AHDB Agronomy 2020 – East Midlands

Stoke Rochford Hall

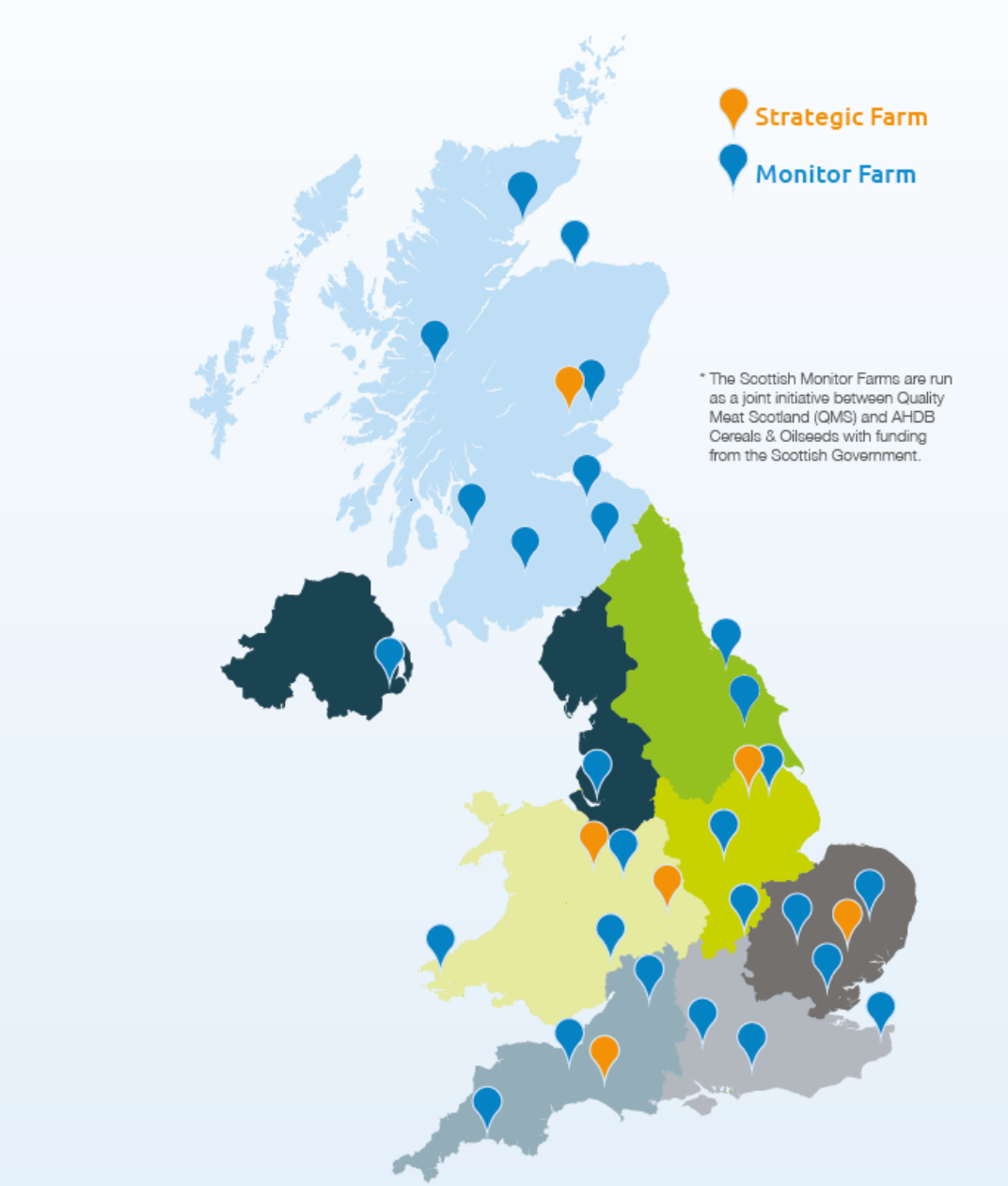
5th February 2020

AHDB update

Judith Stafford

Knowledge Exchange Manager, East Midlands

Farm Excellence Platform



Vale of Belvoir Monitor Farm

James & Michael Parker, Sherwood Farms, Hickling

Next meeting: Thursday 5th March

Soils and cultivations

Benchmarking with AHDB

FARMBENCH

What was your cost of production for harvest 2019?

Wheat and barley disease management guide

GREATSOILS

AHDB

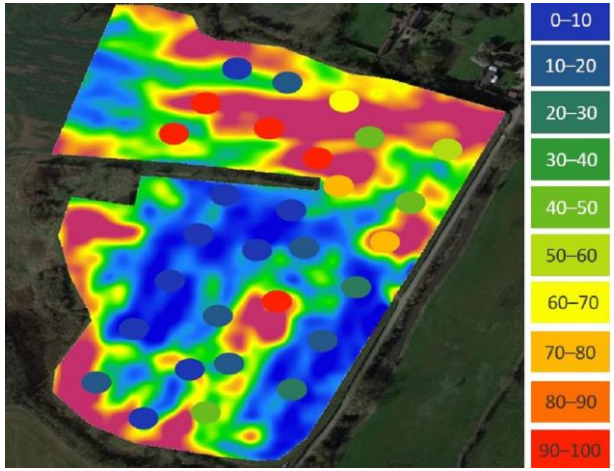
Coming later this year..

Oilseed rape disease management guide

Clubroot management guidelines

Clubroot management

Targeted management of clubroot



See AHDB website

GREATSOILS

AHDB

Principles of soil management

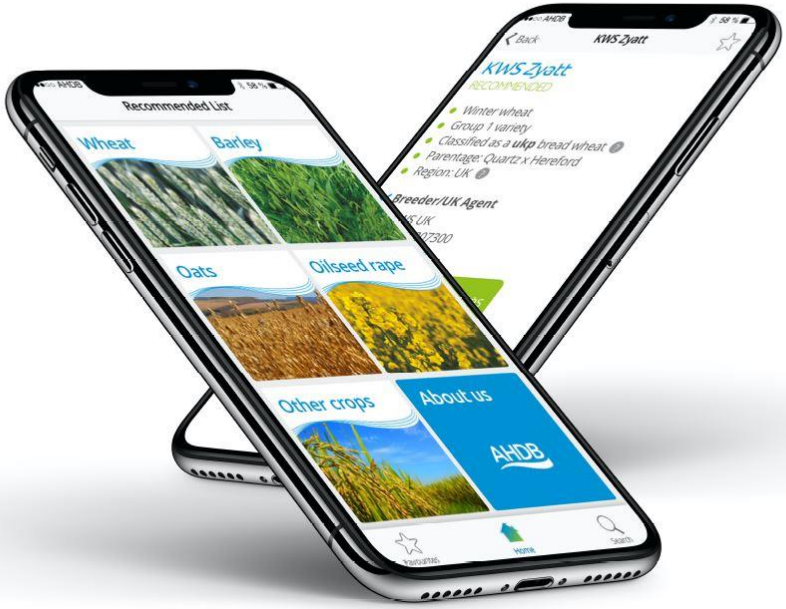
- Soil health
- Soil texture and structure
- Cation exchange capacity
- Soil organic matter
- Soil biology

www.ahdb.org.uk/greatsoils

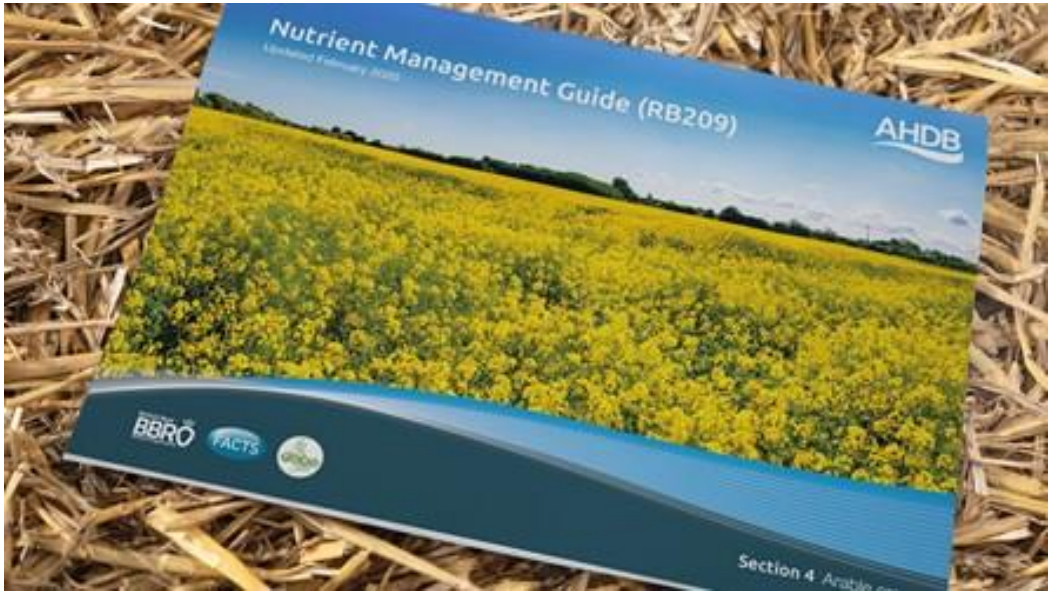
Coming soon..
Arable soil management guide

Recommended List

Variety Selection Tool



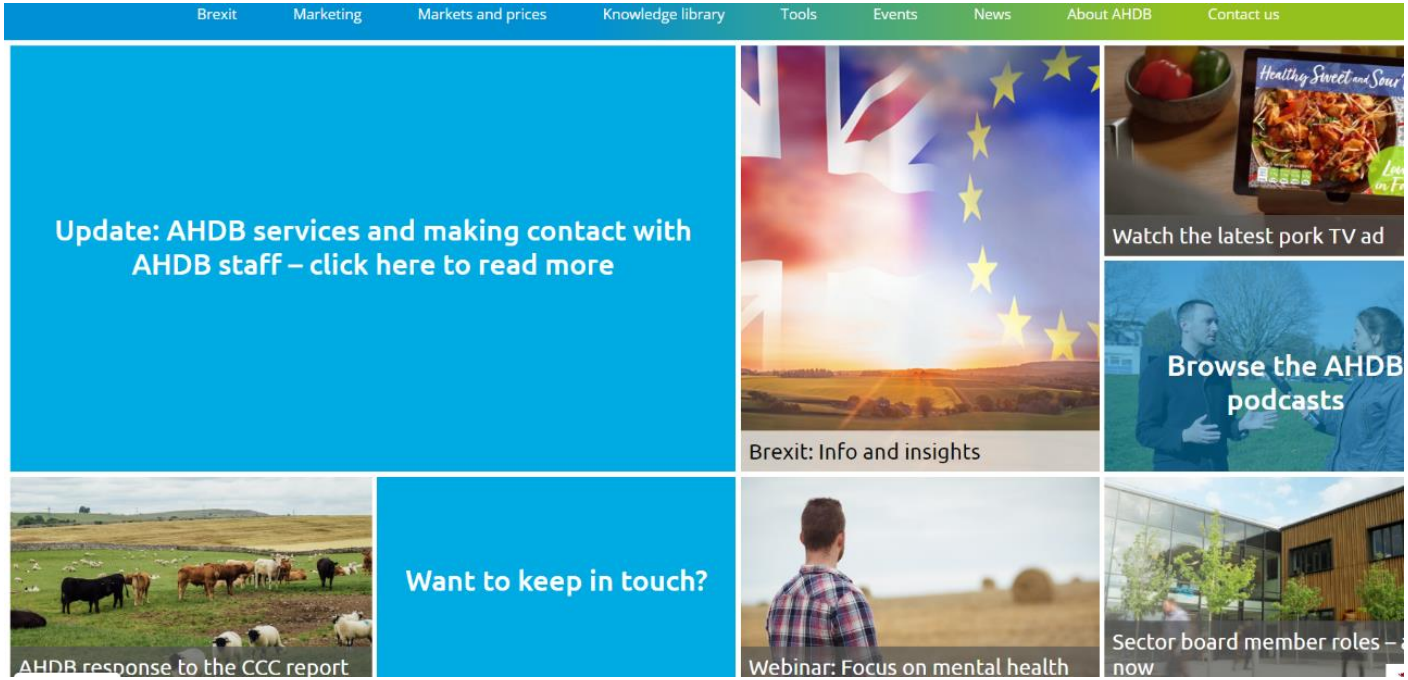
RB209



- Revised edition available now
- RB209: Nutrient Management App

Newsletters

Sign up: ahdb.org.uk/keeping-in-touch



Thank you

Judith.stafford@ahdb.org.uk

07891 556623


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

IPM strategies to control cabbage stem flea beetle

Dr Sacha White, Senior Research Entomologist, ADAS

Agronomy 2020

Today's talk

- Life-cycle
- Causes of increased pressures
- Varietal choice
- Seed rate
- Drill date
- Trap cropping
- Defoliation

Life cycle

Sept
Adults move to new crop, mate and feed on leaves causing ‘shot holing’

Sept-Oct
Eggs laid at base of plants if mild

Oct-Feb
Eggs hatch when mild and larvae feed in leaf petioles

March-April
Larvae feed on main stem behind growing point

May
Larvae pupate in soil

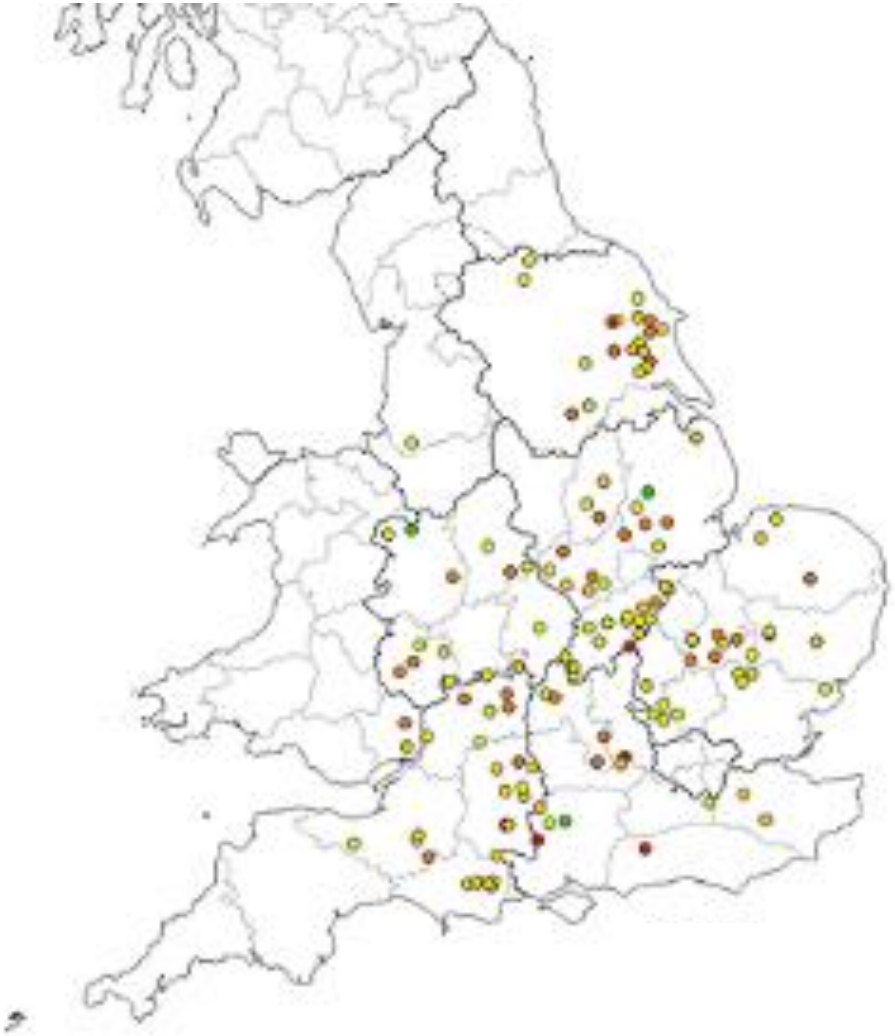
June-July
Adults emerge and feed on foliage

