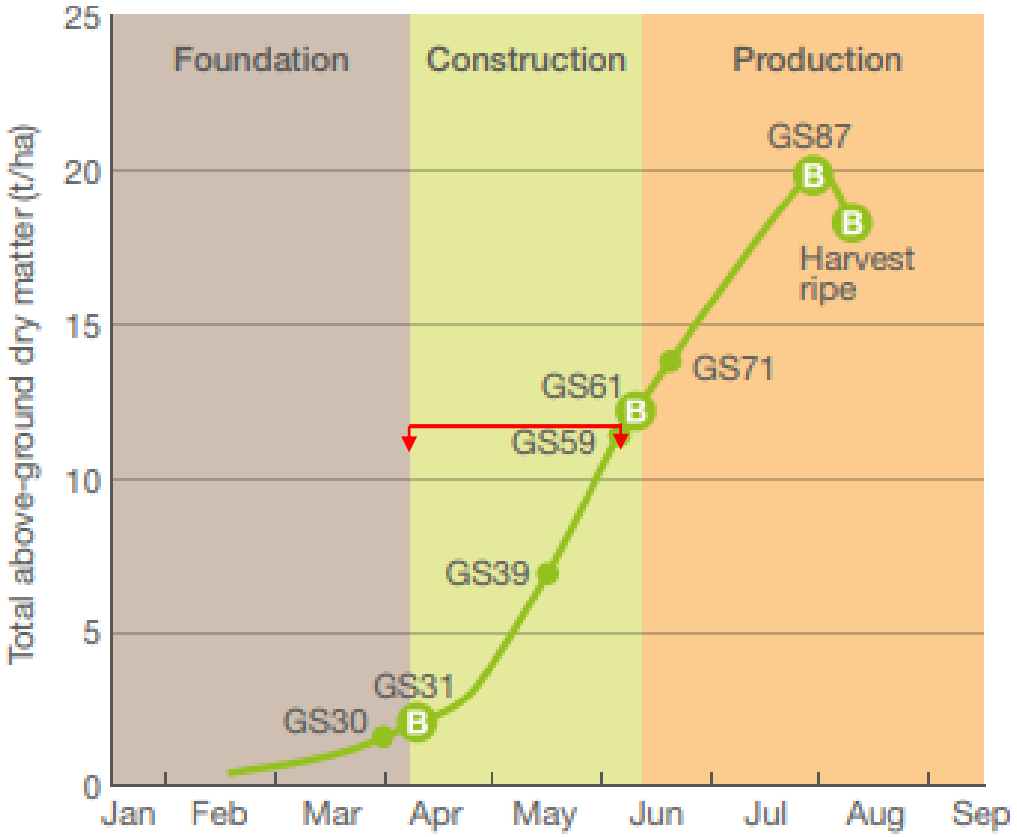
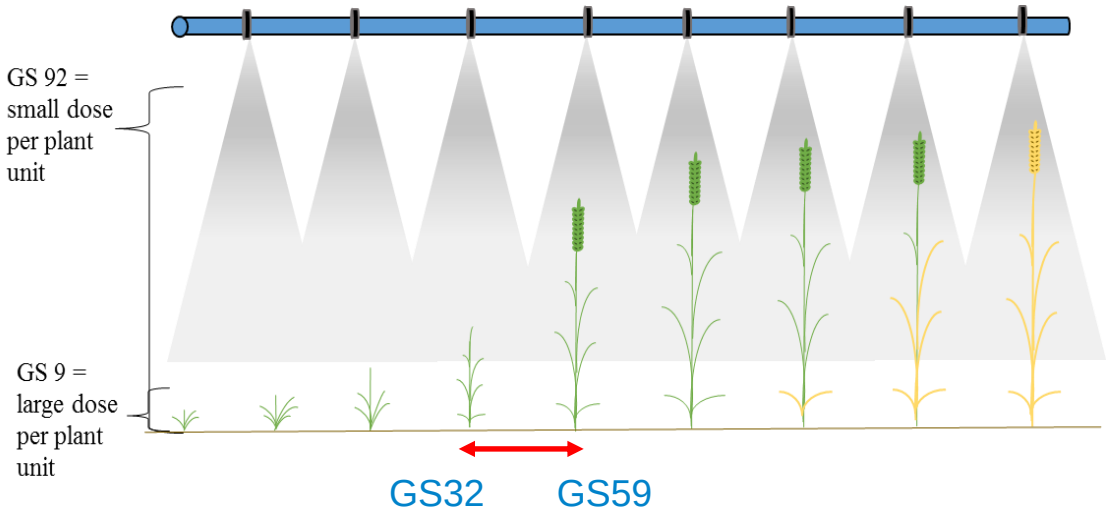


Figure 22. Changes in crop dry matter over a growing season



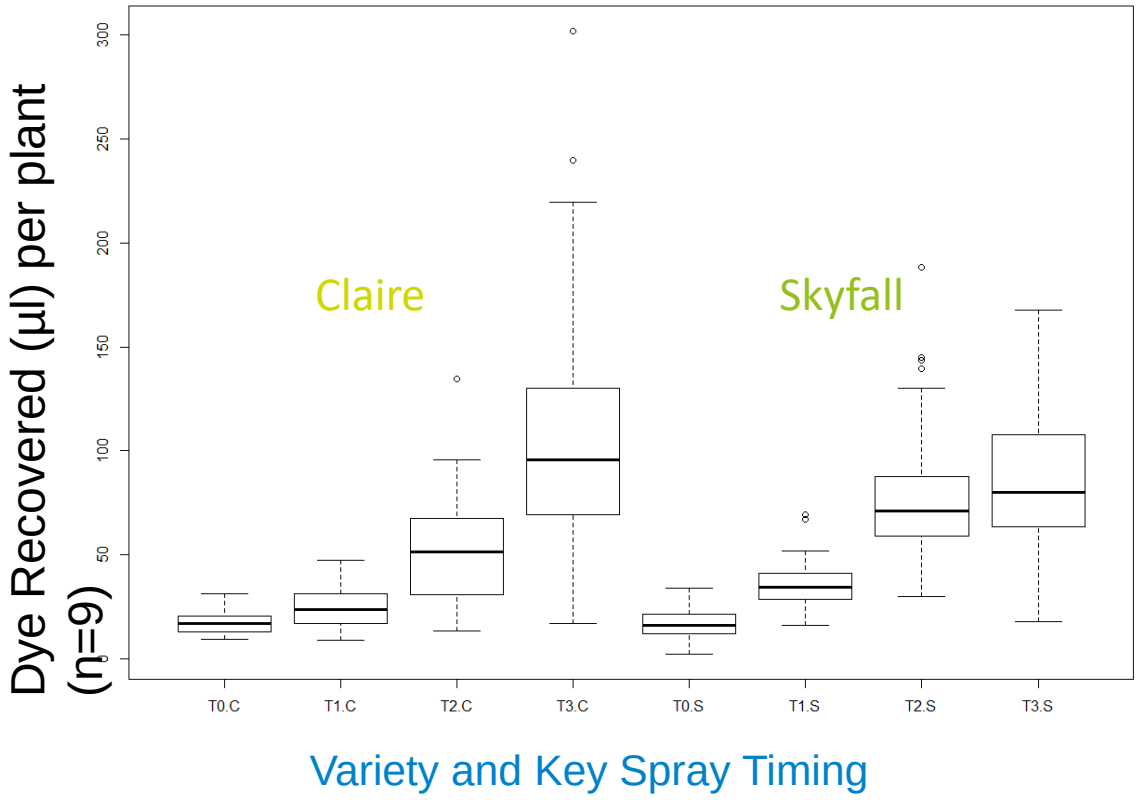
Crop	Disease	Rate per ha	Critical Comments
Wheat	Leaf rust *(Puccinia recondita)* Stripe rust *(Puccinia striiformis)*	500 mL plus 200ml non-ionic surfactant per 100L spray-mix	Apply when conditions favour disease development and preferably prior to development of high levels of disease in the crop. Aim to apply between stem elongation and ear emergence complete (ZGS 32-59). DO NOT apply later than ZGS 59. Repeat spraying may be required for stripe rust. Regularly monitor the crop from 3-4 weeks after spraying for signs of re-infection and treat accordingly.
	Septoria nodorum blotch *(Septoria nodorum)*		

Example label: Epoxiconazole 125, Crop Smart (2018)