Pyrethroid resistance in CSFB

Response to
100% lambda-cyhalothrin
(7.5 g ai/ha) in 2019

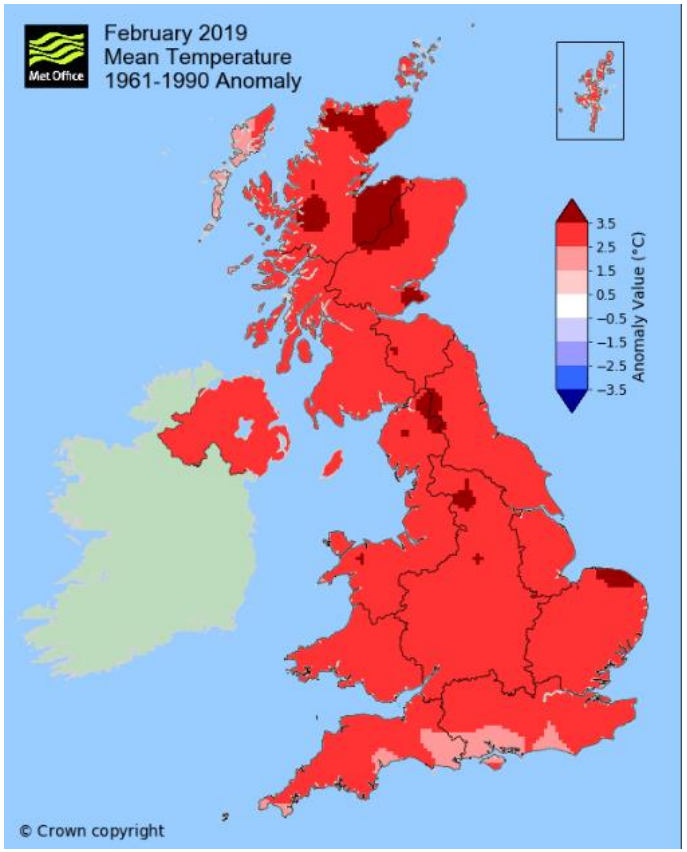
% resistant

- 0%
- 0-25%
- >25-50%
- >50-75%
- >75-99%
- 100%



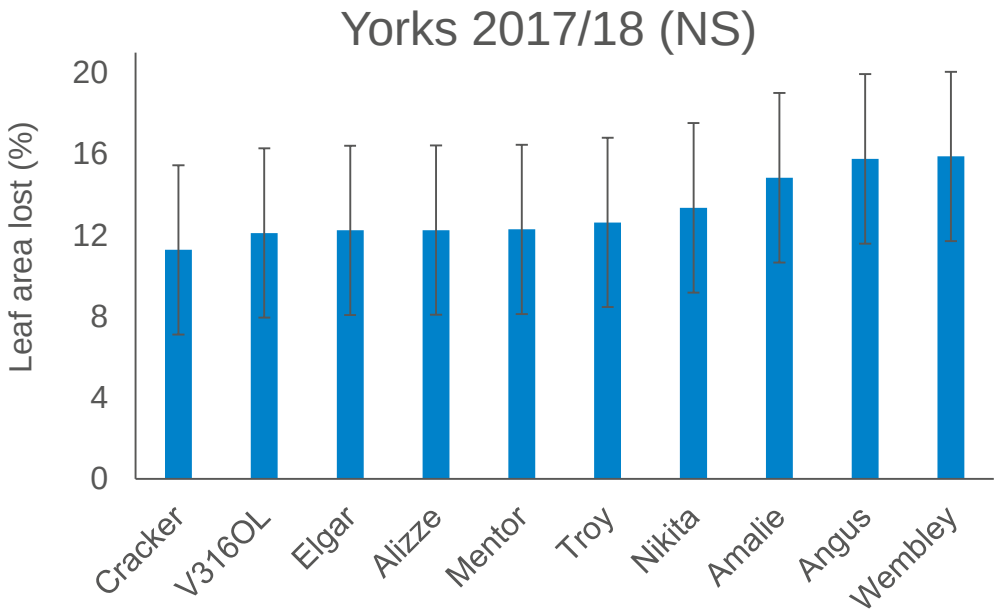
The weather factor…

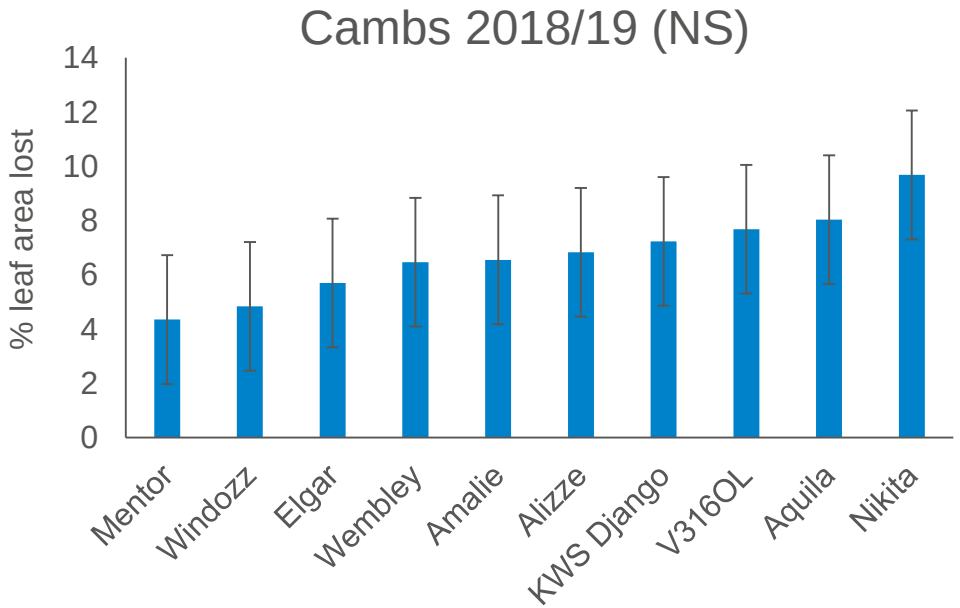
- Modelling work shows that:
- Autumn larval population greater if:
  - Warm September
  - Low rainfall in March, April, June and July
- Spring larval population greater if:
  - Warm November
  - Warm January
- Damage from adult CSFB worse if:
  - Hot June and July
  - Dry August



Varietal selection – adult damage

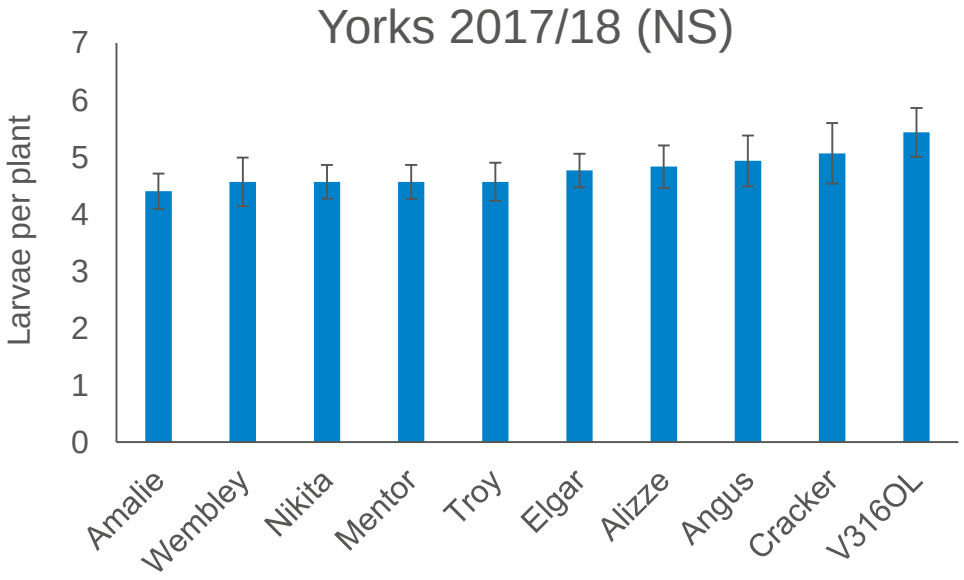
- Monitored 3 RL trials (2016/17) – no sig. differences.
- Drilled variety trials at BX and HM in 2017/18 and 2018/19.
- Adult damage – no sig differences.

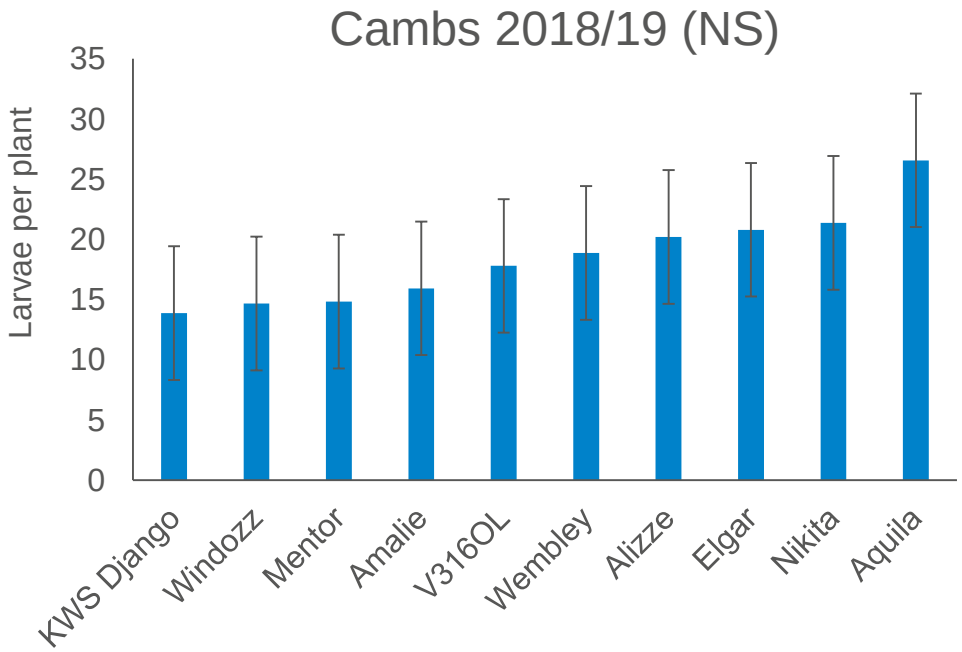




Varietal selection – larval damage

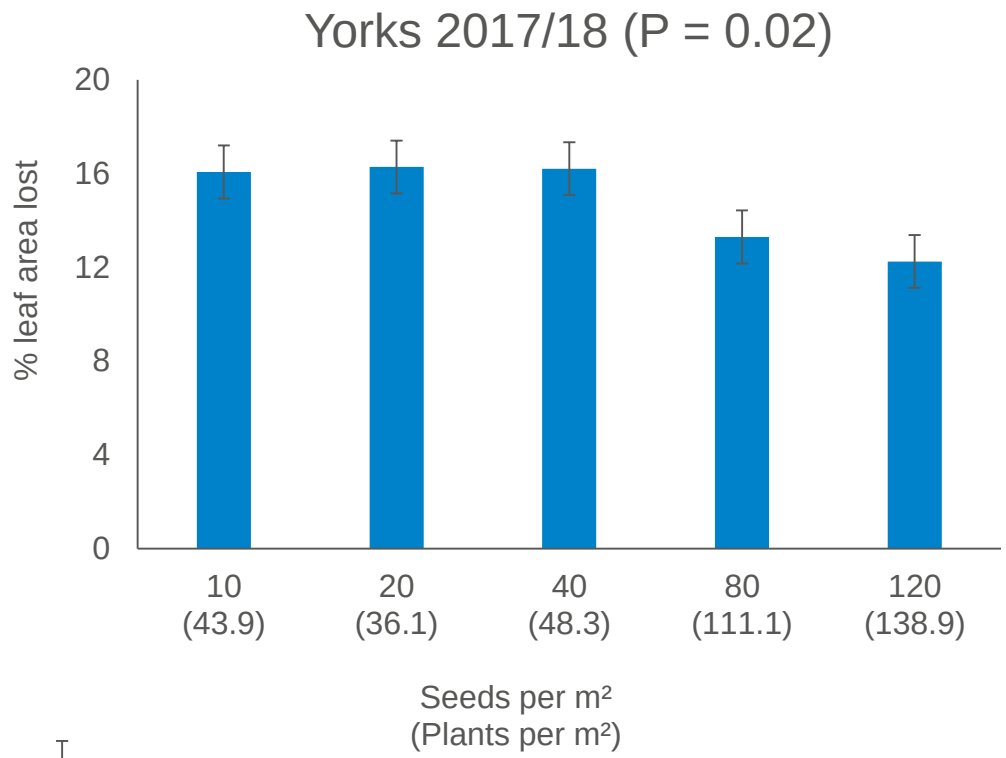
- Larval damage – no sig differences.
- Few differences in attractiveness or palatability.
- Varietal characteristics and tolerance may be important.
- Breeding lines.

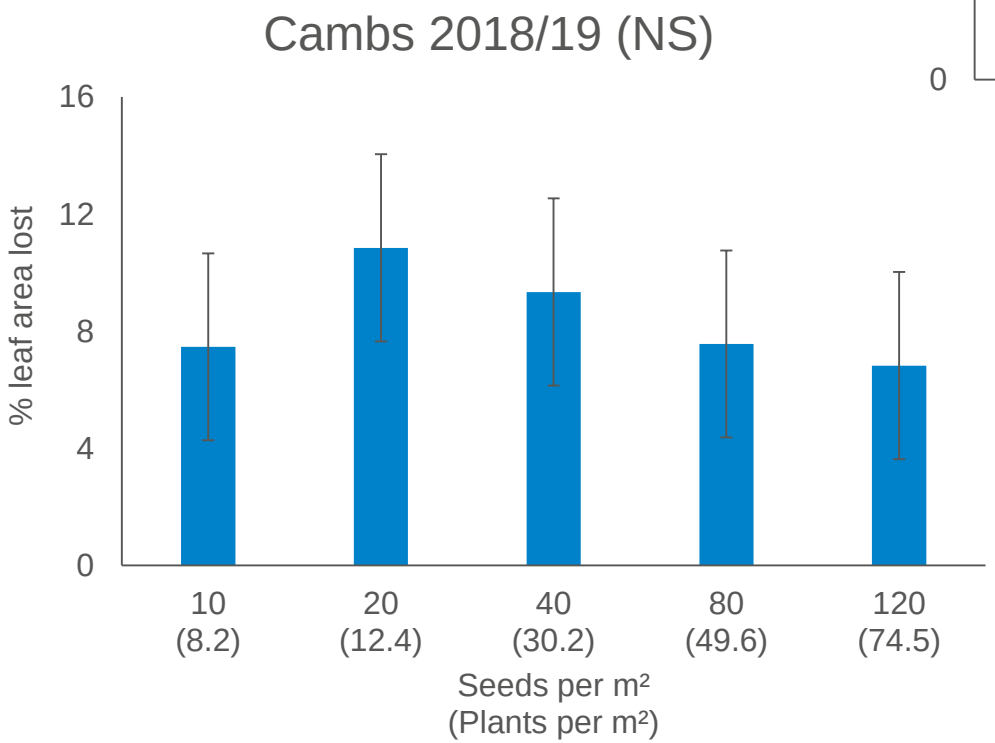




Seed rate – adult damage

- Trend for increasing seed rates to compensate.

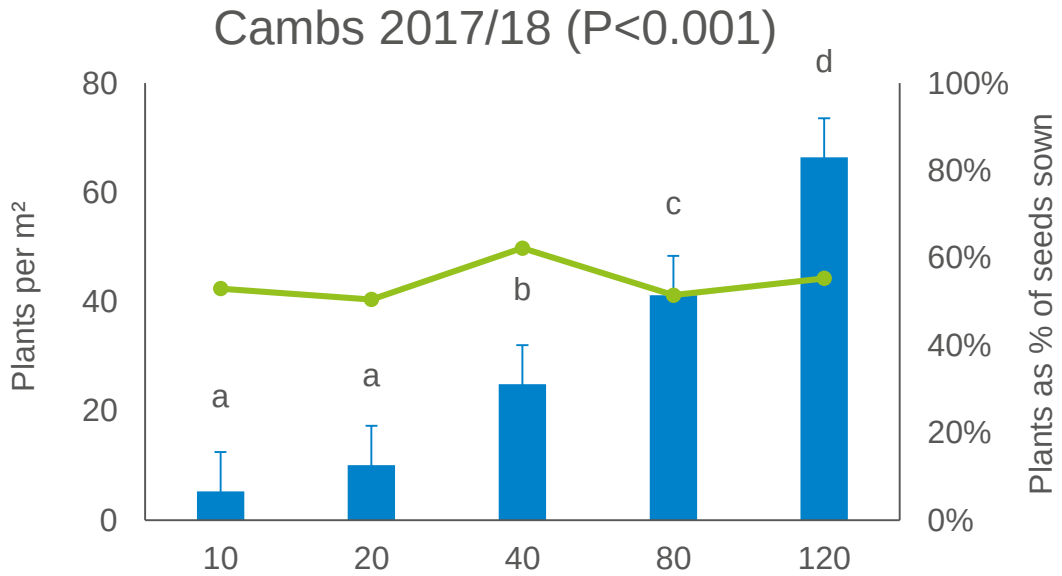


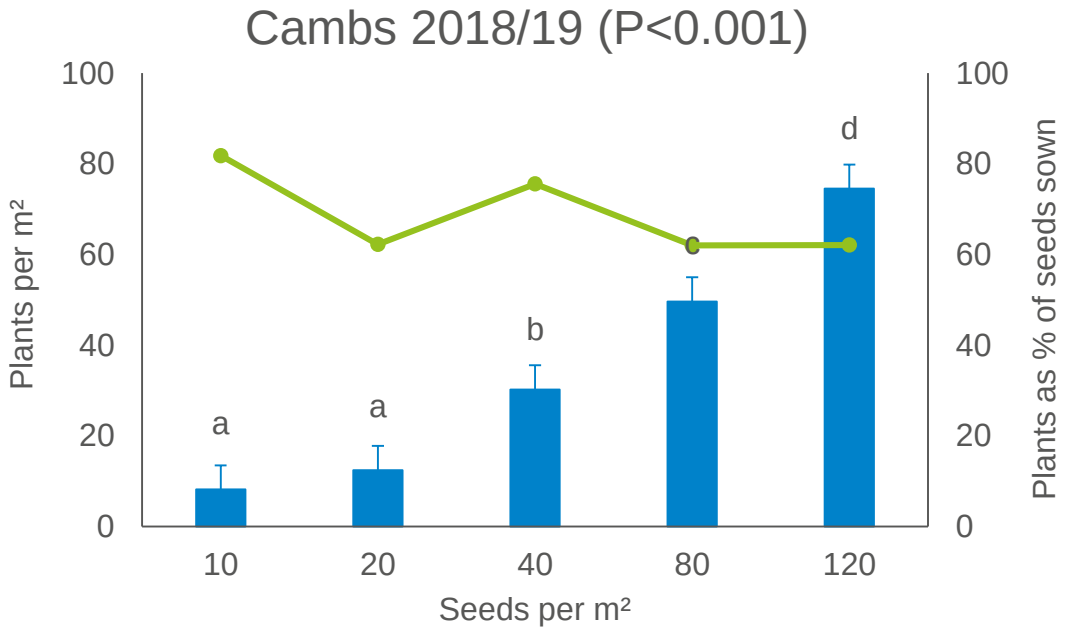


- Adult damage – Generally no sig differences.
- Less damage at highest seed rates on one trial.

Seed rate – plant populations

- Plant number increases with seed rate.
- Similar proportion of plants lost to CSFB at all seed rates.
- No clear benefit of increasing seed rate for crop establishment.



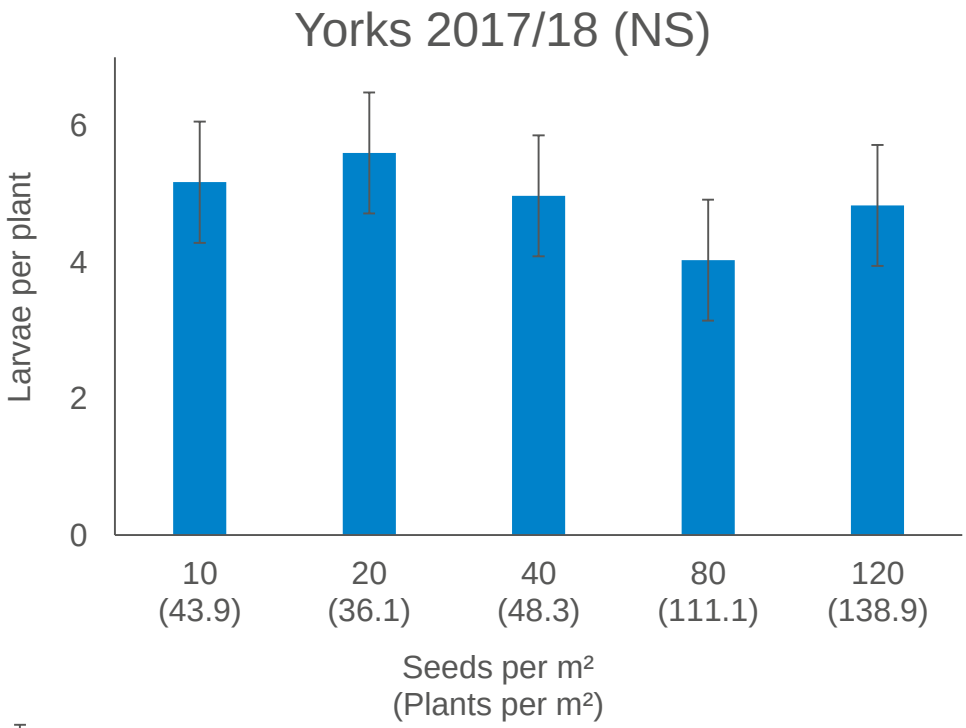


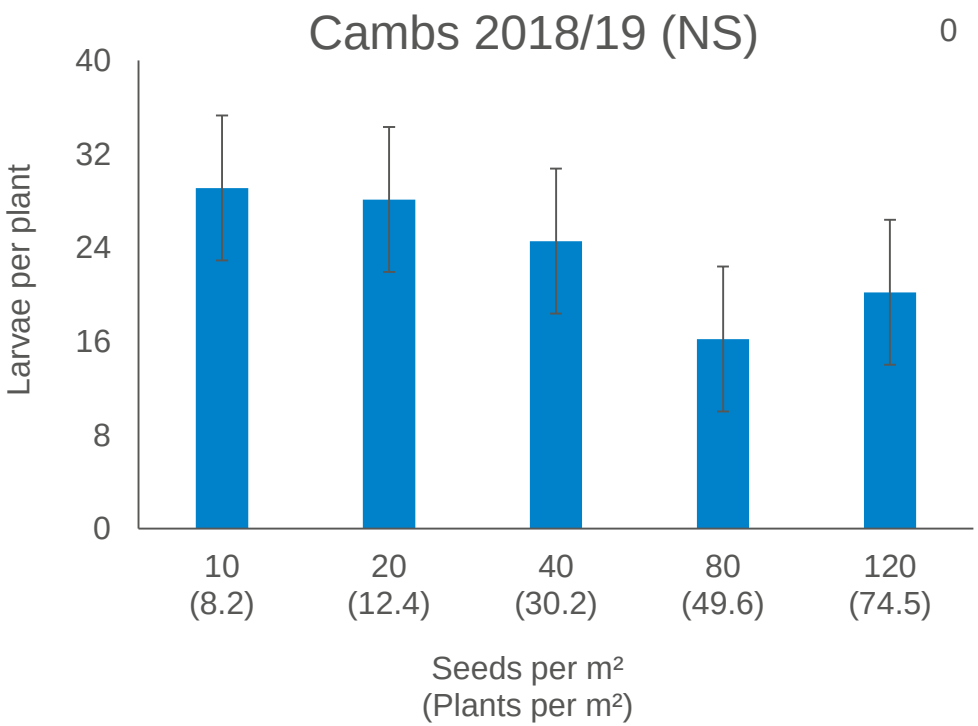
Plant population

Plants as % seeds sown

Seed rate – larval populations

- No significant differences in larvae per plant.

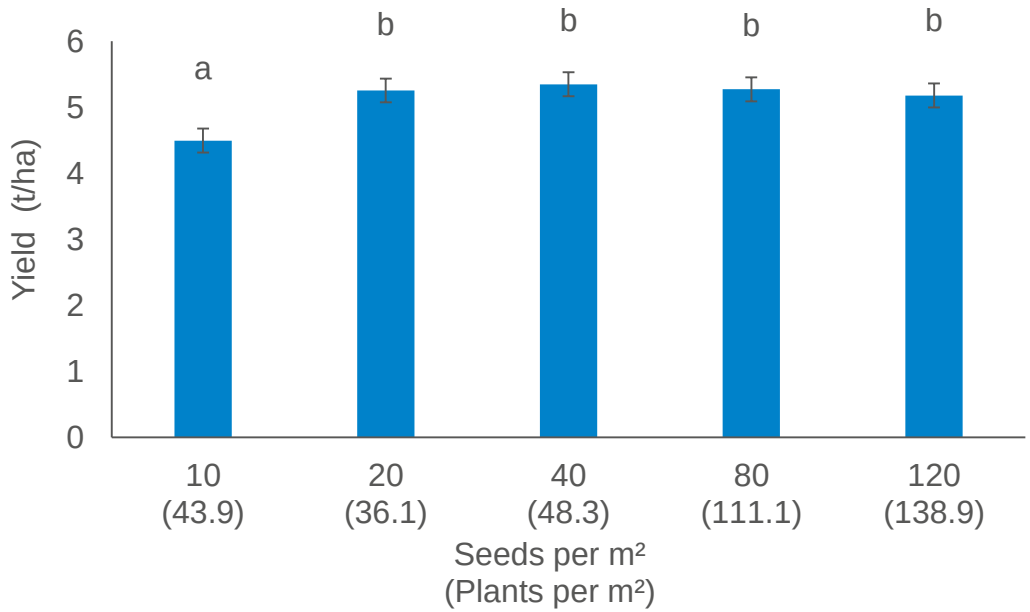


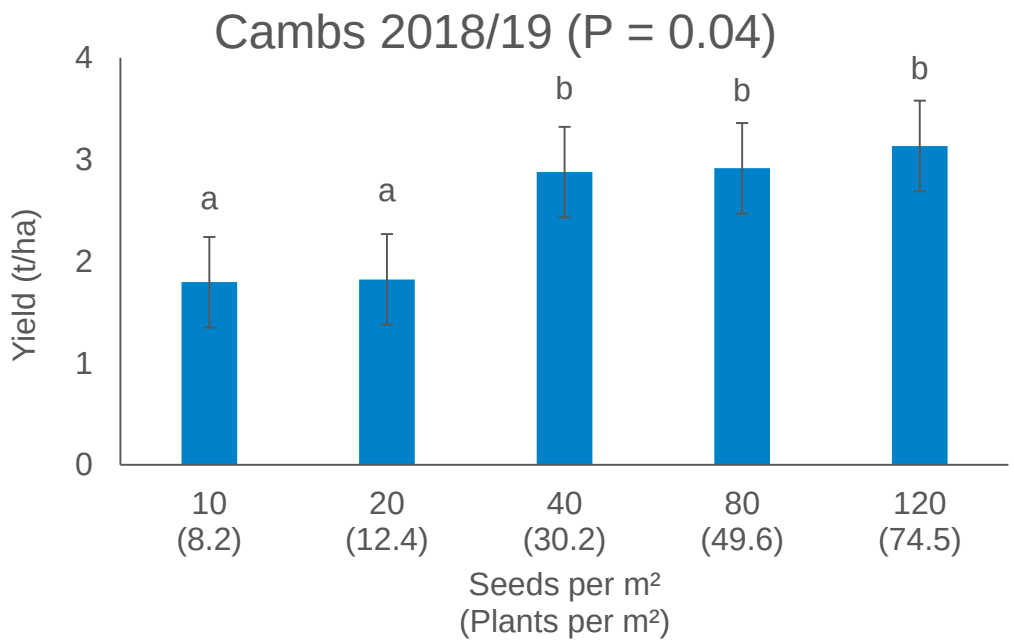


- Density dependent effect?

Seed rate – yield

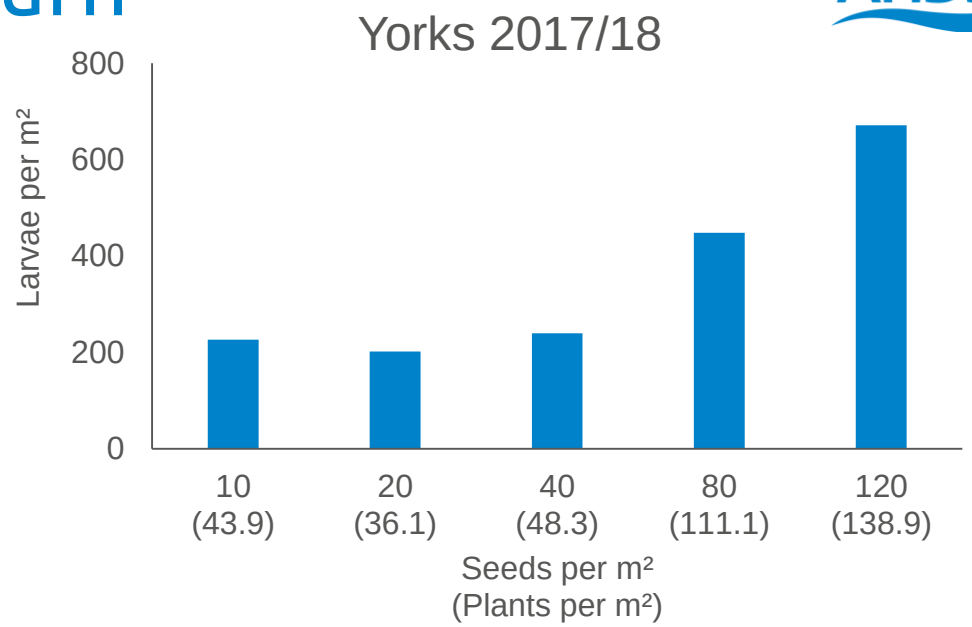
- Yield responses differed by site and year.
- Some significant yield reductions at lowest seed rates.
- Little benefit in seed rate >40 per m².