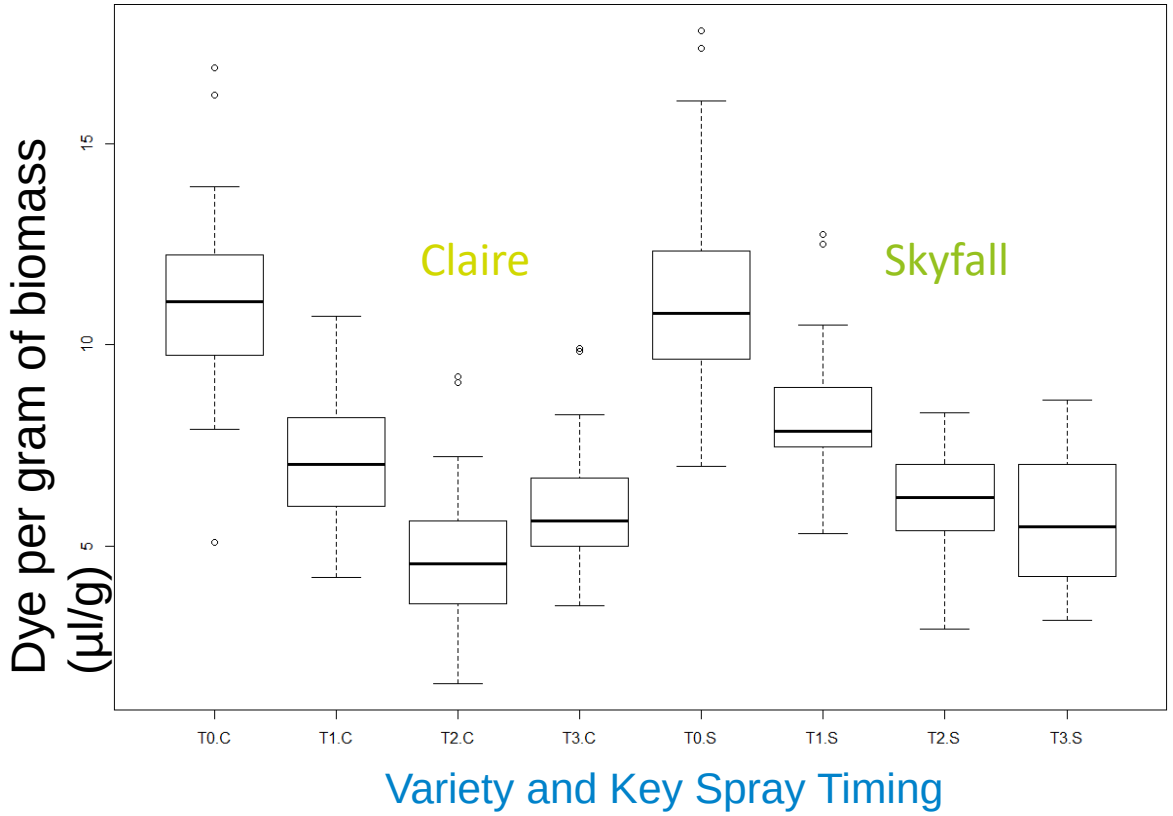
Understanding spray deposition

Silsoe Spray Applications Unit

Findings of spray deposition trial

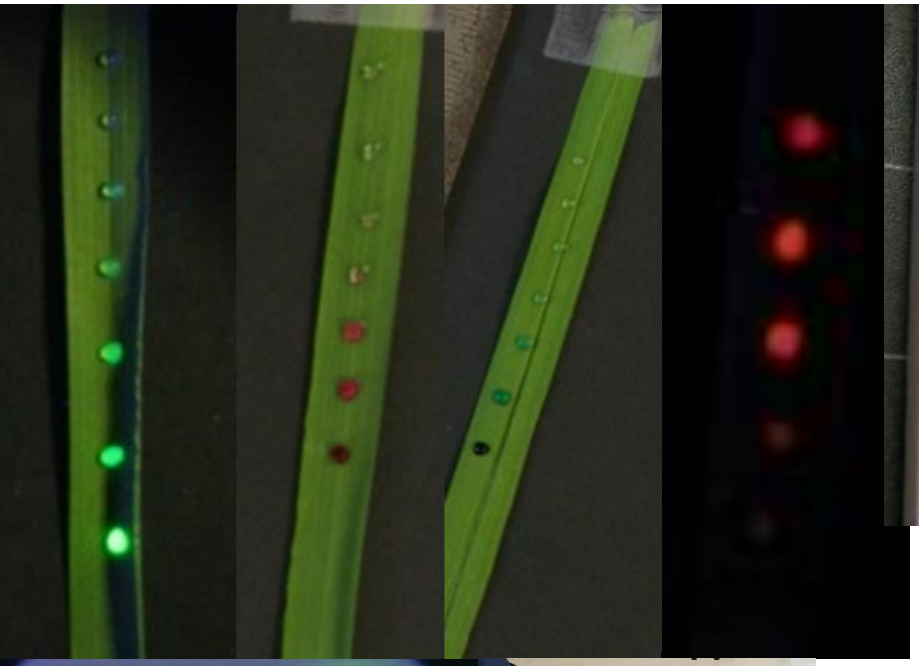


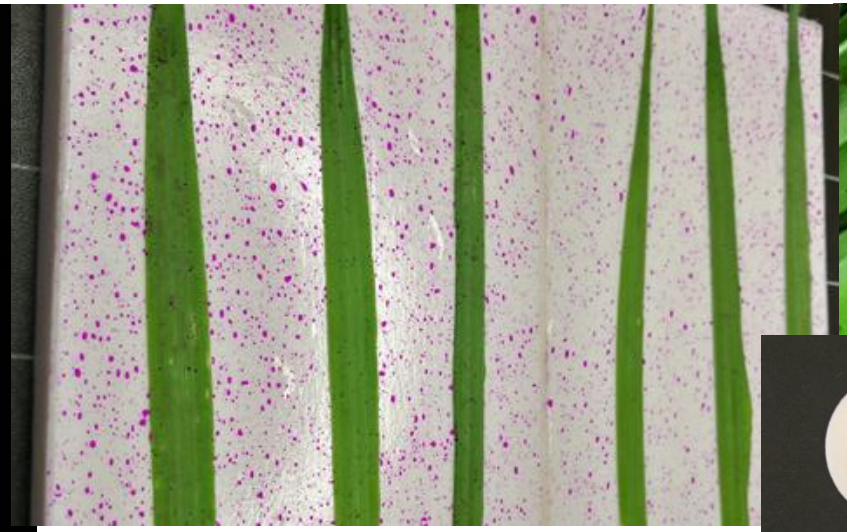
57% of totally variation is due to the timing

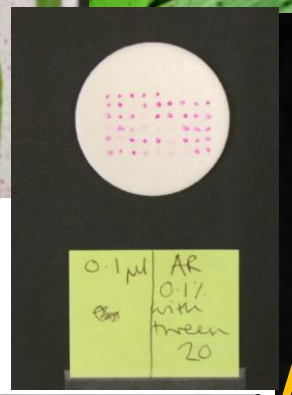


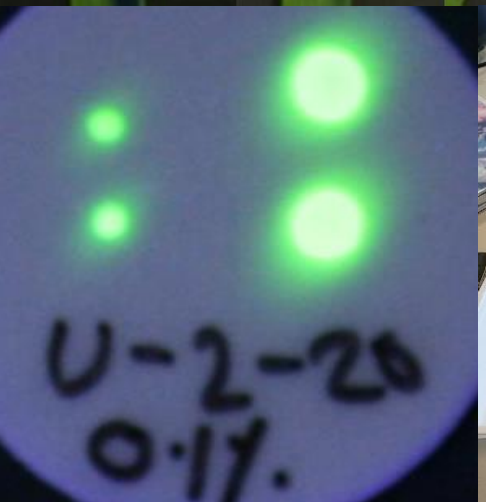
70% of totally variation is due to the timing