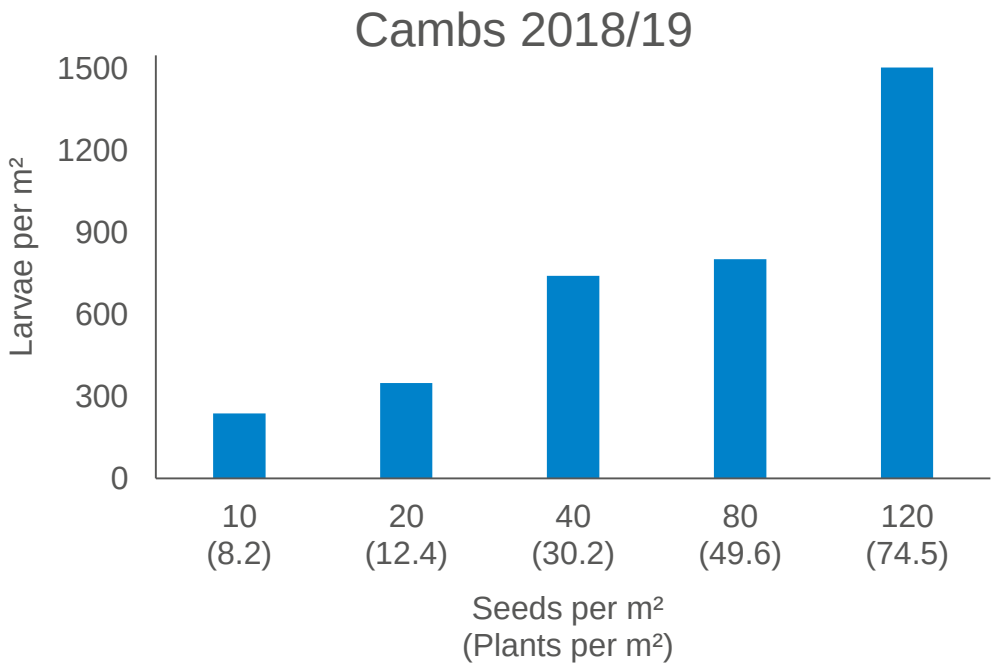




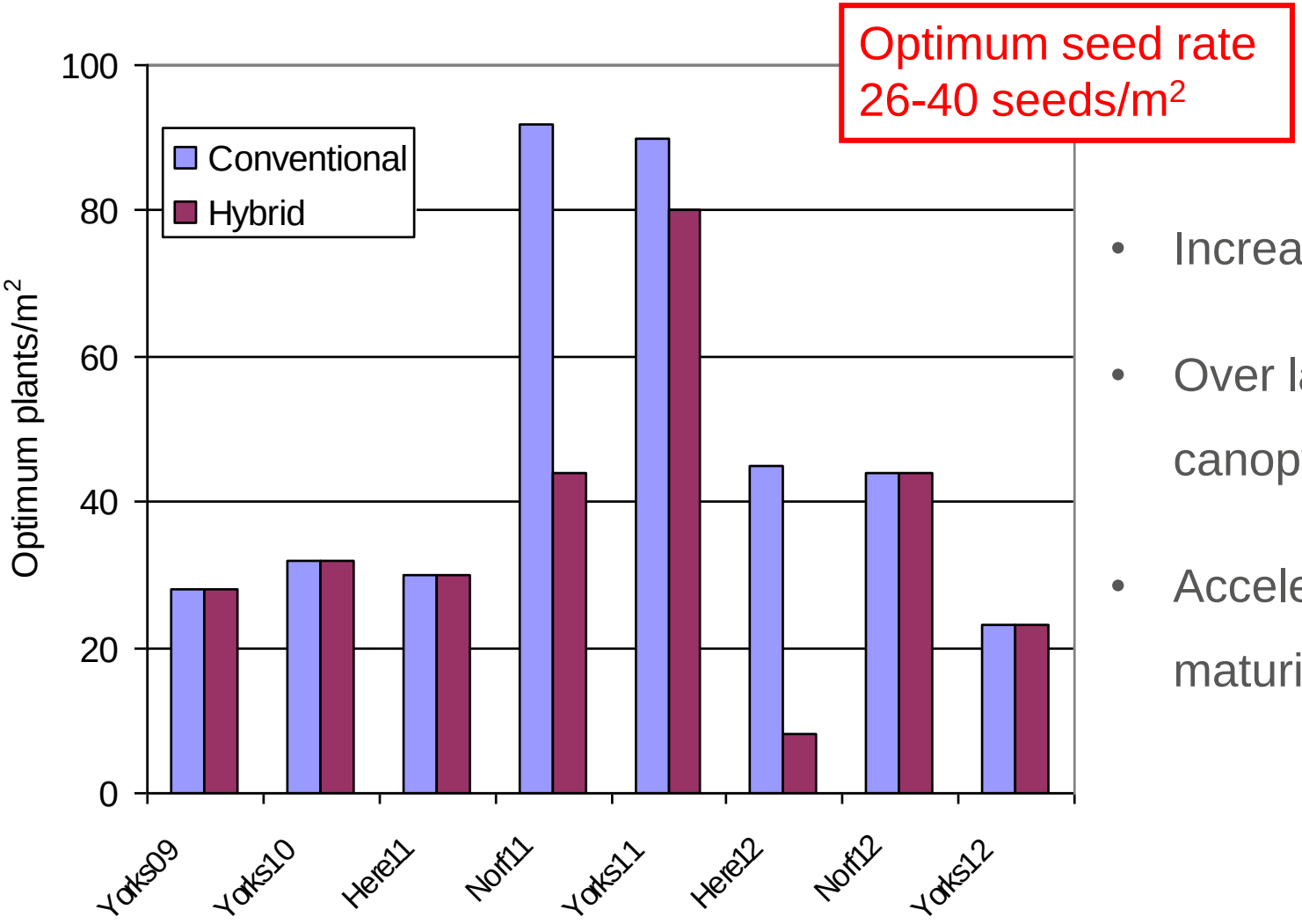
Seed rate – pest return

- Larvae per plant similar regardless of seed rate.
- So higher seed rates produce more larvae per unit area.
- Higher pest pressure in following season?





Economic optimum plants/m² for yield (2009-12)



- Increased lodging.
- Over large-canopy.
- Accelerated maturity.

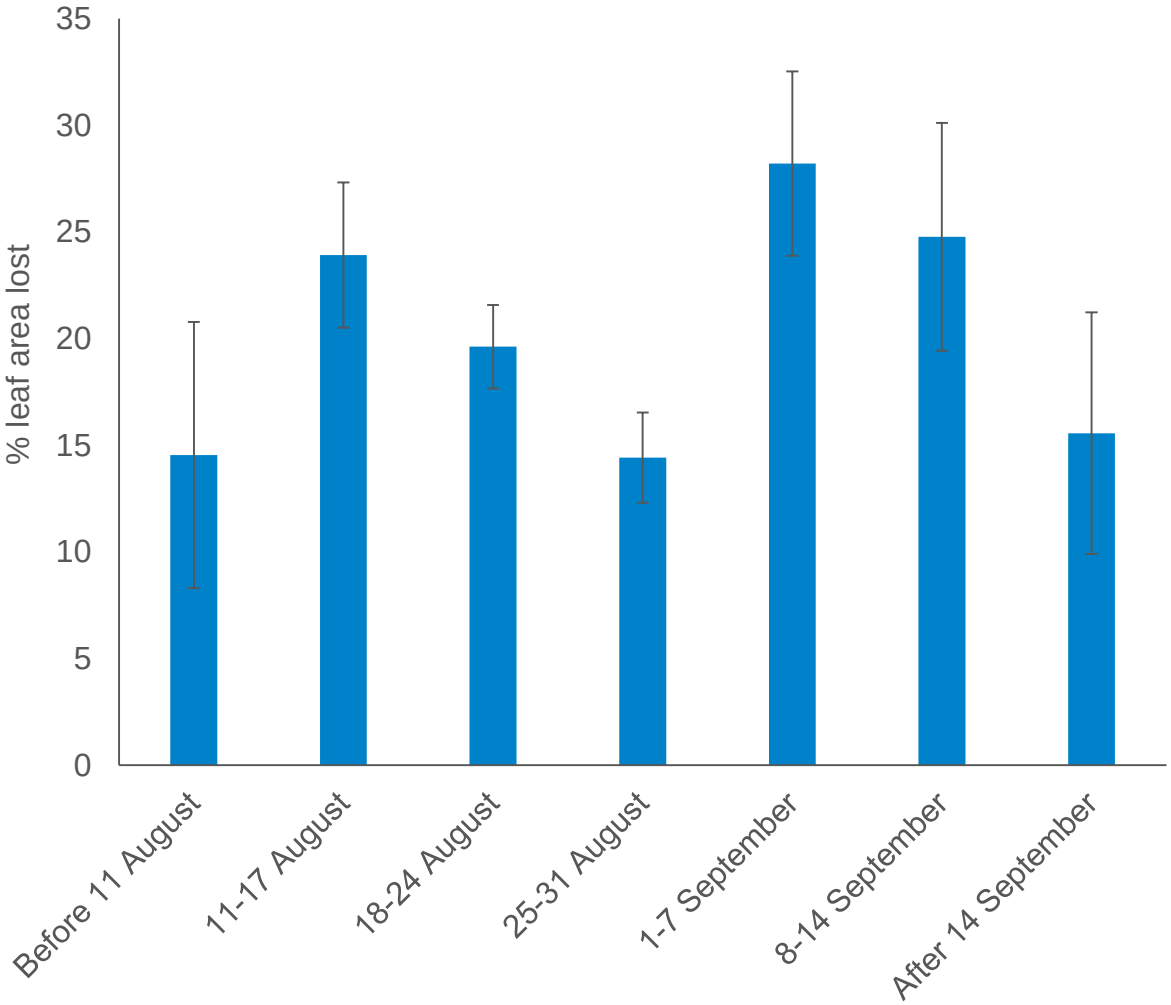
Roques & Berry (2015)

Seed rate conclusions

- Trials found no clear benefit of increasing seed rate for CSFB.
- Difficult to extrapolate findings to situations of **very** high CSFB pressure.
- Increasing seed rate for farm-saved seed may increase crop survival.
- But may decrease yield in situations where CSFB pressure isn’t very high.
- Increased pest carry over.

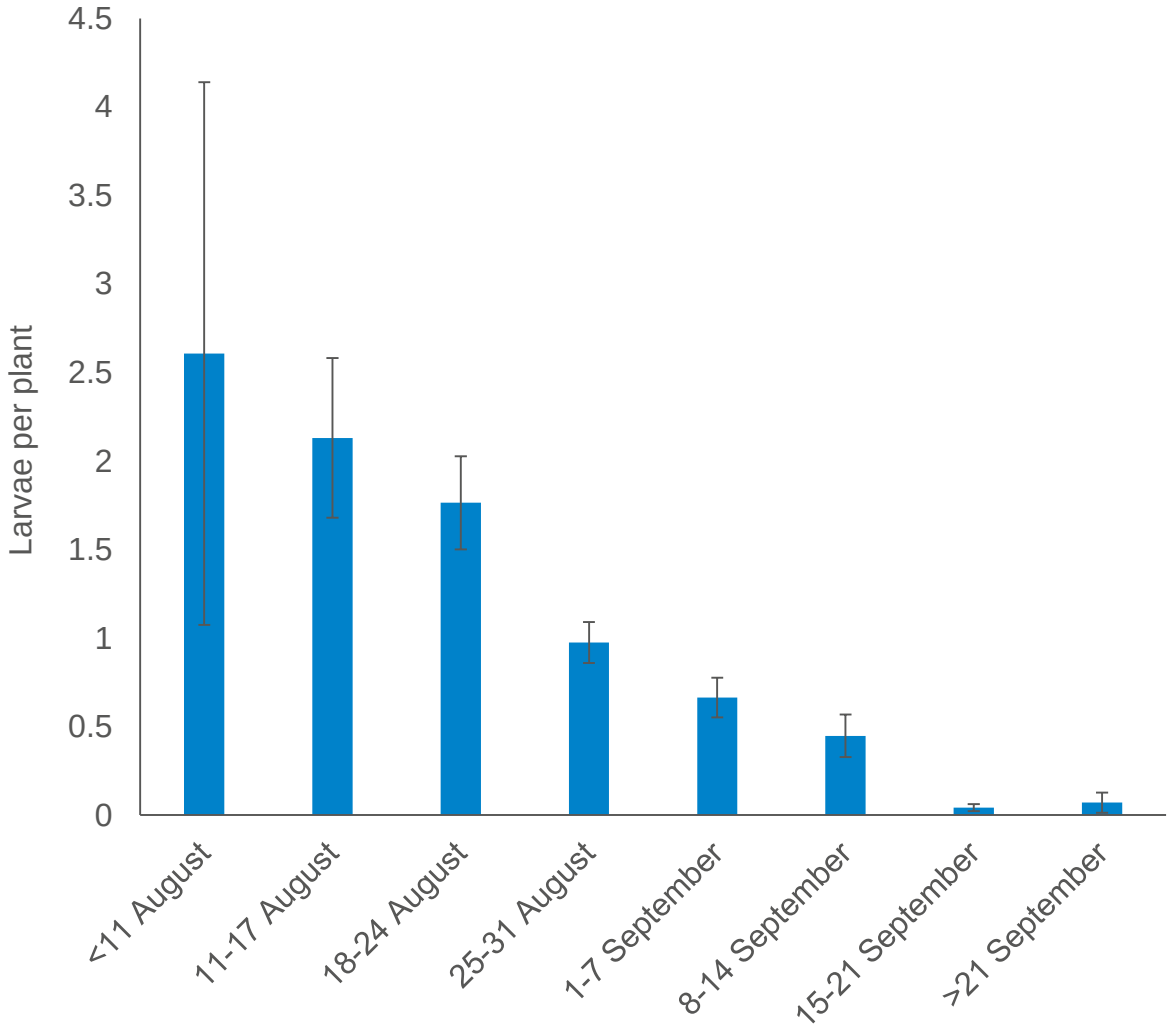
Drill date – minimising adult damage

- Survey work indicates trends in adult and larval damage.
- Modelling found August drilling results in less damage.
- Robust crops and pest avoidance.



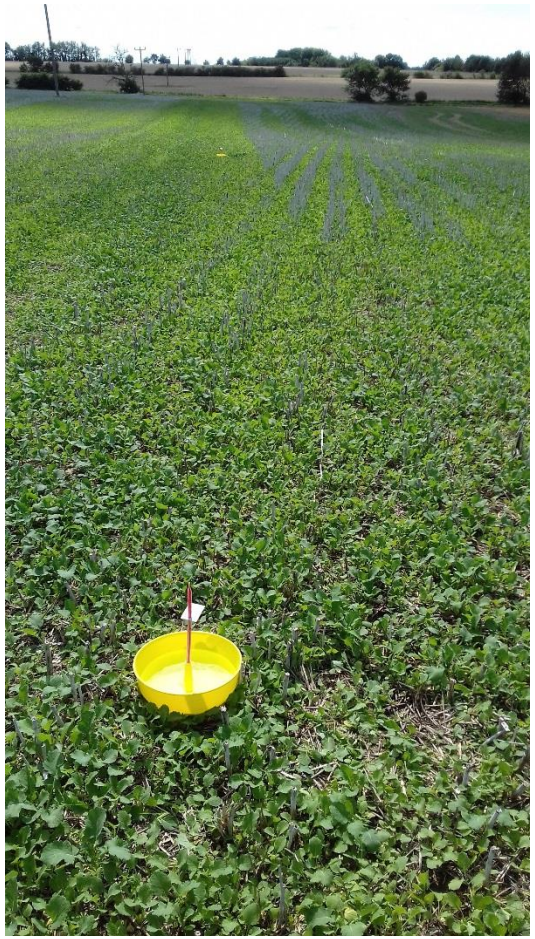
Drill date – minimising larval damage

- Modelling work found September drilled crops have fewer larvae.
- Difficult decision to make.
- Either early August or late September.



Volunteer OSR (vOSR) as a trap crop

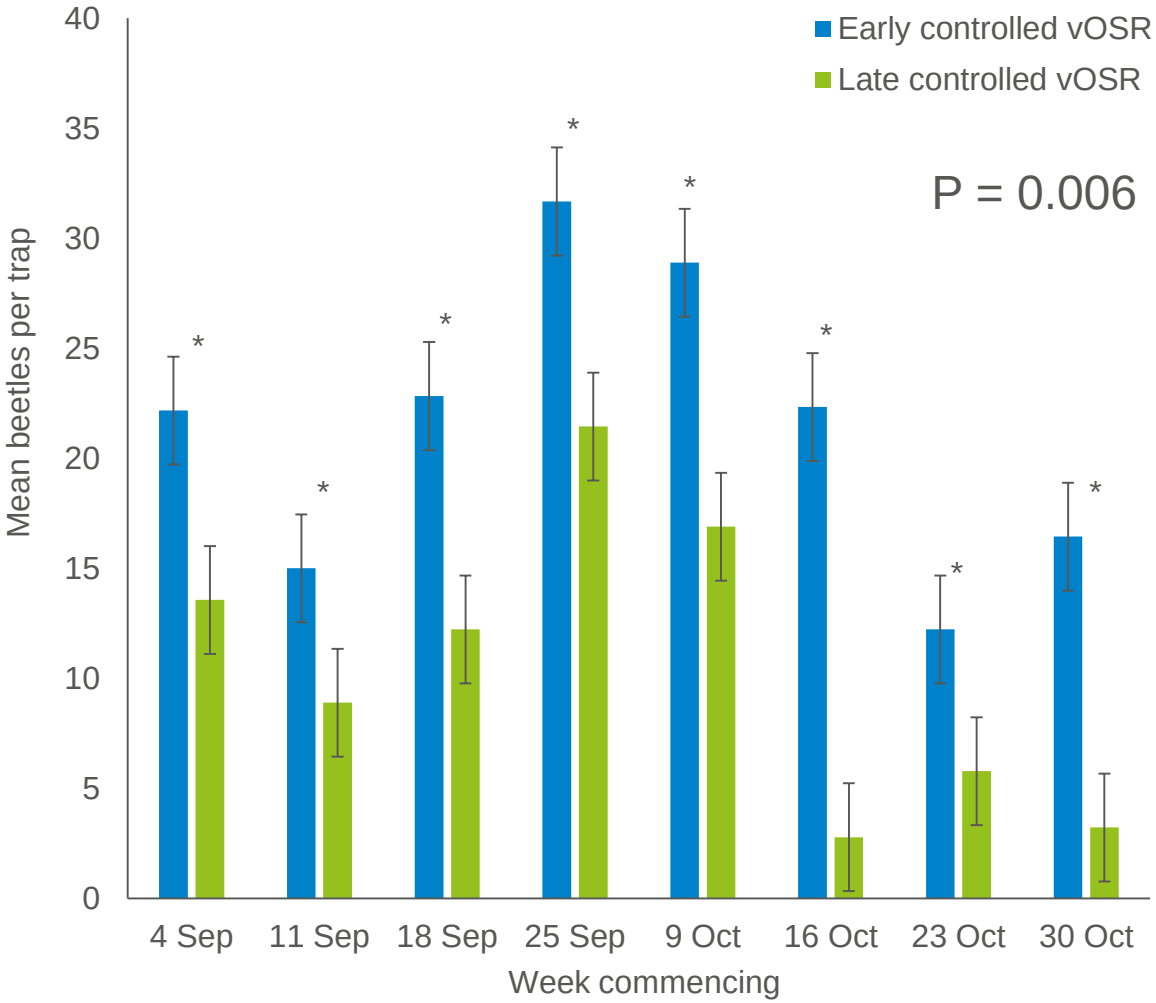
- In August, adult CSFB emerge from aestivation and migrate to OSR.
- Detect glucosinolate breakdown products (isothiocyanates) to locate crops.
- CSFB don’t discern between an OSR crop and a field of vOSR.
- vOSR normally appears before drilled OSR and controlled by mid-August.