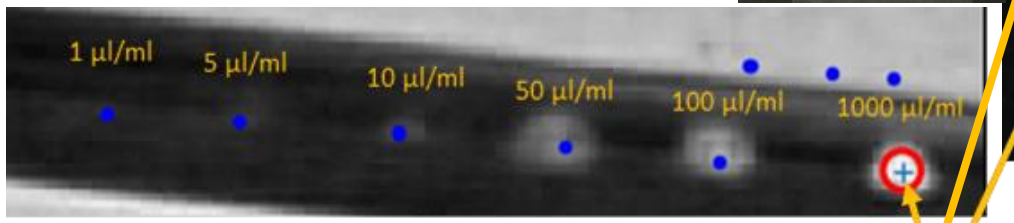
Non-destructive spray sampling

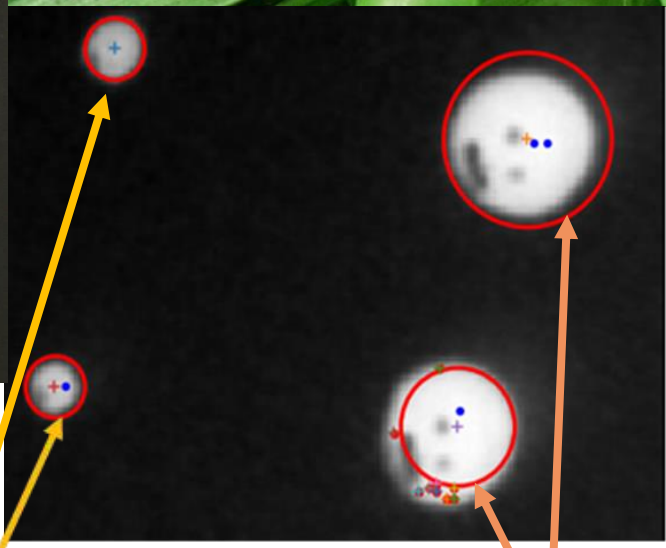










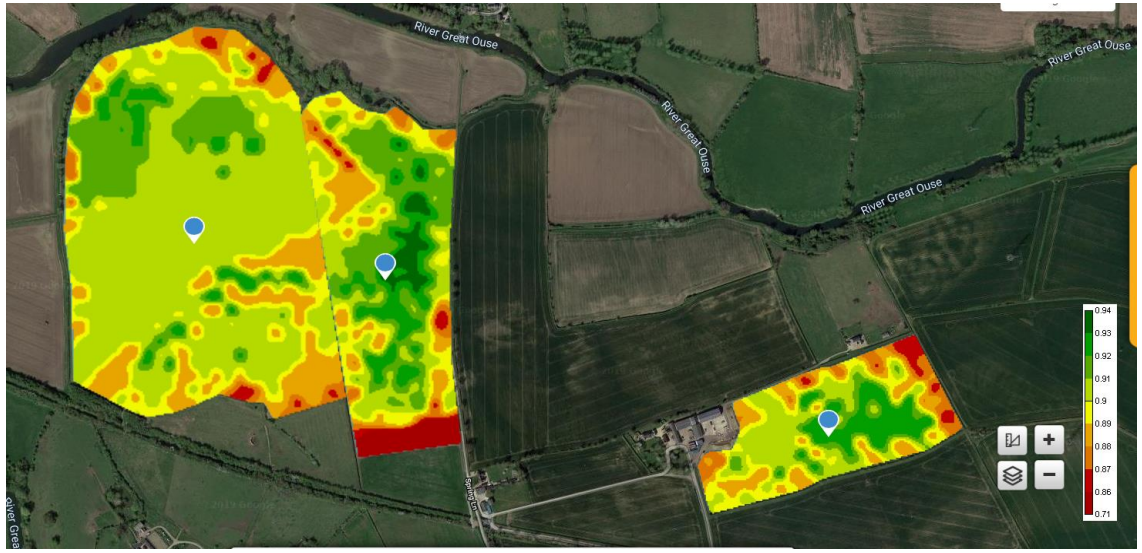


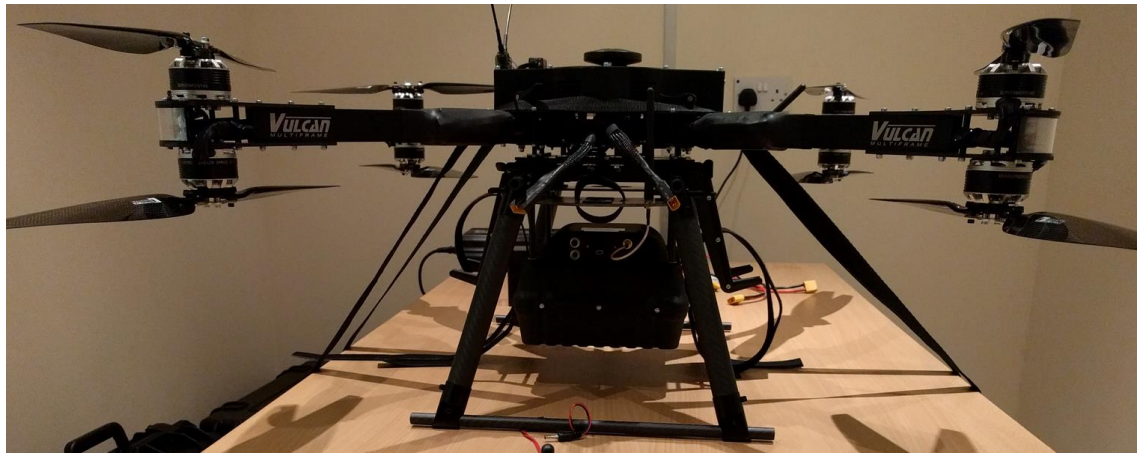
2 µl

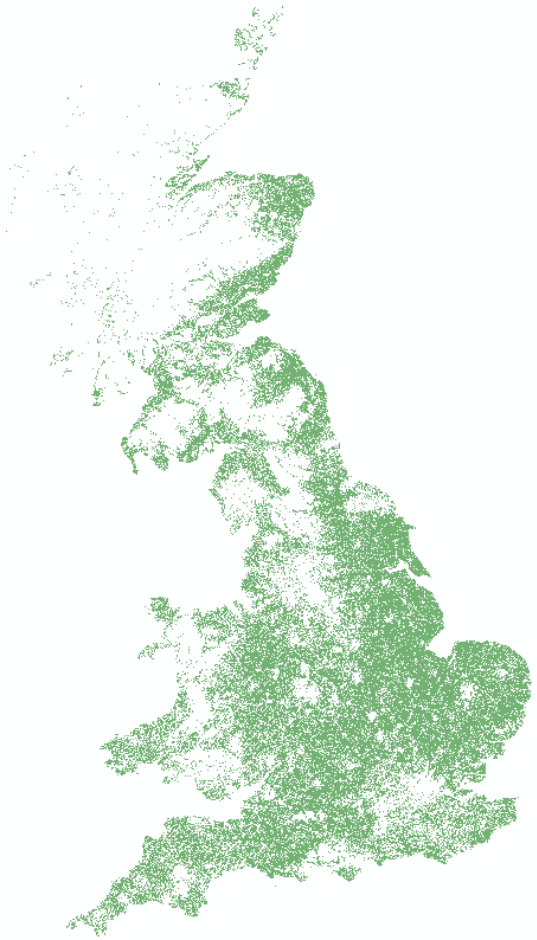
20µl

Non-destructive biomass/growth stage

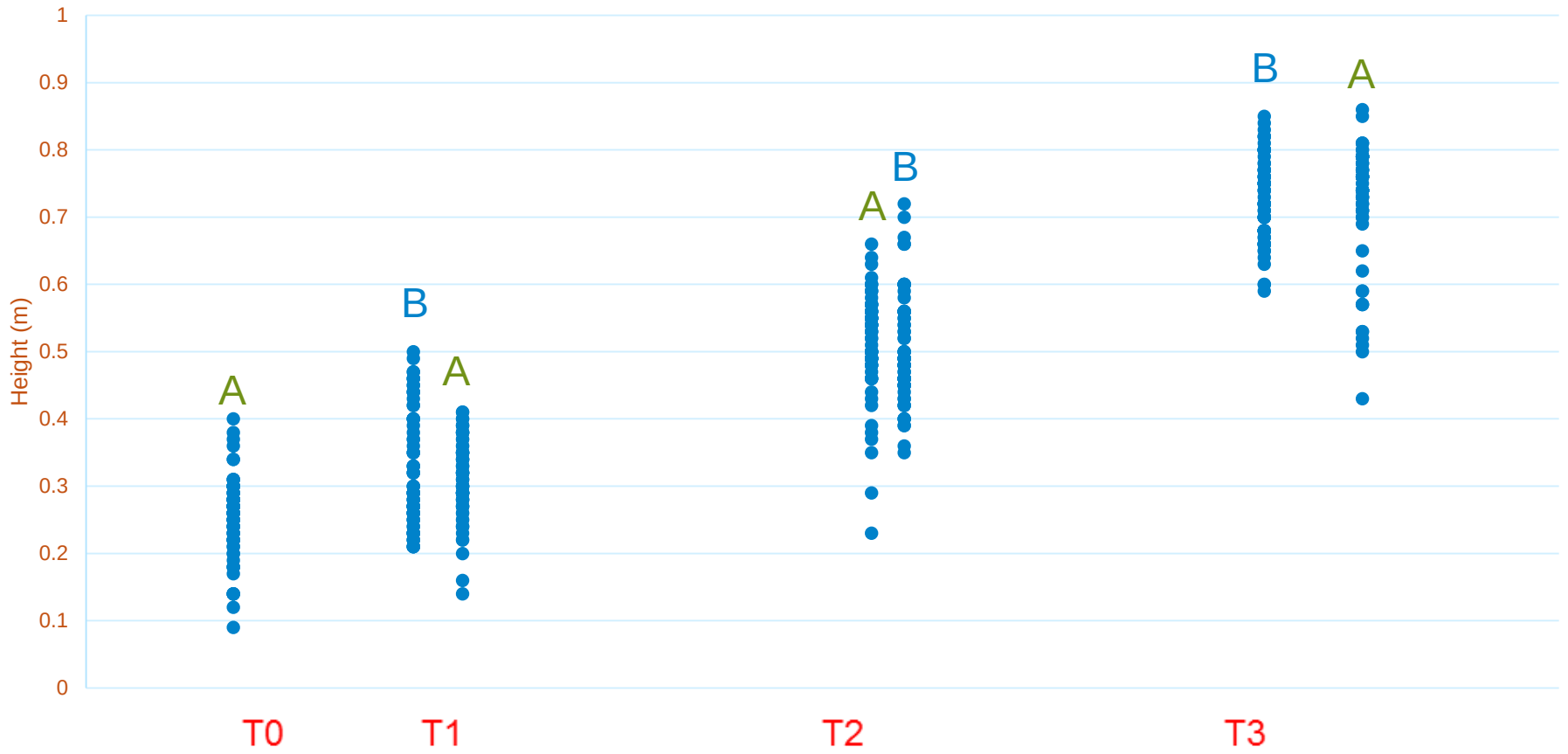
Using remote sensing to understand variation



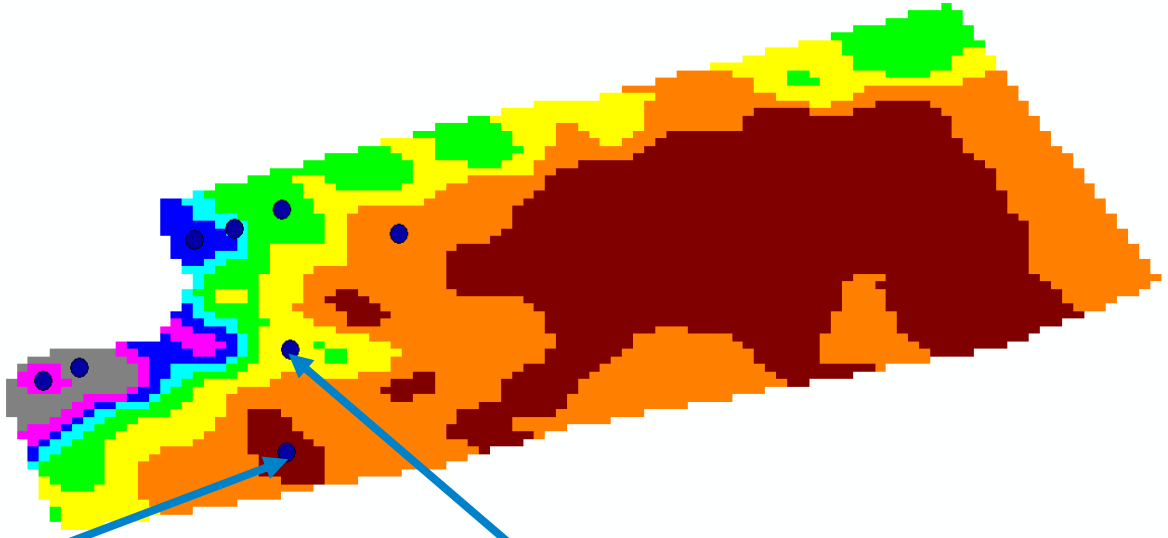




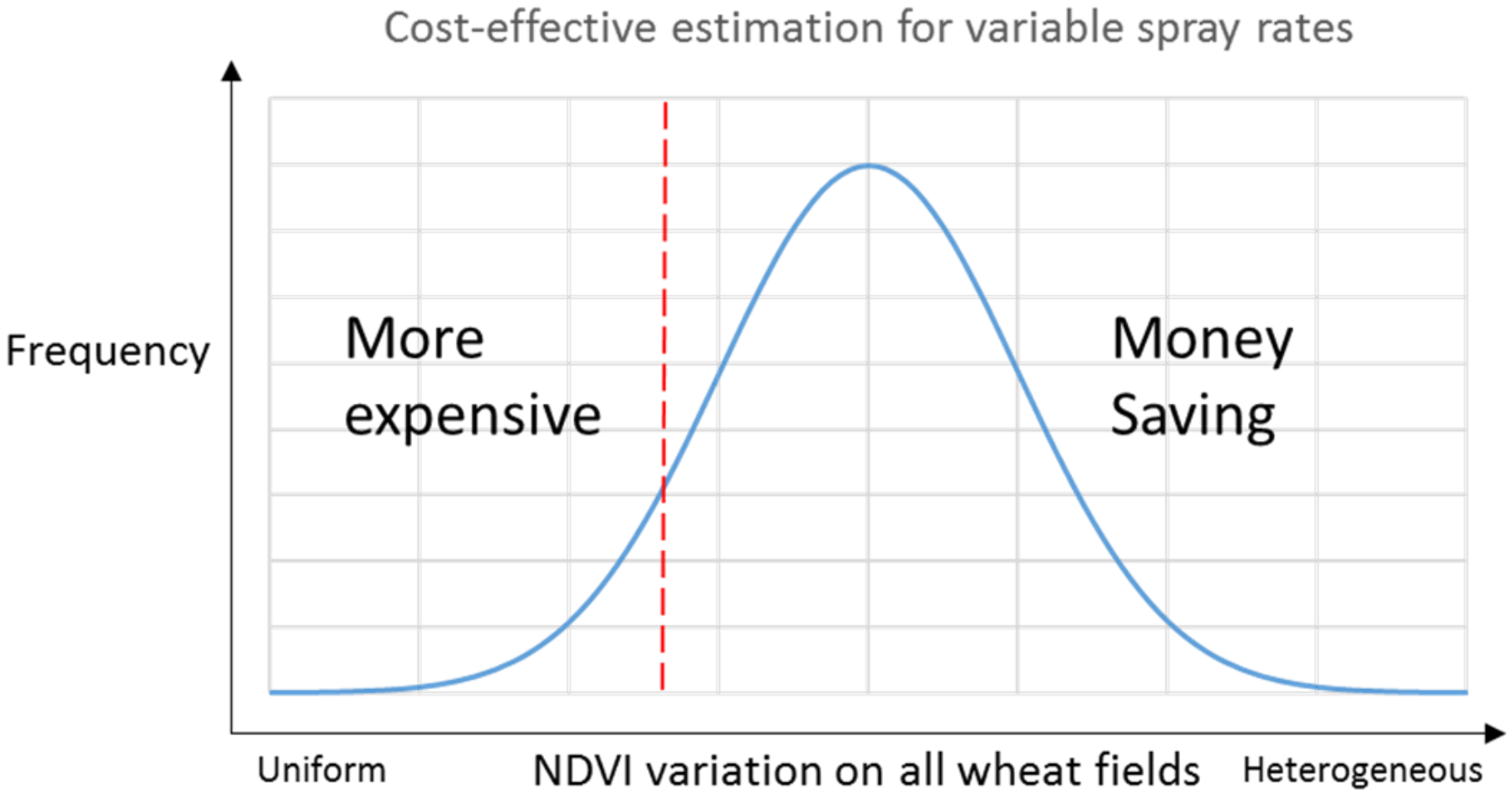
Sampled height variation (m) at each key fungicide timing



T3 – Wheat variation



Appropriate use of VRA



Thank you for listening!

AHDB
CEREALS & OILSEEDS

The Douglas Bomford Trust

frontier

Silsoe Spray Applications Unit


‘Inspiring our farmers, growers and industry to succeed in a rapidly changing world’

AHDB Agronomists' Conference 2019

Session Two – Crop nutrition in cereals & oilseeds

Agronomists' Conference 2019

Starting with Soil Health

Anne Bhogal (ADAS)

CEREALS & OILSEEDS

Soil & Plant Health

Healthy soil = healthy plants = greater resilience & resistance to pest and pathogen attack

Assessing & managing soil health

- How do we know if a soil is healthy?
- What do we need to measure?
- How do we benchmark/interpret those measures?
- How can we improve soil health?

GREATSOILS

British Beet BBRO Research Organisation

AHDB

Soil Biology and Soil Health Partnership

Research and Knowledge Exchange 2017-2021

NIAB

SRUC

ADAS

fera

Game & Wildlife Conservation Trust

University of Lincoln

Natural England

Organic Research Centre Elm Farm

LEAF Linking Environment and Farming

fA Innovation for Agriculture

The Wye & Usk Foundation

BASF We create chemistry

frontier

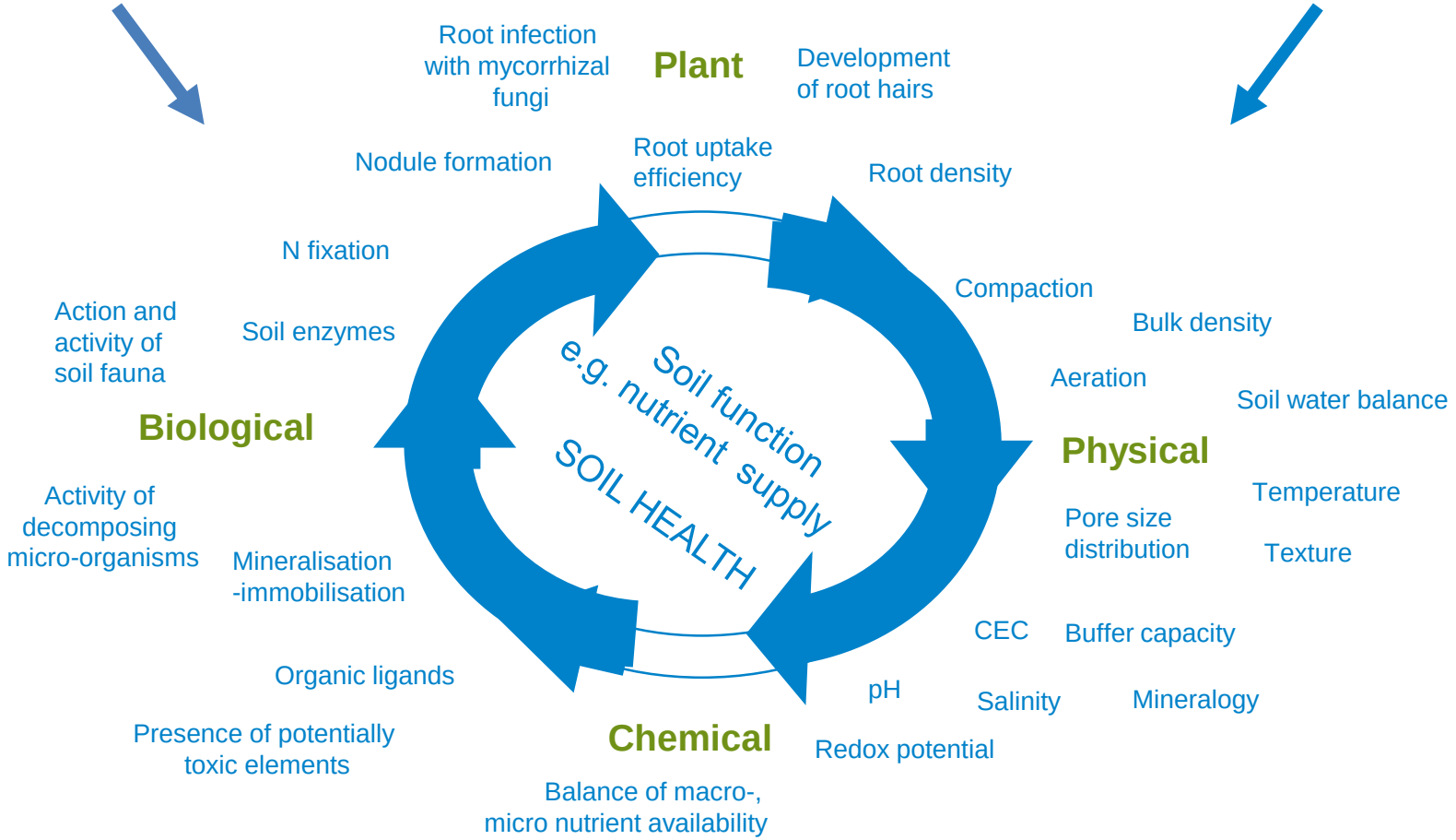
nrm laboratories

What do we know?