Delaying control of vOSR

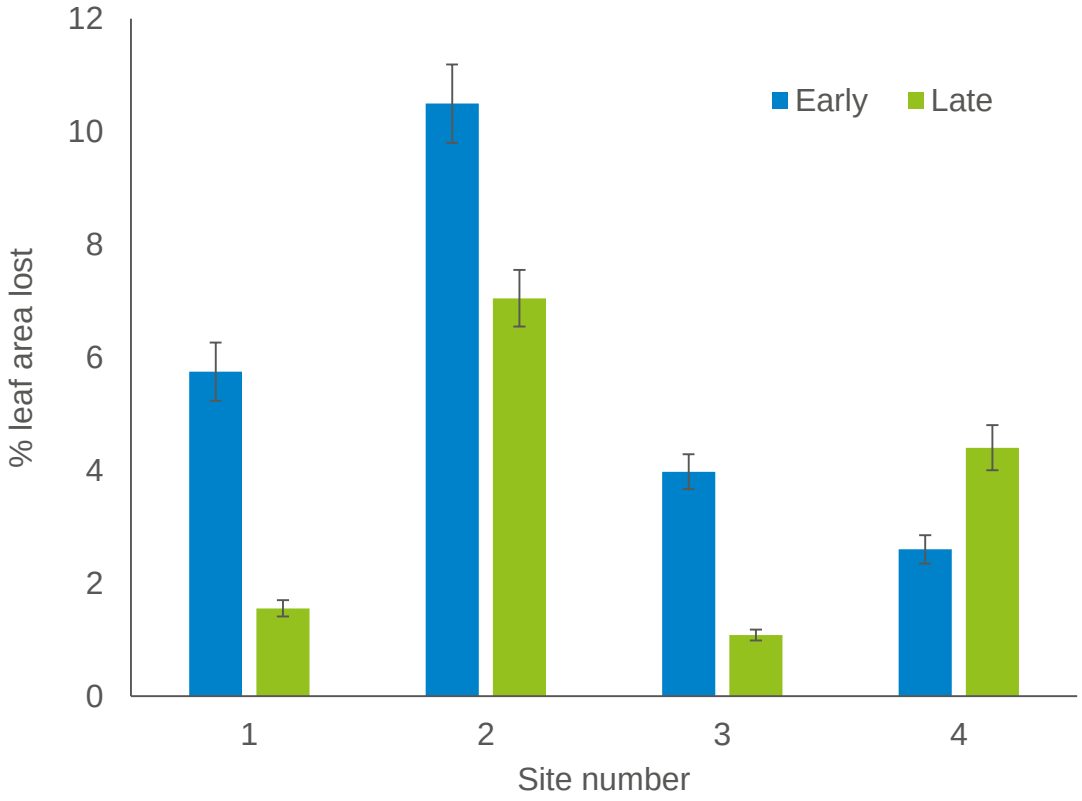
- If vOSR control is simply delayed will this be more attractive than drilled OSR?
- Exploits CSFB biological quirk.
- Investigated in 6 trials over 2 years.
- Compared CSFB pressure in crops next to fields in which vOSR controlled
  a) Early August
  b) Late September

Delaying control of vOSR – effects on adult CSFB



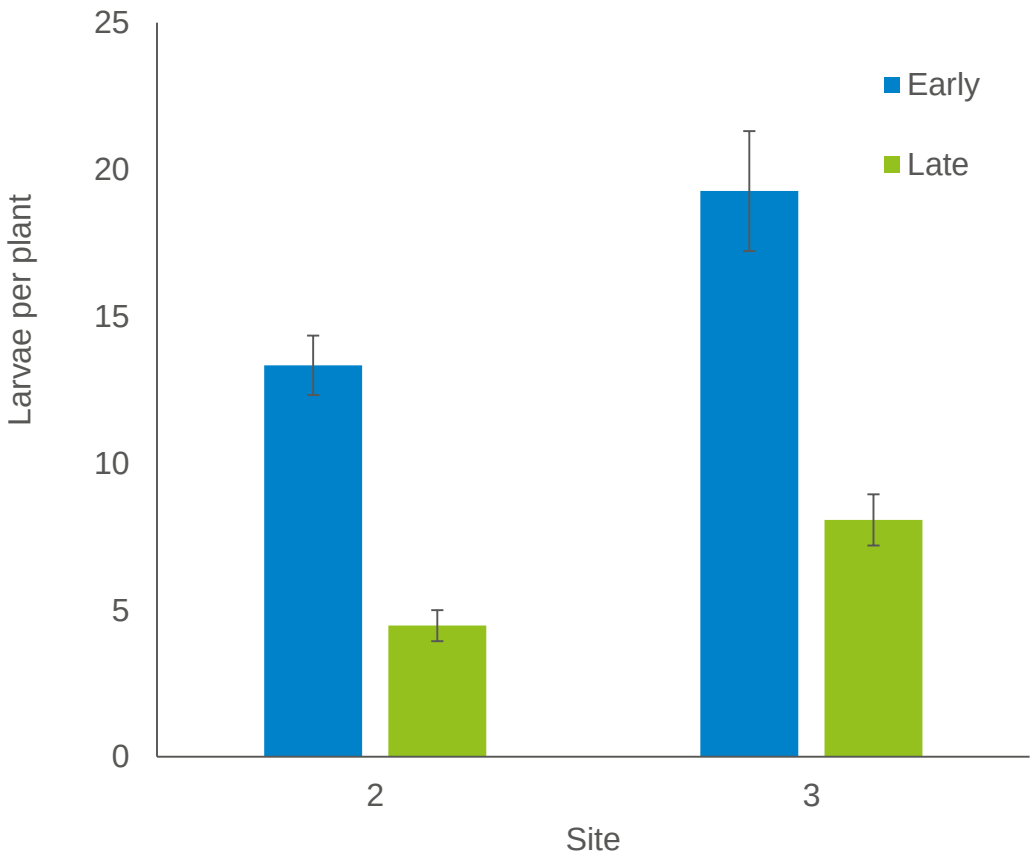
- Significant reductions in adults in neighbouring OSR crop.
- Reductions continue after vOSR controlled.

Delaying control of vOSR – effects on adult CSFB feeding damage



- Significant reductions in adult damage in neighbouring OSR crop.

Delaying control of vOSR – effects on larval infestation



- Reductions in larval populations in neighbouring OSR crop.

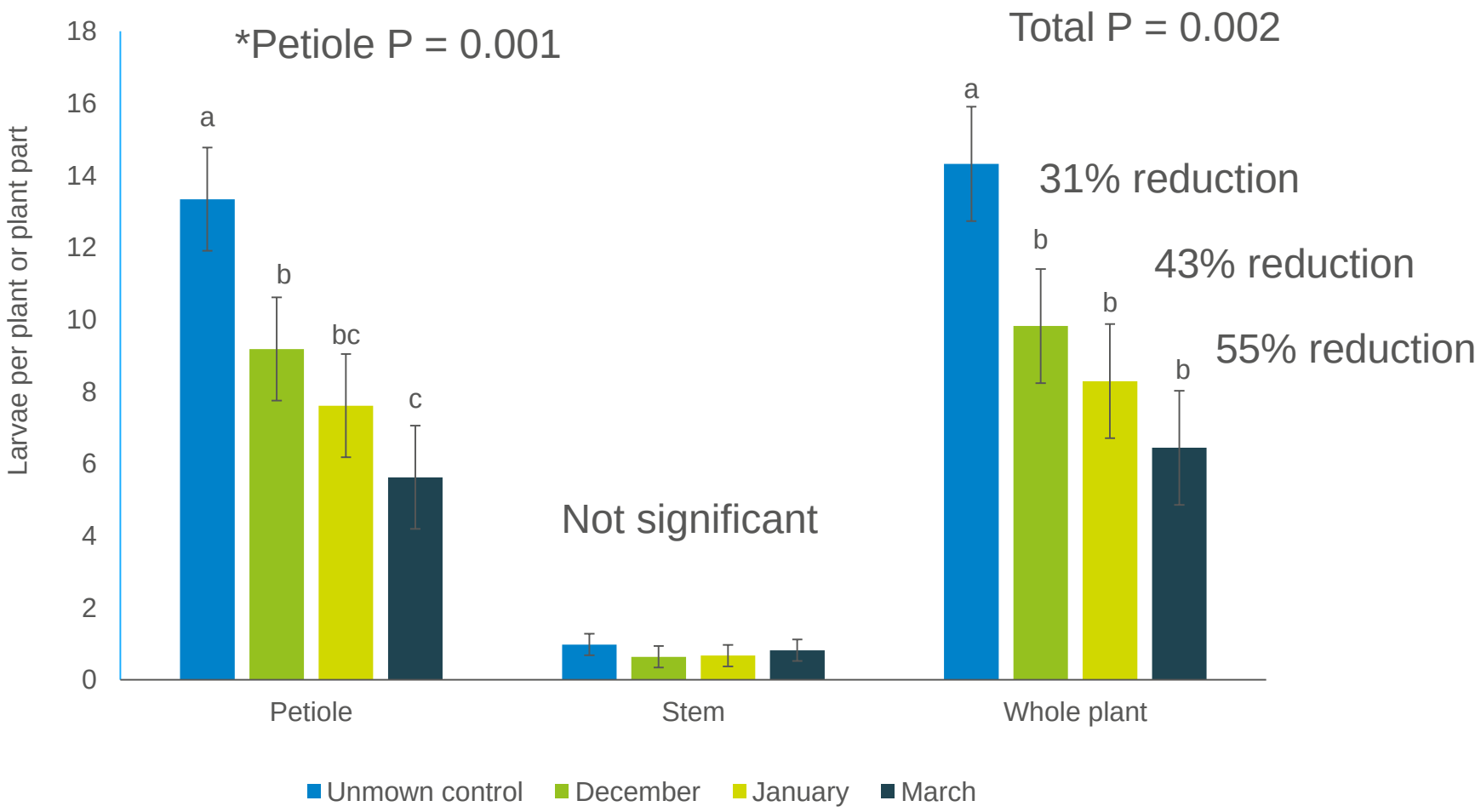
Volunteer OSR conclusions

- Delaying control of vOSR reduced CSFB incidence and damage.
- Any eggs or larvae laid in vOSR would die so breaks pest life-cycle.
- Benefits not seen at two sites. Why?
  - Area of vOSR?
  - Crop stage v's vOSR stage?
- May not be practical or fit into rotation.

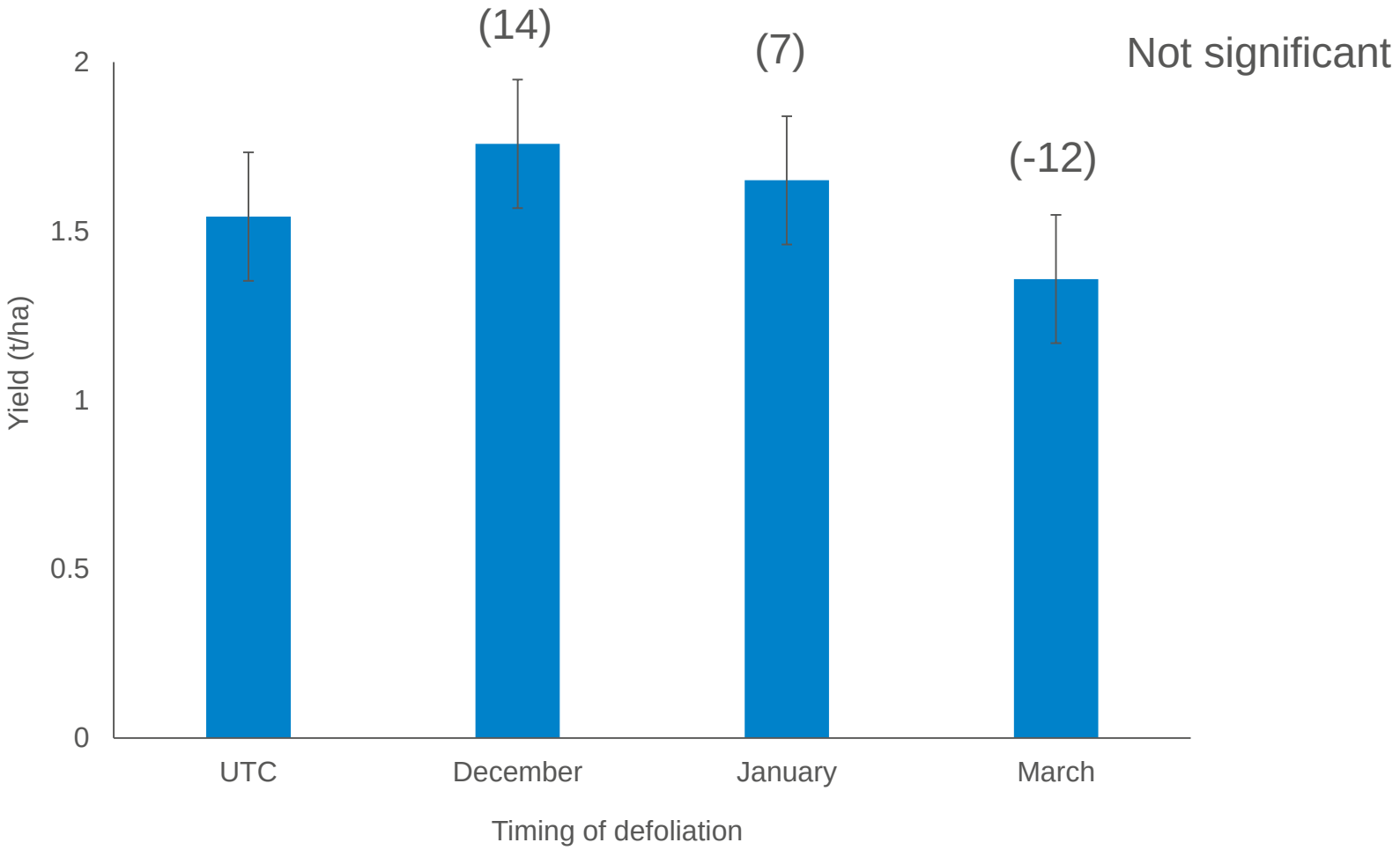
Controlling larvae

- Resistance means pyrethroids provide little control.
- Defoliating OSR in winter can have negligible yield impact provided occurs before stem extension.
- Can winter defoliation control CSFB larvae?
- Physical control (e.g. livestock ingesting larvae) or exposing larvae to cold and natural enemies.
- Plot trials using a mower to defoliate.