Soils are complex!

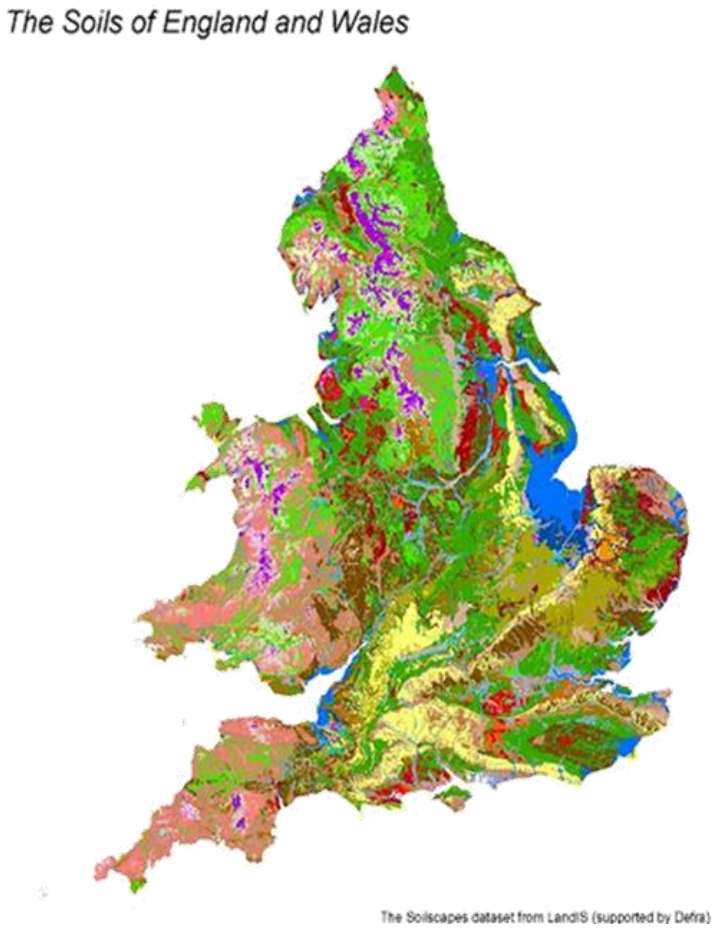
CLIMATE
Temperature, rainfall, evaporation;
where impact is mediated by
both amount and seasonality

NUTRIENT INPUTS
Fertiliser, manure, deposition;
where availability is mediated
by many of the same factors



What do we know?

Soils are very variable!

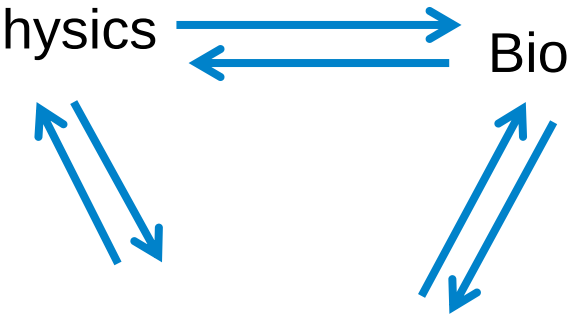


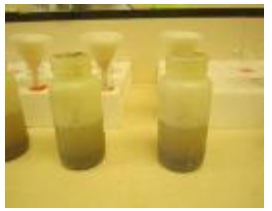
Variation in soil texture at AHDB Strategic Farm West, field 42 (32 ha)

Key aspects of soil health

Chemical, physical & biological properties:

- ***Inherent*** e.g. texture, depth, stoniness – '*boundaries of the soil habitat'*
- ***Dynamic*** e.g. SOM, nutrients, biology – *nature & composition of the habitat*





Putting it all together will need a different approach to sample collection – linking physical observation and soil samples sent for testing

Assess on a rotational basis at a similar time & from the same location in the field

Soil health scorecard approach

- A ‘health check for soils’
  - ➢ Indicators of chemical, physical & biological condition of agricultural soils
  - ➢ Relevant & practical with clear interpretation scheme; use with farmers to guide soil management

Physical (17 ‘candidates’)	Chemical (14 ‘candidates’)	Biological (14 ‘candidates’)
Visual Assessment of Soil Structure (VESS)	pH	Earthworms
Penetration resistance	Routine nutrients	Respiration
Bulk density	Soil organic matter (SOM)	Microbial biomass

Benchmarking & interpretation

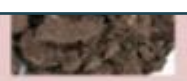
Indicators	Benchmarks
pH & routine nutrients (Ext P, K, Mg)	The nutrient management guide-RB209
Visual Soil Assessment of Soil Structure (VESS)	Limiting layer score; SRUC guidance
Soil organic matter (loss on ignition)	Comparison with ‘typical levels’ for soil & climate

Investigate

Monitor

No action needed

Visual evaluation of soil structure

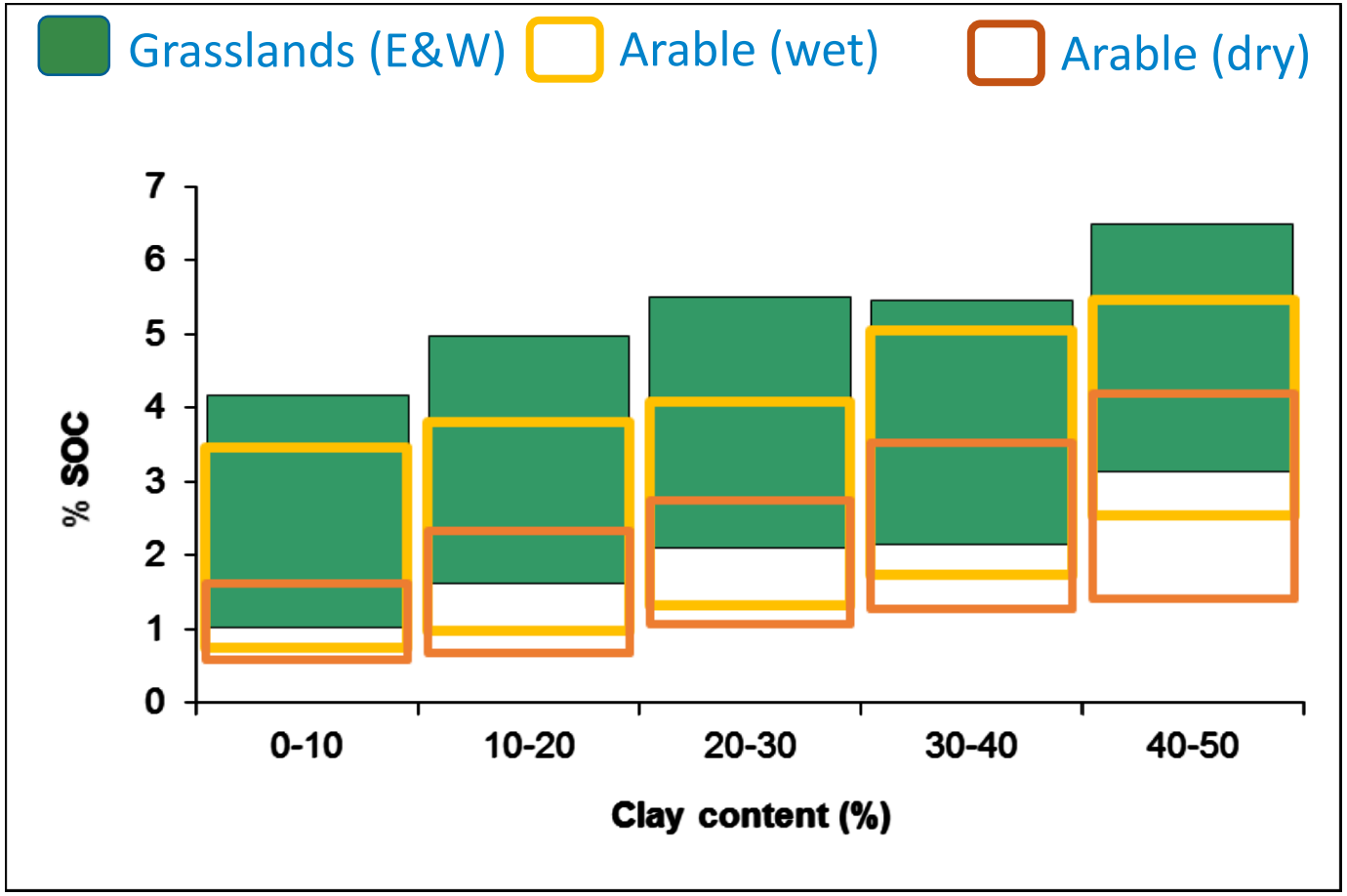
Structure quality	Size and appearance of aggregates	Visible porosity and Roots	Appearance after break-up: various soils	Appearance after break-up: same soil different tillage	Distinguishing feature	Appearance and description of natural or reduced fragment of ~1.5 cm diameter
Sq1 Friable Aggregates readily crumble with fingers	Mostly < 6 mm after crumbling	Highly porous. Roots throughout the soil				 The action of breaking the block is enough to reveal them. Large aggregates are
Sq2 Intact Aggregates easy to break with one hand						
Sq3 Firm Most aggregates break with hand effort						
Sq4 Compact Requires considerable effort to break aggregates with one hand	30% are <7 cm	macropores and around aggregates			Distinct macropores	internally.
Sq5 Very compact Difficult to break up	Mostly large > 10 cm, very few < 7 cm, angular and non-porous	Very low porosity. Macropores may be present. May contain anaerobic zones. Few roots, if any, and restricted to cracks			 Grey-blue colour	 Aggregate fragments are easy to obtain when soil is wet, although considerable force may be needed. No pores or cracks are visible usually.