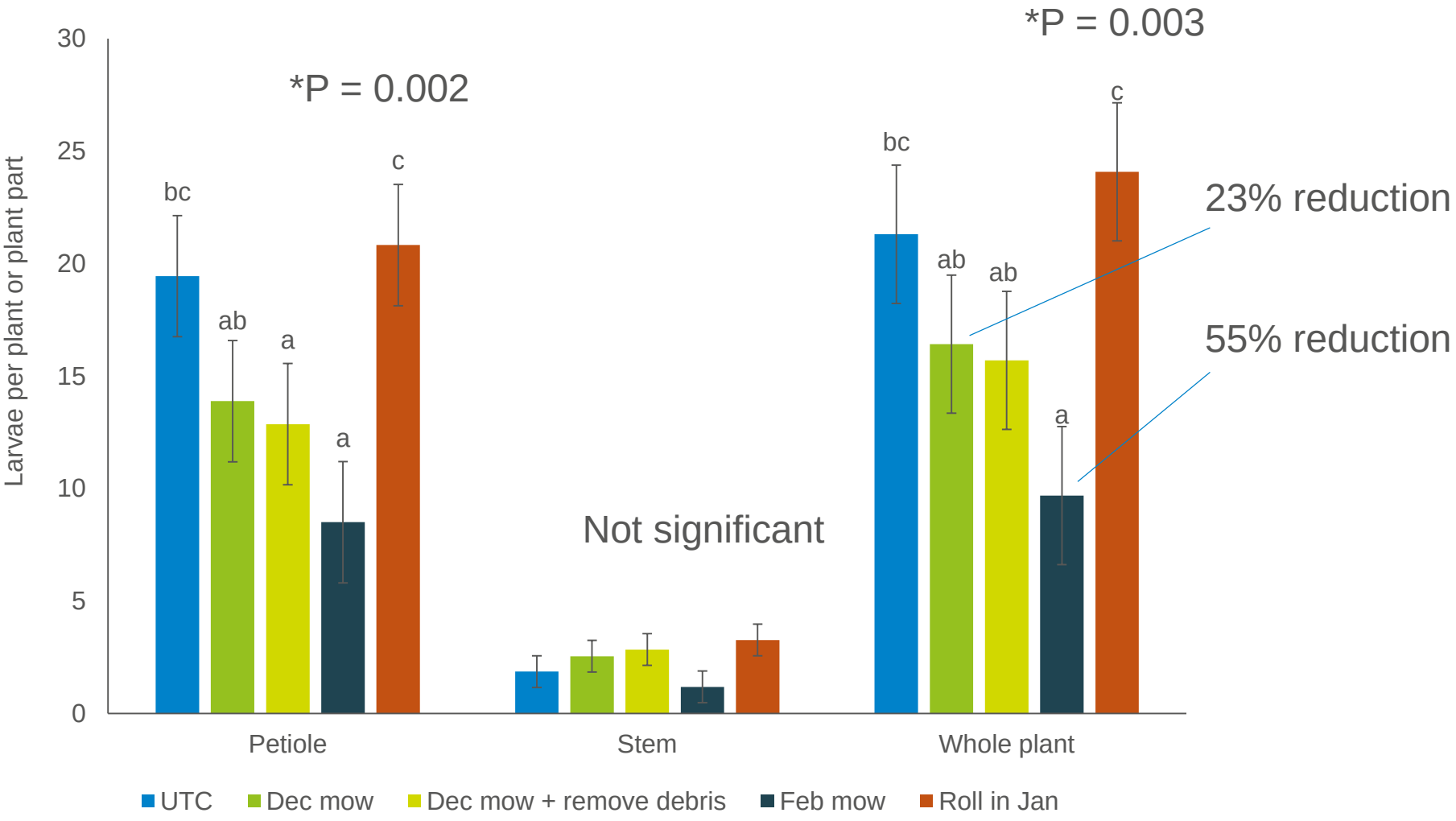
Impact of defoliation on larval populations (late March) (2016/17)



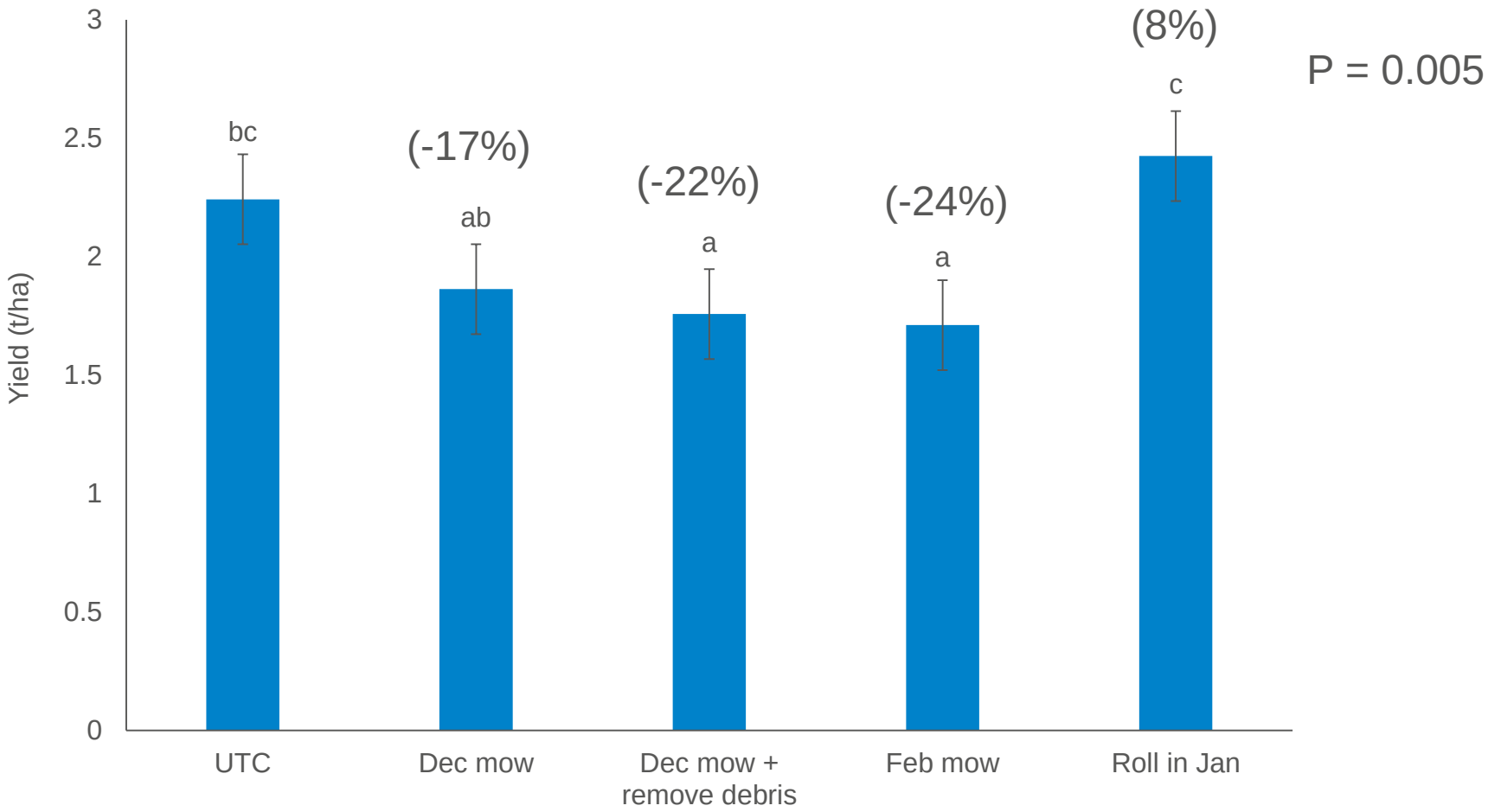
Impact of defoliation on yield (2016/17)
(figures in brackets = % difference from control)



Impact of defoliation on larval populations (late March) (2018/19)

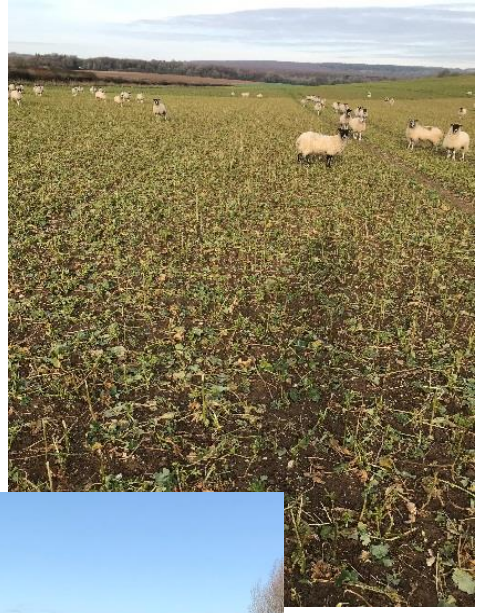


Impact of defoliation on yield (2018/19) (figures in brackets = %difference from control)

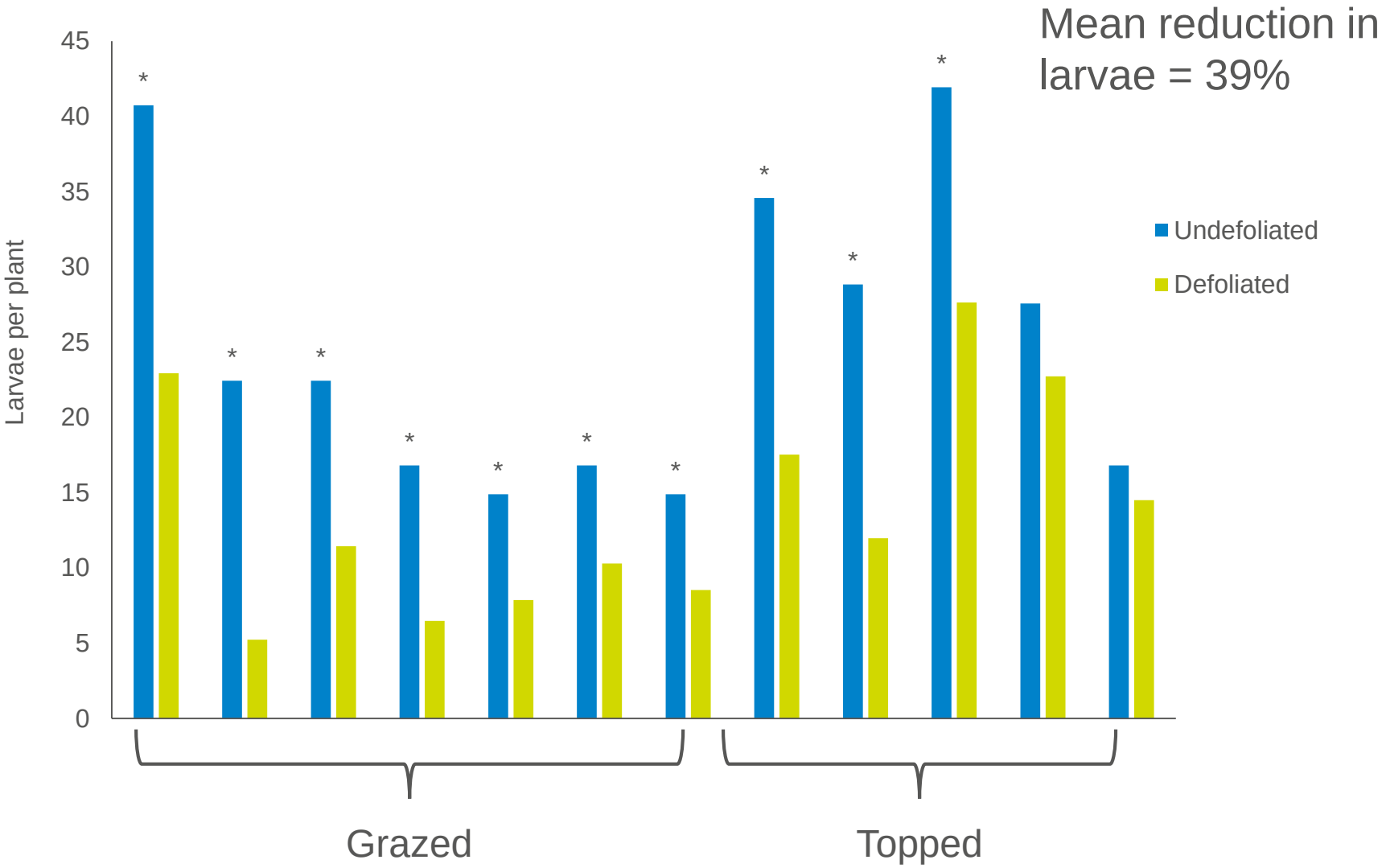


Defoliation Field Lab

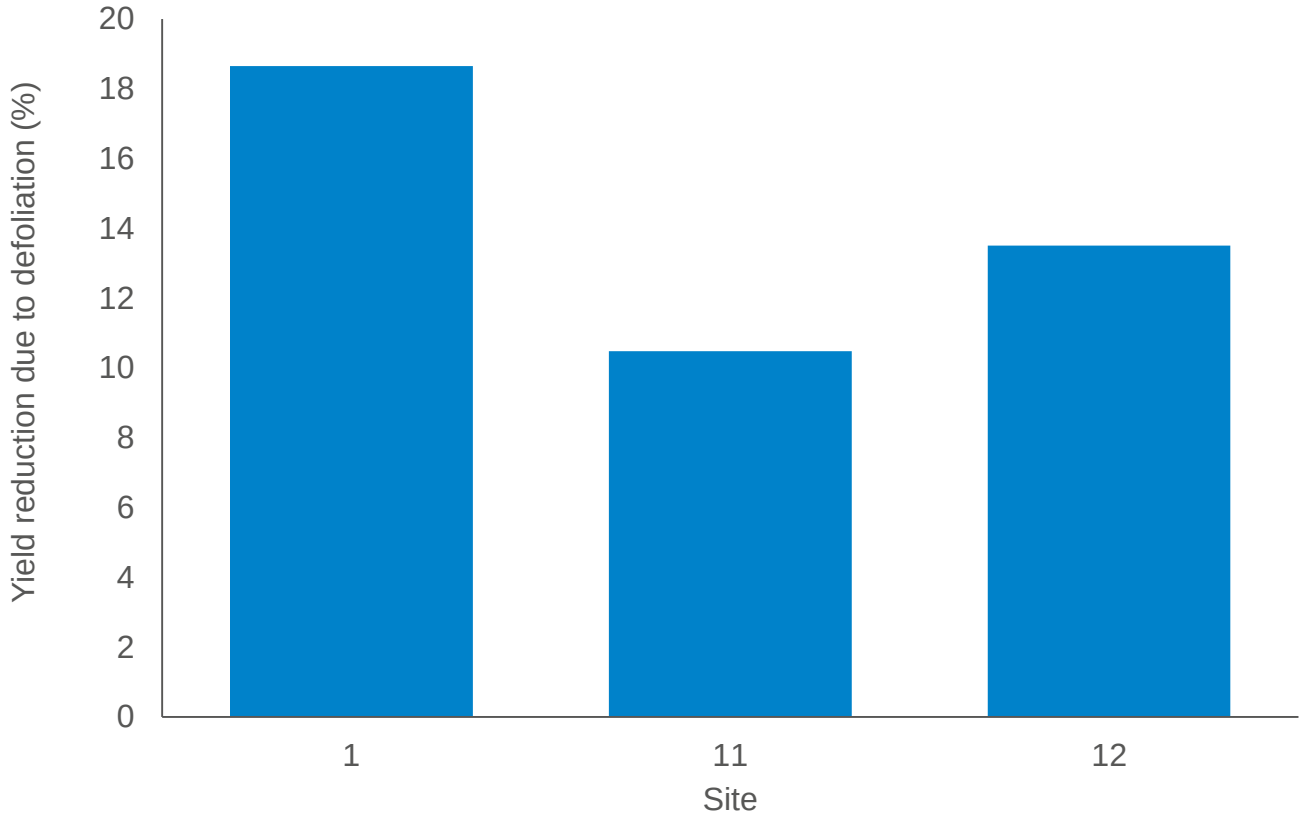
- Farmer-led project.
- Network of farmers taking part in an Innovative Farmer ‘Field Lab’ last winter.
- 8 farms (Hertfordshire, Norfolk and West Sussex).
- 12 fields across 8 farms.
- Defoliated using topper or sheep.
- Late December to March.



Field Lab results – larval populations



Field Lab results - yield



Defoliation conclusions

- Can reduce larval populations. Innovative Farmer field lab showed grazing or topping to be effective.

- Yield effect unclear. Yield reductions in 2018/19. Likely due to poor spring conditions, e.g. dry spring, cool May.

- Choose good crop with damage.

- Defoliate prior to stem extension.

- Further Field Lab this winter. Would you like to take part? Email sacha.white@adas.co.uk.

IPM components

Drill date

Early-mid August:

More tolerant of adult feeding.

Mid-Sept onward:

Adult escape.

Lower larval pressure.

Variety

Autumn and/or spring vigour

Thicker stem?

Volunteer OSR trap crop

Others

Right conditions

Companion cropping

Crop amendments

Natural enemies

Defoliation overwinter

Take home messages

- Managing CSFB extremely challenging.
- No silver bullet.
- Suite of non-chemical control options needed.
- Consider natural enemies.