Sq score	Soil structural quality	Management needs
1-2	Good	No changes needed
3	Moderate	Long-term improvements
4-5	Poor	Short-term improvements

www.sruc.ac.uk/info/120625/visual_evaluation_of_soil_structure

‘Typical’ SOM levels

- There is no easily defined ‘critical level’ of organic matter below which soil functions become impaired



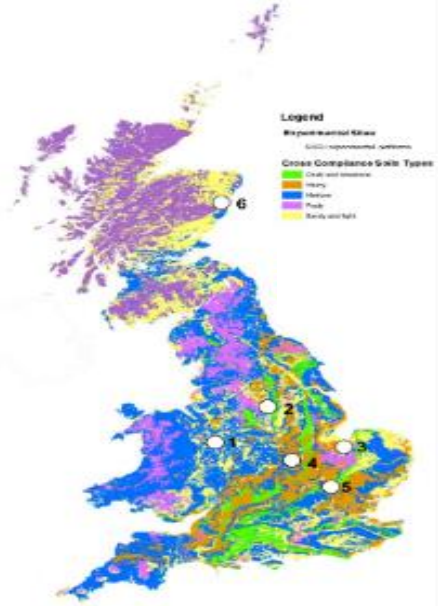
Simplified to:

- Light < 18% clay; medium 18-35% clay; heavy > 35% clay
- Low, mid & high rainfall regions
- Arable & ley arable; permanent grassland

Investigate	Very low for climate & soil type
Monitor	Below average
No action needed	≥ average

Source: Verheijen et al., 2005

Evaluation & development

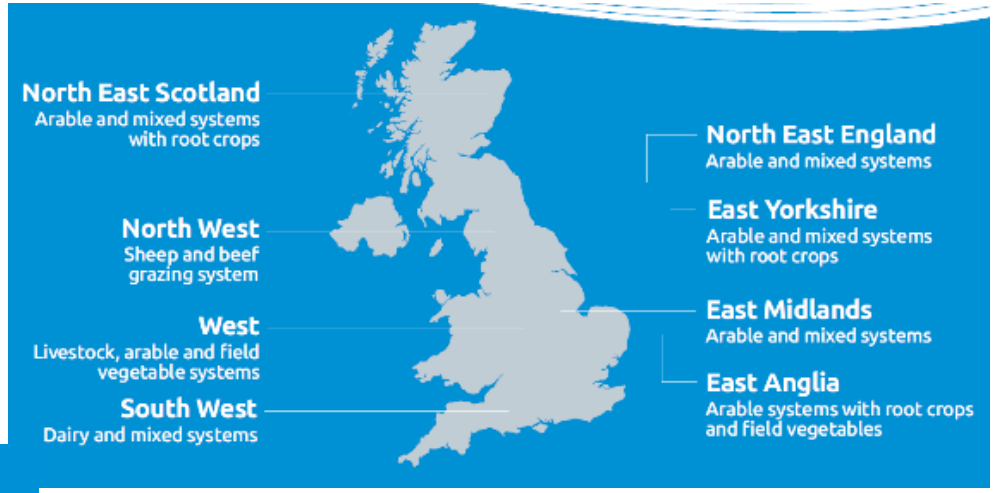


Long term experimental sites (7):

- Selected to explore the key drivers of biological functioning
- Provide a test bed for the scorecard & evaluation of new indicators

Farmer groups (8):

- Review & test the scorecard on farm
- Extend the range of practices evaluated



AHDB Strategic & Monitor Farms

Long-term experimental sites

Harper Adams:

Repeated organic material additions (est. 1993)

Sampled October 2017

Attribute	Control	FYM (23yrs)	Slurry (23 yrs)	Green compost (13 yrs)
SOM (%LOI)	3.0	4.1	3.6	4.0
pH	6.4	7.0	6.4	7.0
Ext. P (mg/l)	56	73	53	60
Ext. K (mg/l)	80	311	194	187
Ext. Mg (mg/l)	44	87	75	63
VESS score	2	2	2	1
Earthworms (No./pit)	11	13	9	11

Craibstone:

Constrasting pH levels (est. 1961)

Sampled October 2018

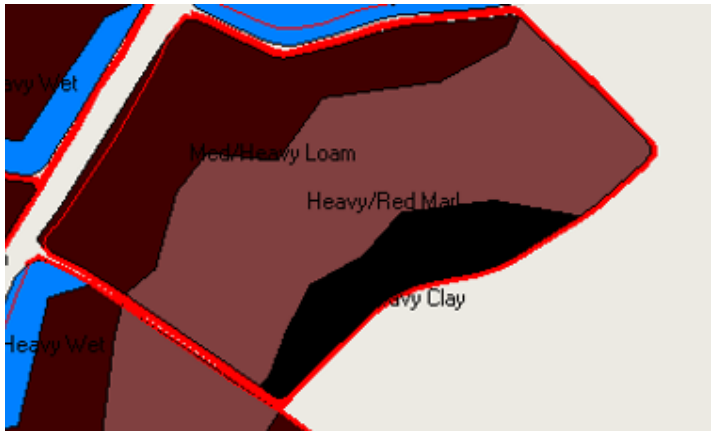
Attribute	pH 4.5	pH 6.0	pH 6.5	pH 7.5
pH	4.9	6.1	6.6	7.5
SOM (%LOI)	10.3	10.1	10.3	10.3
VESS score	2	1	2	1
Microbial biomass (mg/kg)	98	157	231	163
Respiration (CO_2-C mg/kg)	99	124	140	101
Earthworms (No./pit)	1	5	5	6

Investigate Monitor No action needed

Note: benchmarks are subject to review

Assessing baseline soil health at Strategic Farm West (Squab Hall farm)

- Using the scorecard to benchmark soil health at the outset and track changes over time



Field 25: Rob's soil map

Field 25: Sampling zones:
1. 'heavy red'
2. 'Medium/heavy loam'
3. 'heavy clay'

Soil sample & physical evaluation

Scorecard for field 25

10.5ha; Spring barley @ harvest 2019

Zone	1	2	3
% clay	37	43	51
SOM (%LOI)	5.0	4.7	4.4
pH	7.5	8.1	8.1
Ext. P (mg/l)	18	13	21
Ext. K (mg/l)	344	375	433
Ext. Mg (mg/l)	849	708	675
VESS score (limiting layer)	3	4	4
Bulk density (g/cm^3)	1.17	1.26	1.28
Earthworms (No./pit)	6	1	2

Investigate
Monitor
No action needed

Note: benchmarks are subject to review

Key issues (field 25): soil structure & earthworm numbers (particularly zones 2 & 3 – heavier textures & below average SOM)

Key issues for Squab Hall Farm

- Soil structure and earthworm numbers identified as key issues across the farm

Sq 2 'intact'

Sq 4: 'Compact'

Key to managing soil health




KNOW YOUR SOILS

principles to improve soil health

Biological

- Feed the soil regularly through plants and OM inputs
- Move soil only when you have to
- Diversify plants in space and time

Chemical

- Maintain optimum pH
- Provide plant nutrients – right amounts in the right place at the right time
- Know your textures and minerals – buffering capacity, free supply!

Physical

Know your textures and understand limits to workability, trafficability

- Optimise water balance through drainage if necessary
- Improve soil structure, minimise compaction – effective continuous pore space

Soil improving practices:

- Organic materials
- Grass leys
- Cover crops & diverse rotations
- Reduce tillage

Also….

- Appropriate operations – timing & type
- Drainage

Summary

- Assessment of soil health requires an integrated approach linking chemistry, physics and biology
- To evaluate impact of management practices, track changes over time by assessing on a rotational basis & from same location/timing.
- A scorecard approach is being developed & evaluated which aims to provide benchmark data to guide interpretation & track changes over time

Thank you!

For more info:

AHDB-BBRO Soil Biology and Soil Health Partnership: https://ahdb.org.uk/greatsoils

Introduction to Soil Biology

This short factsheet is a starter's

Soil Food Web

Soils contain a very high diversity of organisms. These soil organisms

How to count earthworms

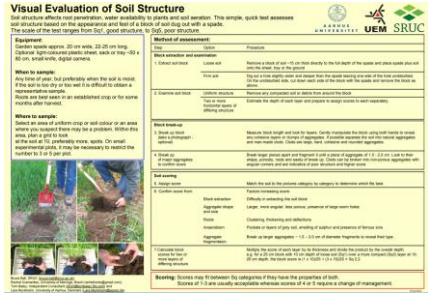
These publications explain how

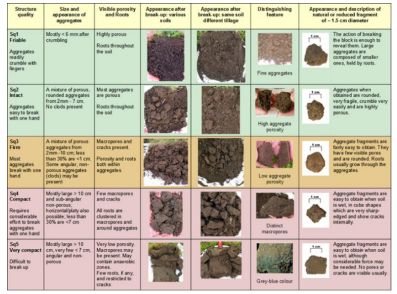
Earthworm recording sheet

Simple recording sheet to used on

Healthy grassland soils

SRUC VESS guidance: https://www.sruc.ac.uk/info/120625/visual_evaluation_of_soil_structure





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‘Inspiring our farmers, growers and industry to succeed in a rapidly changing world’

Fostering Populations Of Arbuscular Mycorrhizal Fungi Through Cover Crop Choices and Soil Management

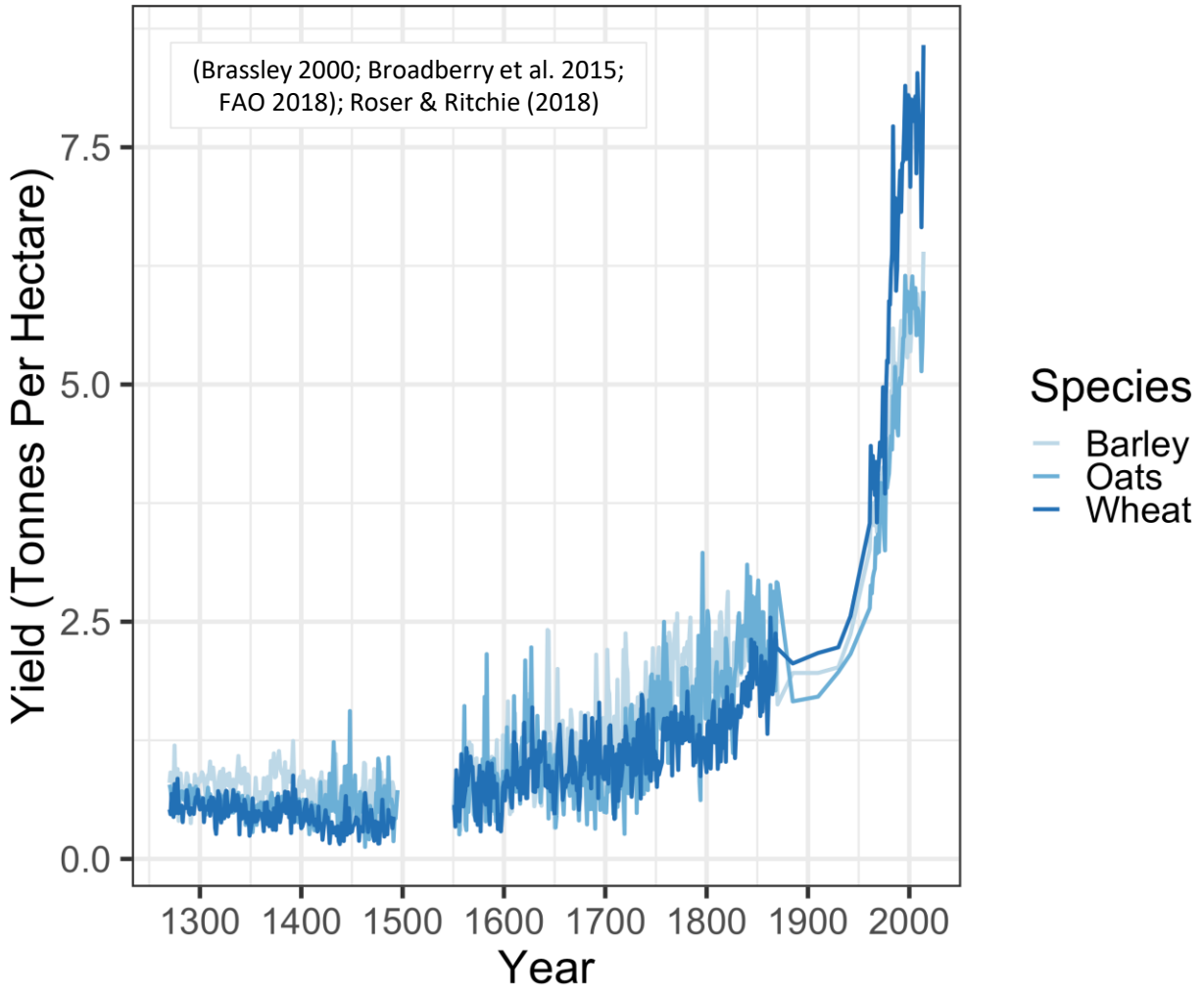
George Crane

Department of Plant Sciences/ NIAB

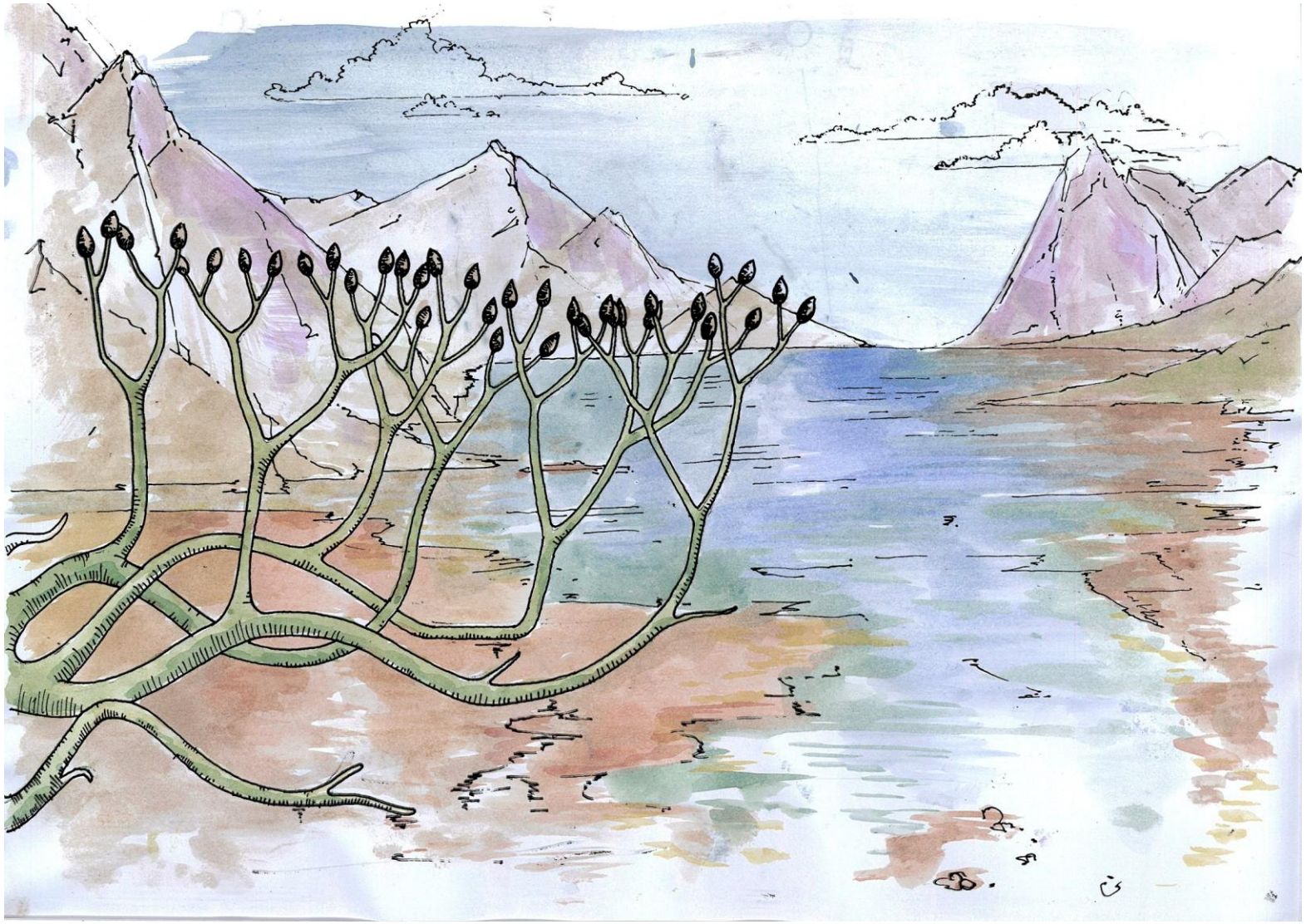
The Problem with Food Production

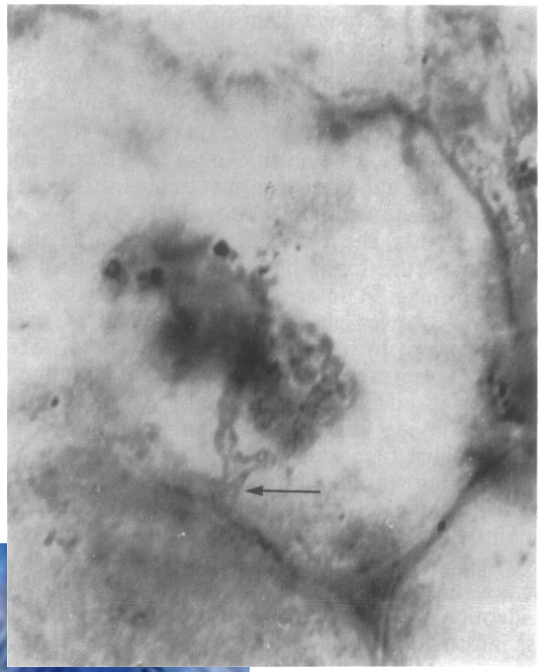
- Since the 1960s
  - **Incredible yield increase!** But..
  - 7.5 times more nitrogen fertiliser
  - 3.3 times more phosphorus fertiliser
  - Degradation of soils