© Trevor and Dilys Pendleton

© Khaleim & Sheng

Thank you for listening. Any questions?

Thanks to:

Charlotte Rowley

Emma Hurrell

Helen Aldis

Fiona Geary

Max Newbert

Luke Cotton

Host farmers & agronomists

ADAS technical staff

Steve Ellis

Sarah Kendall


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

The role of plant breeding in ICM

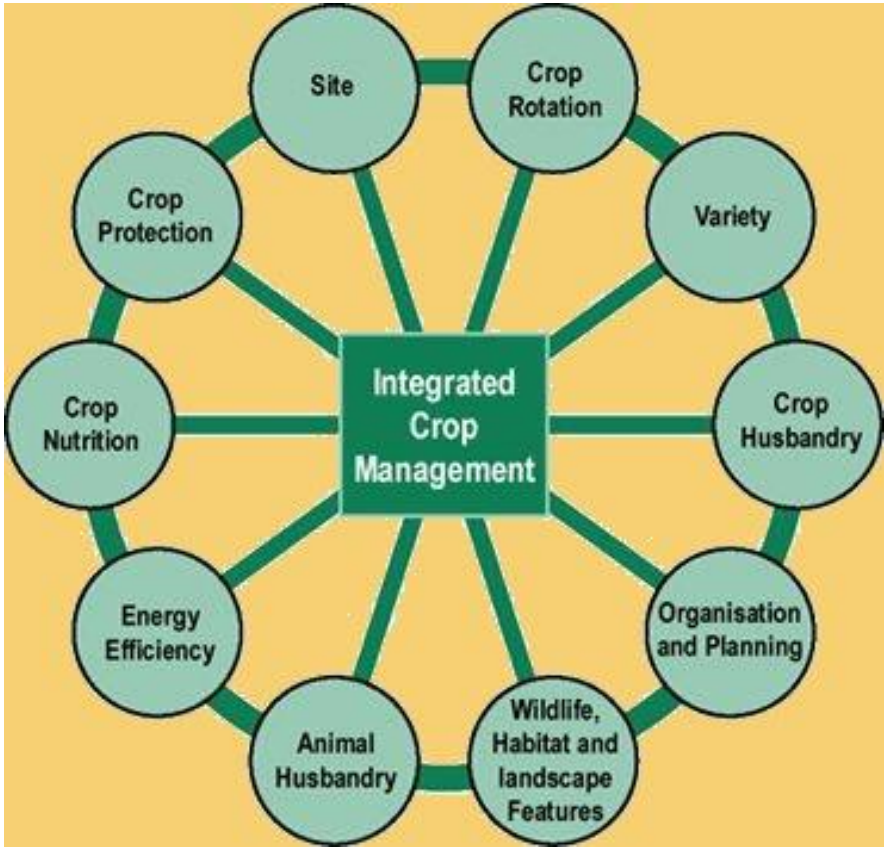
John Miles KWS UK

Genetics, one spoke in the wheel?

- crop & variety site suitability

- Cropping options
- Sustainable rotations

- Protection
- Sustainable use



- Utilisation
- sustainable use

- Variety and crop scheduling
- Cost of production

- Water use efficiency
- Different species

- Variety and crop scheduling

AHDB

Search

Brexit | Marketing | Markets and prices | Knowledge library | Tools | Events | News | About AHDB | Contact us

Home > News > IPM: what's it all about?

IPM: what's it all about?

Tuesday, 23 July 2019

Integrated pest management (IPM) is a hot topic, but it's not a new idea.

In this podcast episode we find out who's doing what, and why, along the road towards integrated pest management. We hear from Warwickshire arable farmer Rob Fox, AHDB's Jon Knight, Emma Hamer from the NFU and Alison Stewart, all the way from New Zealand's Foundation for Arable Research.

SUBSCRIBE

Image: Natural enemy Asilidae Diotctria rufipes, by Ian Andrews. The larvae predate the larvae of other insects and the adults predate other insects on the wing. Find out more in the Encyclopaedia of pests and natural enemies

View AHDB resources on IPM

AHDB

- Sustainable use Directive sets out the principles of IPM
- Varieties have an important part to play
- A greater role for genetics moving forward

What does IPM mean?

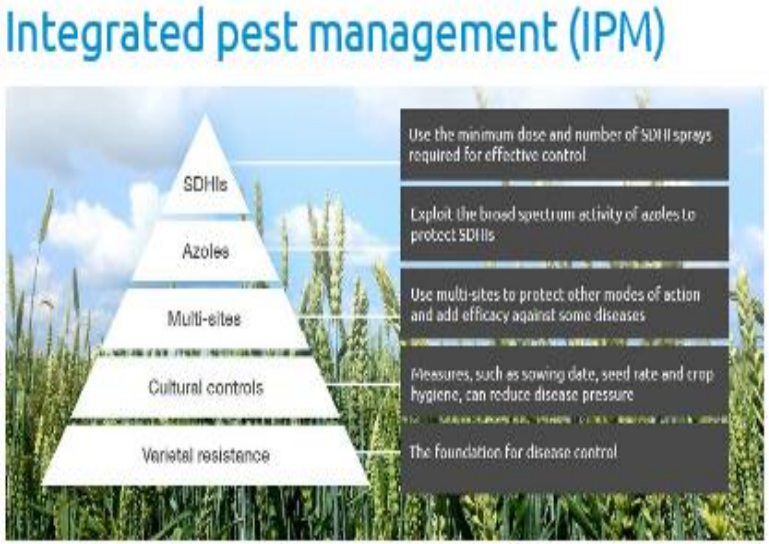
'Integrated Pest Management' is the careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms and keep the use of plant protection products and other forms of intervention to levels that are economically and ecologically justified and reduce or minimise risks to human health and the environment. *SUD 2009*

Q What is Integrated Pest Management (IPM)?

A The Sustainable Use Directive defines IPM under the following 8 headings the VI believes that most UK growers will be implementing some if not all of these measures depending upon the farm enterprise.

Source https://voluntaryinitiative.org.uk/schemes/integrated-pest-management/

- crop rotation,
- cultivation techniques,
- use of resistant/tolerant cultivars and standard/certified seed/planting material,
- use of balanced fertilisation, liming and irrigation/drainage practices,
- hygiene measures (e.g. cleansing of machinery)
- protection and enhancement of important beneficial organisms,
- Monitoring of Harmful organisms
- Application of plant protection based on monitoring data
- Use of biological, physical and other non-chemical methods must be preferred to chemical methods if they provide satisfactory pest control.
- Application of pesticide should be as Targeted as possible.
- The professional user should keep the use of pesticides and other forms of intervention to levels that are necessary and that do not increase the risk for development of resistance in populations of harmful organisms.
- Anti-resistance strategies should be applied to maintain the effectiveness of the products.
- Review the success of plant protection measures.

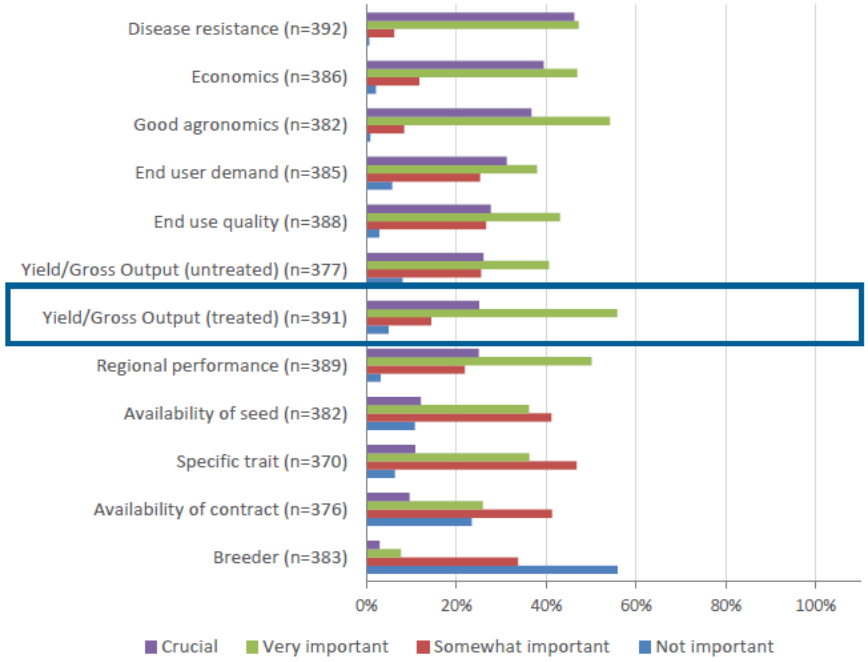


Use a pyramid of control measures to manage disease. An appropriate variety (to resist the main diseases present) and a well-designed rotation (to minimise disease pressure) are at the heart of IPM

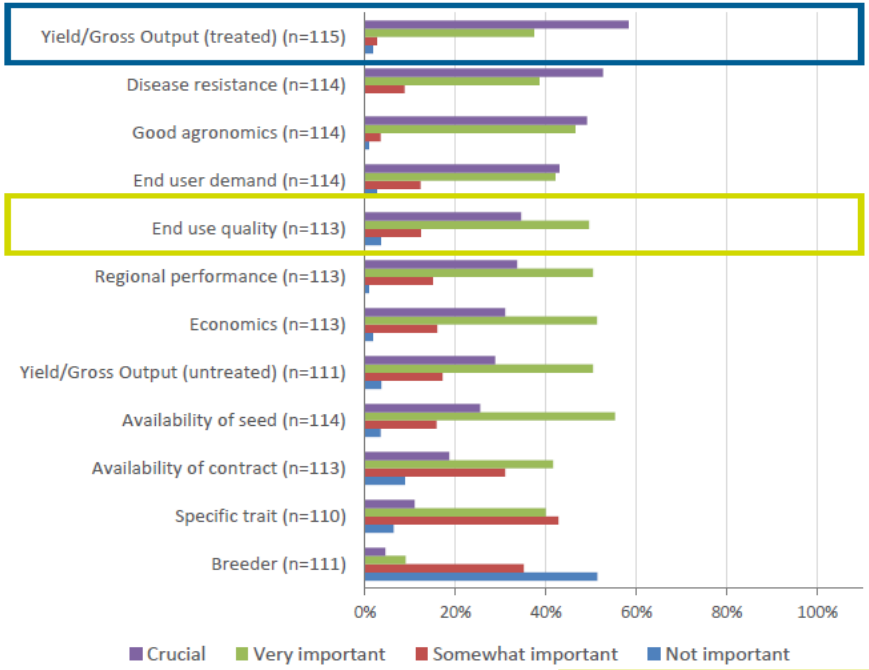
Source https://ahdb.org.uk/cereal-dmg

What characteristics are important to growers?

Grower & Agronomist response



Other stakeholder response



Most crucial for millers

Principles

- Resistance genetics allow plant to withstand levels of infection from a pathogen
- Mechanisms of resistance will work in a number of ways
  - restricting pathogen growth- methods by which may not clearly known
    - Septoria
    - Light leaf spot
  - Interrupting a life cycle
    - OWBM
- RL varieties have differing levels of disease resistance
  - None are immune but some show very few symptoms.
- Two types of Resistance:
  - Genetic
  - Adaptive resistance (Avoidance)

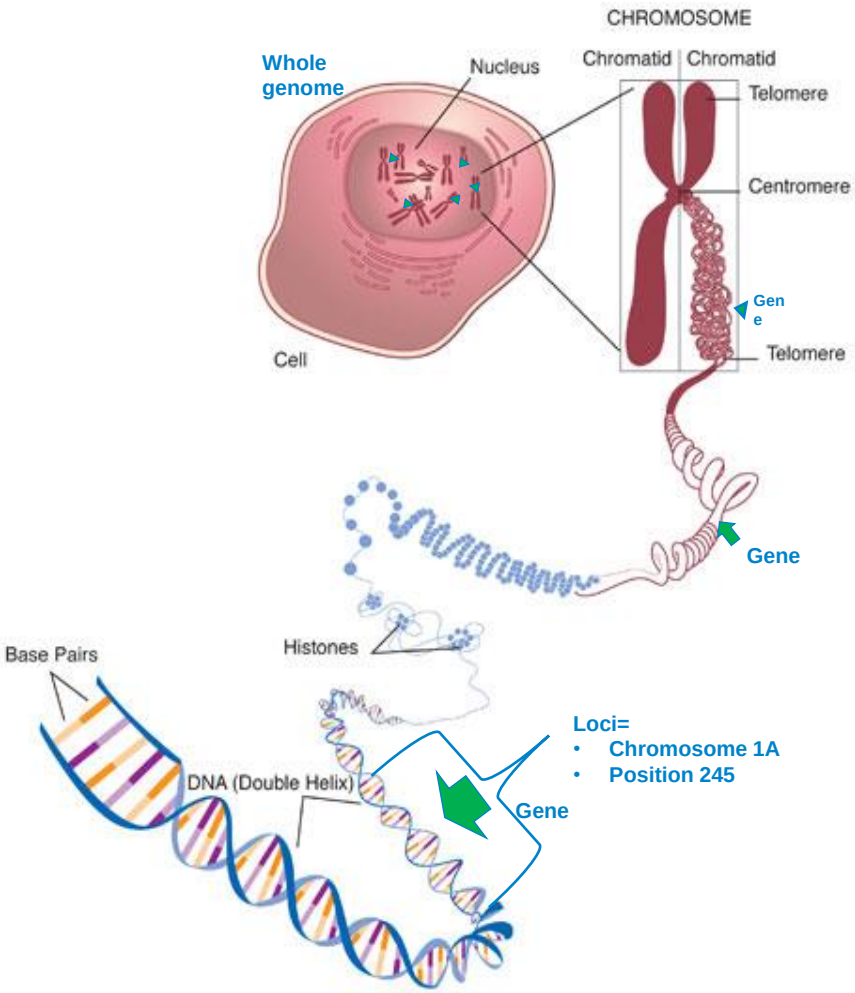
Resistance through adaptation (*Zymoseptoria tritici*)

- Septoria is dispersed through water droplets. Rain splashes move Septoria up the plant.

- Taller lines show less disease symptoms.
  - Speed of movement in the spring
  - Proximity of early leaf layers

- Leaf morphology is also indicated in disease avoidance
  - Smaller leaves
  - Lower stomatal density
  - Altered stem to leaf angle

Why is genetic Resistance complicated

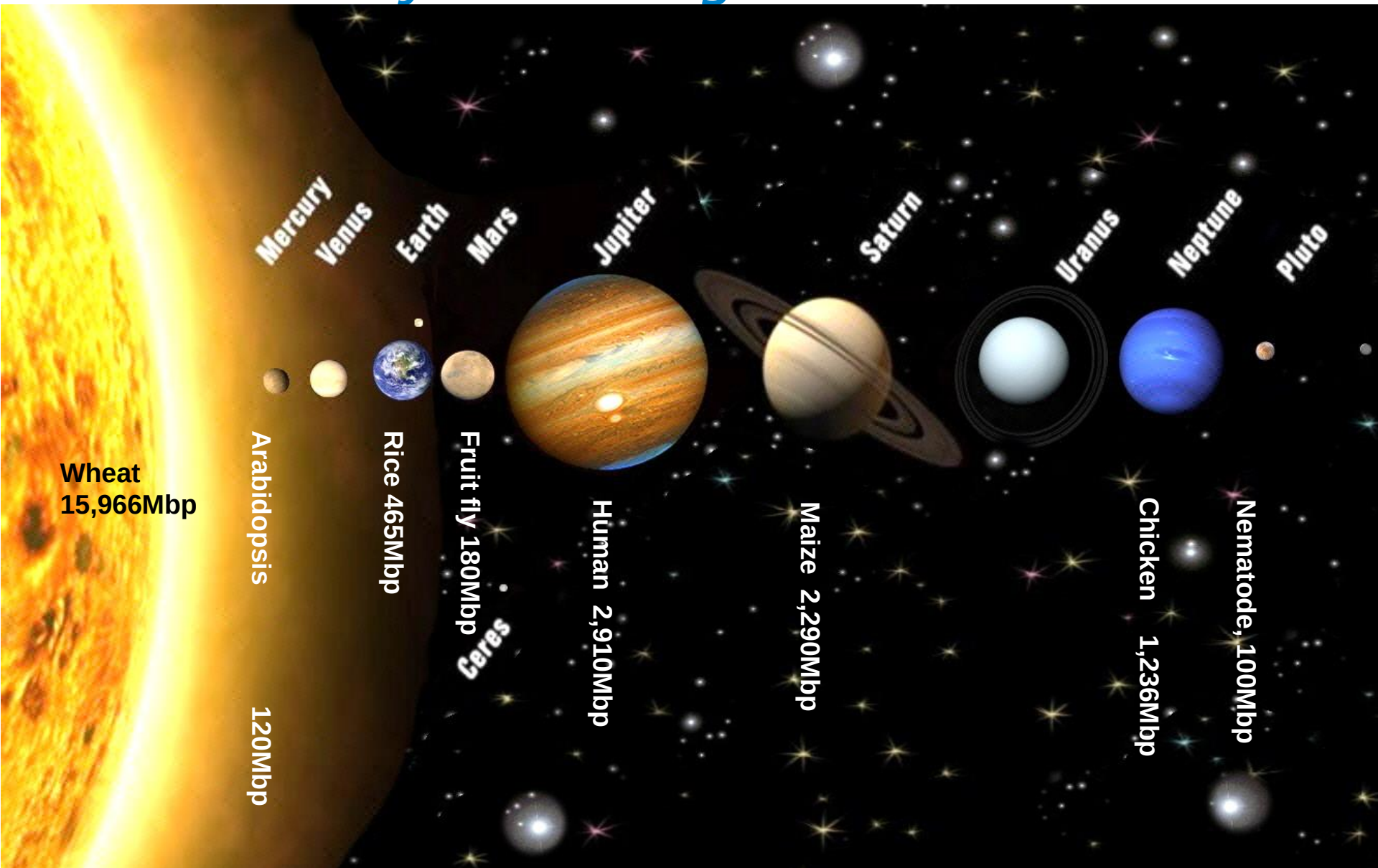


- Genes are situated on specific locations in the genome – **loci**.