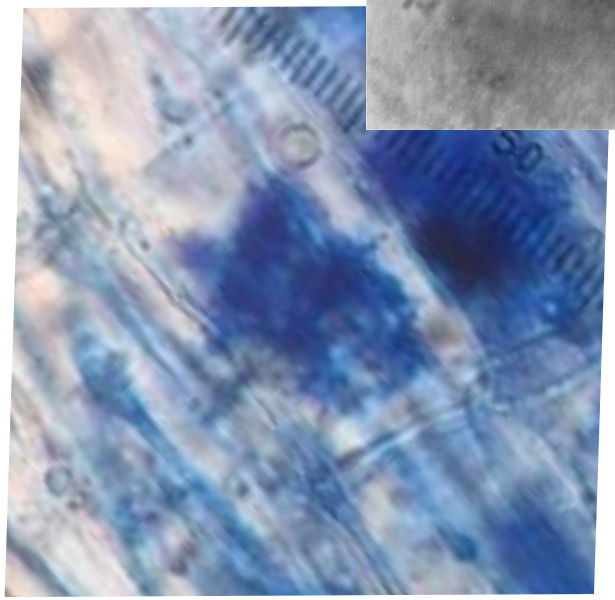
- Finite, energy intensive, and contribute to global climate change and pollution



Arbuscular Mycorrhizal (AM) Fungi







(Remy et al. 1994)

AM Fungi 450 Million Years Later

- Interact with **80%** of extant land plants
- Essential for ecosystem functioning

- Studies show that colonisation by AMF resulted in:
  - 35% increase in **biomass**
  - 23% increase in **yield**

..But intensive agriculture detrimental to AM fungi

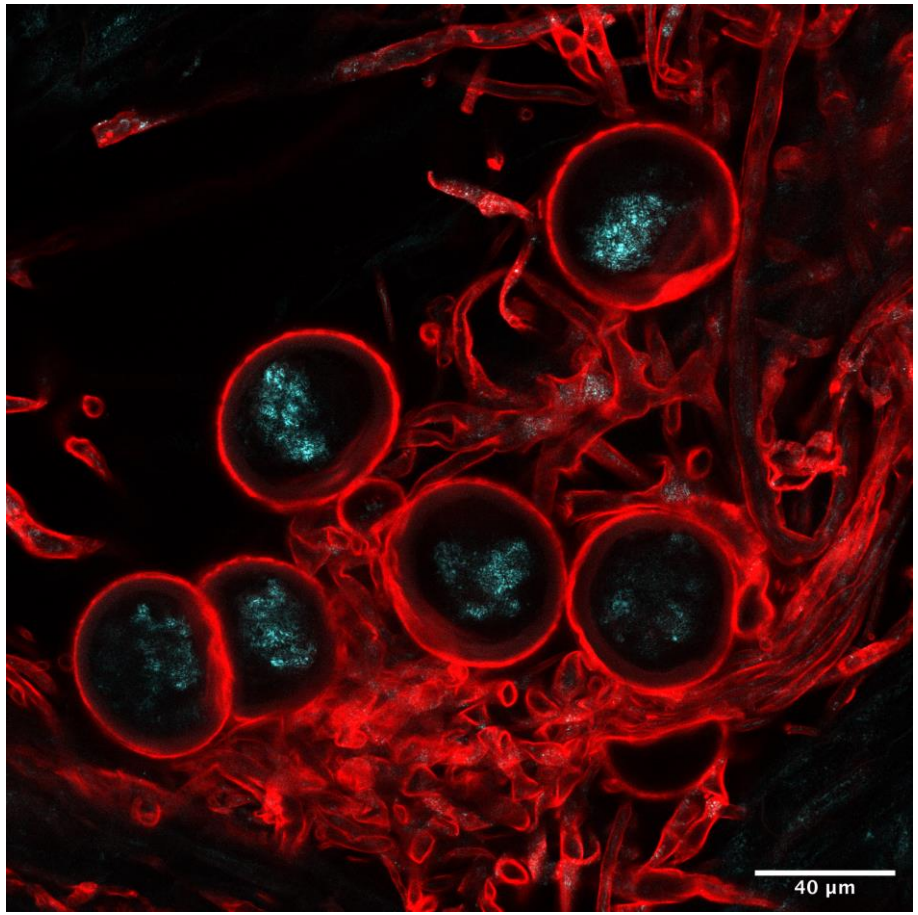
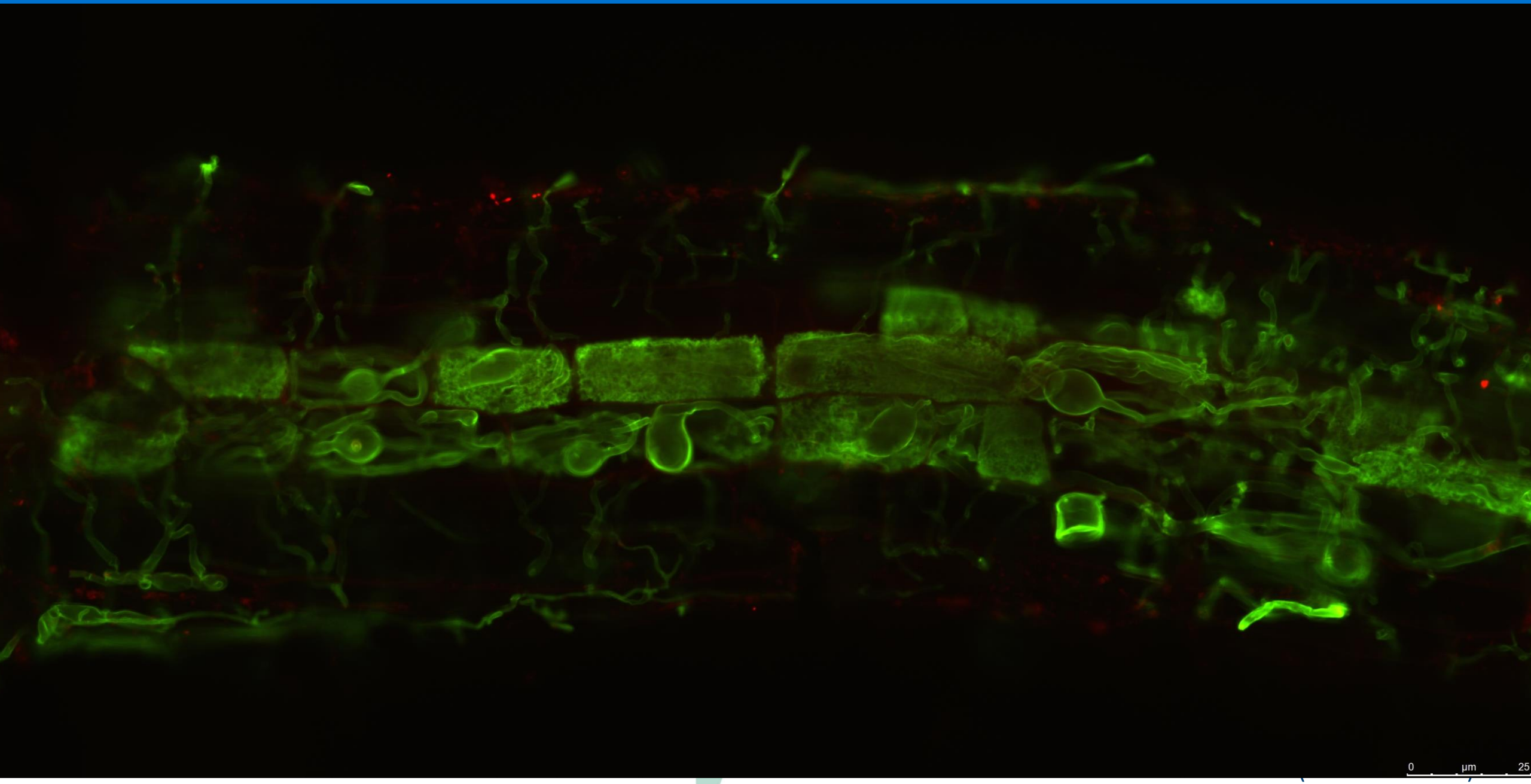


Image: Mieke Jürgens

(Van Geel *et al.* 2016, Lekberg and Koide 2005)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µm
25

PhD Hypotheses

1. The use of cover crops promote the **establishment**, and **maintenance** of a **diverse** range of AMF species, which facilitates **increased interaction** with following cash crops

2. Increasing **diversity** and **abundance** of arbuscular mycorrhizal fungi improves **soil health**, crop growth, and yield of following cash crops

Current Projects

Thanks

- Dr Lydia Smith and the Innovation Farm team
- Professor Uta Paszkowski and the Cereal Symbiosis lab.
- Dr Nathan Morris, Dr Liz Stockdale, David Clarke, and the trials team at NIAB Morley
- Innovative Farmers: Jim and Patrick Allpress, Andrew Blenkiron, James Beamish, Phil Rayns, Robert England, and David Wright

AHDB

AFCP The AgriFood Charities Partnership

Agri-Tech East

Allpress

INNOVATIVE FARMERS PART OF THE DUCHY FUTURE FARMING PROGRAMME

Plant Works