- **Single gene Traits (Major gene)** are traits that often show big phenotypic effects
- e.g. yellow rust genes, OWBM, RLM 7
  - Controlled by one gene at a single loci
  - Simpler to breed for, clear phenotypical differences

- **Quantitative Traits (Minor gene)** are traits that show small effects singularly if found, strength is in the sum of parts
- e.g. Yield, Septoria
  - Controlled by many genes at different loci
  - Difficult to breed for, needles in haystacks

The difficulty in working with wheat



Genetic disease Resistance (*Zymoseptoria tritici*)

- 20 major resistance genes have been mapped
- Many genes have been identified over the years conferring isolate specific resistance

- Major genes can be risky
  - They work very well providing strong resistance
  - Often breakdown after ‘short’ period of time with potentially severe consequences.

- Partial resistances have much smaller effects but are additive.
- Most RL varieties are relying on partial resistance.
- One study identified over 50 genes involved directly in either resistance or susceptibility.
- Adult and Juvenile resistance genes

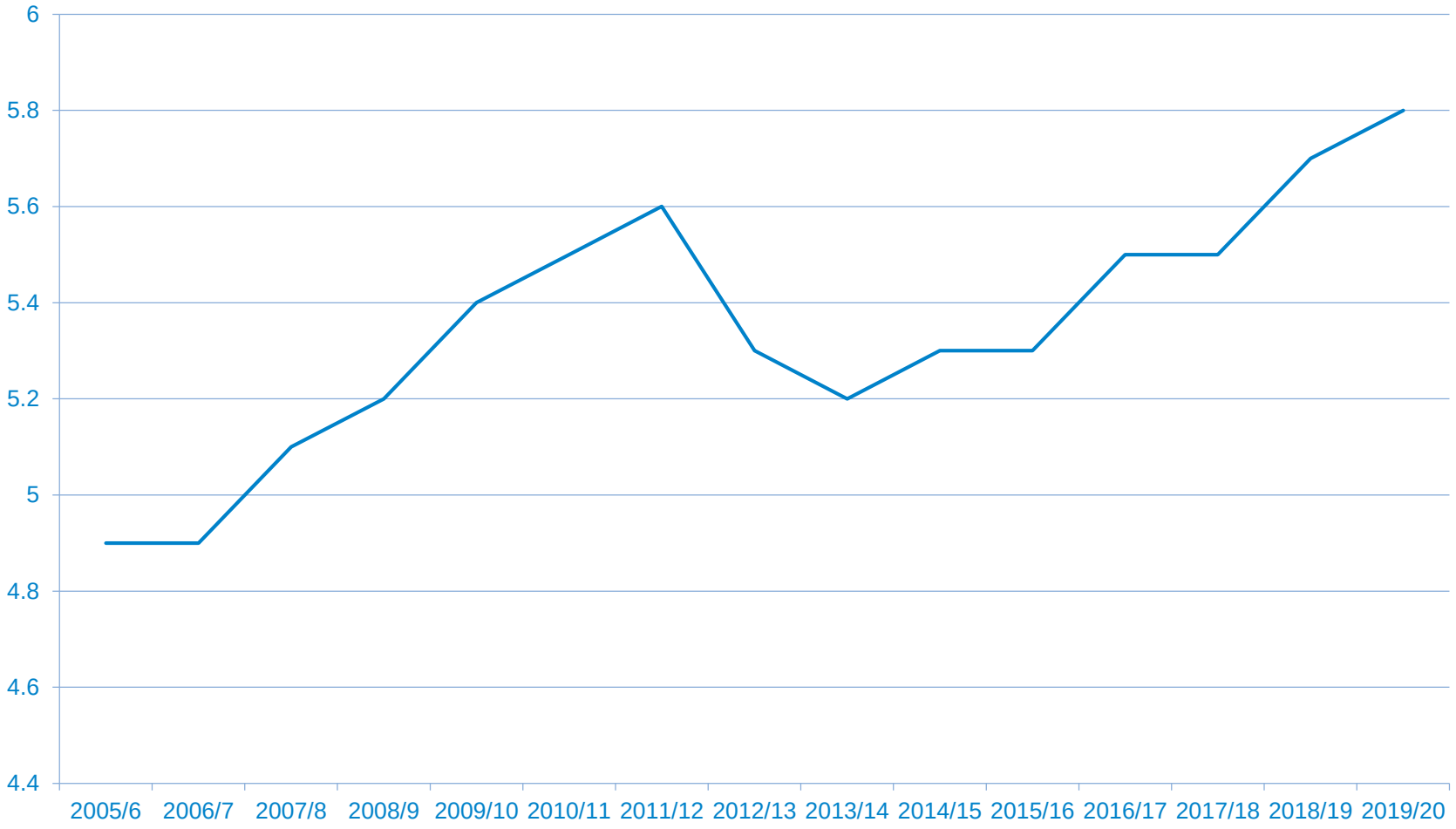
Current status

- Currently overall ratings for Septoria are as high as they have been in the last 15 years
- Much more of a focus area for breeding community

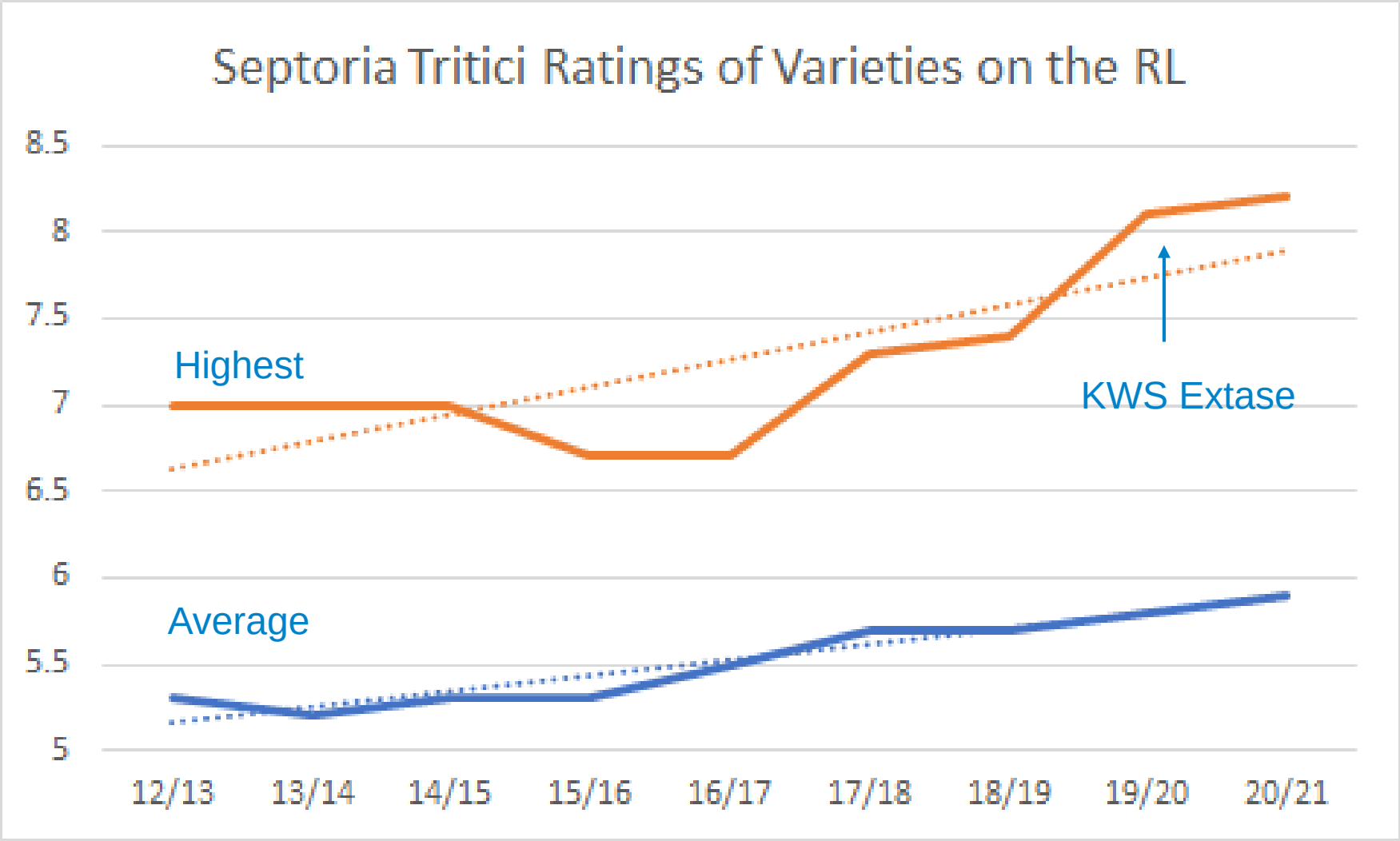
- Major gene resistances are present in current RL varieties but history shows these major genes can breakdown
- Protecting and utilising current genetic resistances is of extreme importance

- Adequate fungicide control can assist with longevity of effectiveness
- In most cases major genes are identified after field resistance breakdown has started

Recommended list average Septoria score



The Highest resistances available



RL response to fungicides

Variety	Untreated (T/Ha)	Treated (T/Ha)	*Septoria tritici score*	Yield difference (T/Ha)
Theodore	10.1	11.2	8.2	1.1
KWS Extase	10.6	11.3	8.1	0.7
LG Sundance	9.5	11.2	7.9	1.7
KWS Firefly	9.4	11.4	7	2.0
RGT Saki	9.6	11.6	6.8	2.0
Graham	9.9	11.4	6.8	1.6
KWS Siskin	9.3	11.3	6.6	2.0
SY Insitor	9.2	11.8	6.6	2.6
KWS Zyatt	9.3	11.1	6.4	1.8
Gleam	9.4	11.5	6.3	2.1
Crusoe	8.0	10.8	6.2	2.8
Costello	9.1	11.1	6.1	2.0
KWS Crispin	9.3	11.3	5.9	2.0
Skyfall	8.7	10.9	5.8	2.1
KWS Parkin	9.1	11.4	5.5	2.4
LG Skyscrapper	9.3	11.8	5	2.5
KWS Barrel	8.1	11.2	4.3	3.1

Combining agronomy, variety and chemistry to maintain control of septoria tritici in wheat

Start date:01/08/2015, End date: 31/03/2019

Factors being investigated:

- Varieties: 3 with different Septoria susceptability

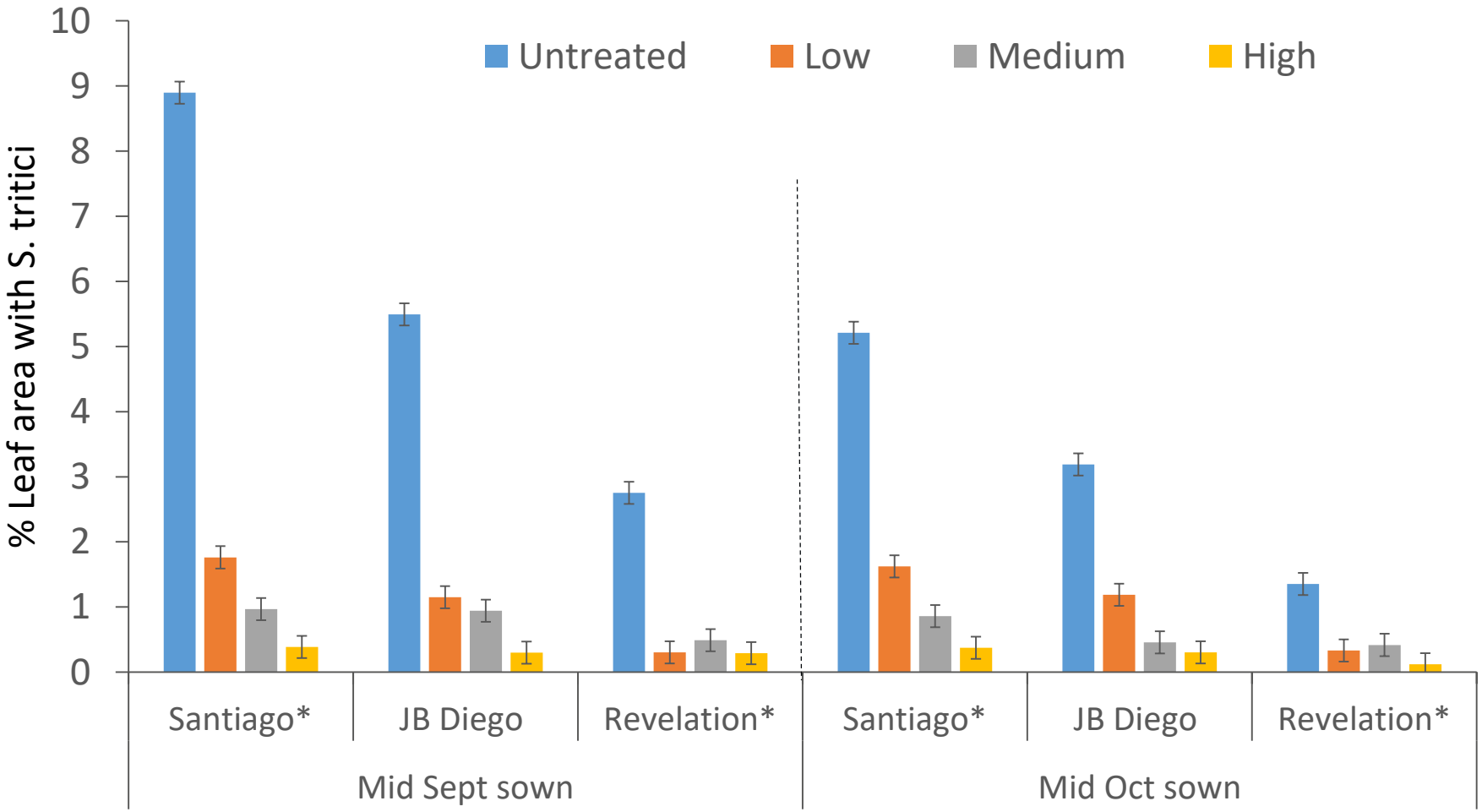
- Two sowing dates and seed rates targeting:
- 80 or 160 plants/m^2 (mid Sept)
- 160 or 240 plants/m^2 (mid Oct sown)

- Four fungicide treatments:

Treatment	T1 – GS32	T2 – GS39
Nil	Untreated	Untreated
Low	CTL 1.0	CTL 1.0
Medium	Brutus 1.5 + CTL 1.0	Brutus 2.25 + CTL 1.5
High	Brutus 1.5 + CTL 1.0 + Imtrex 1.0	Brutus 2.25 + CTL 1.5 + Imtrex 1.5

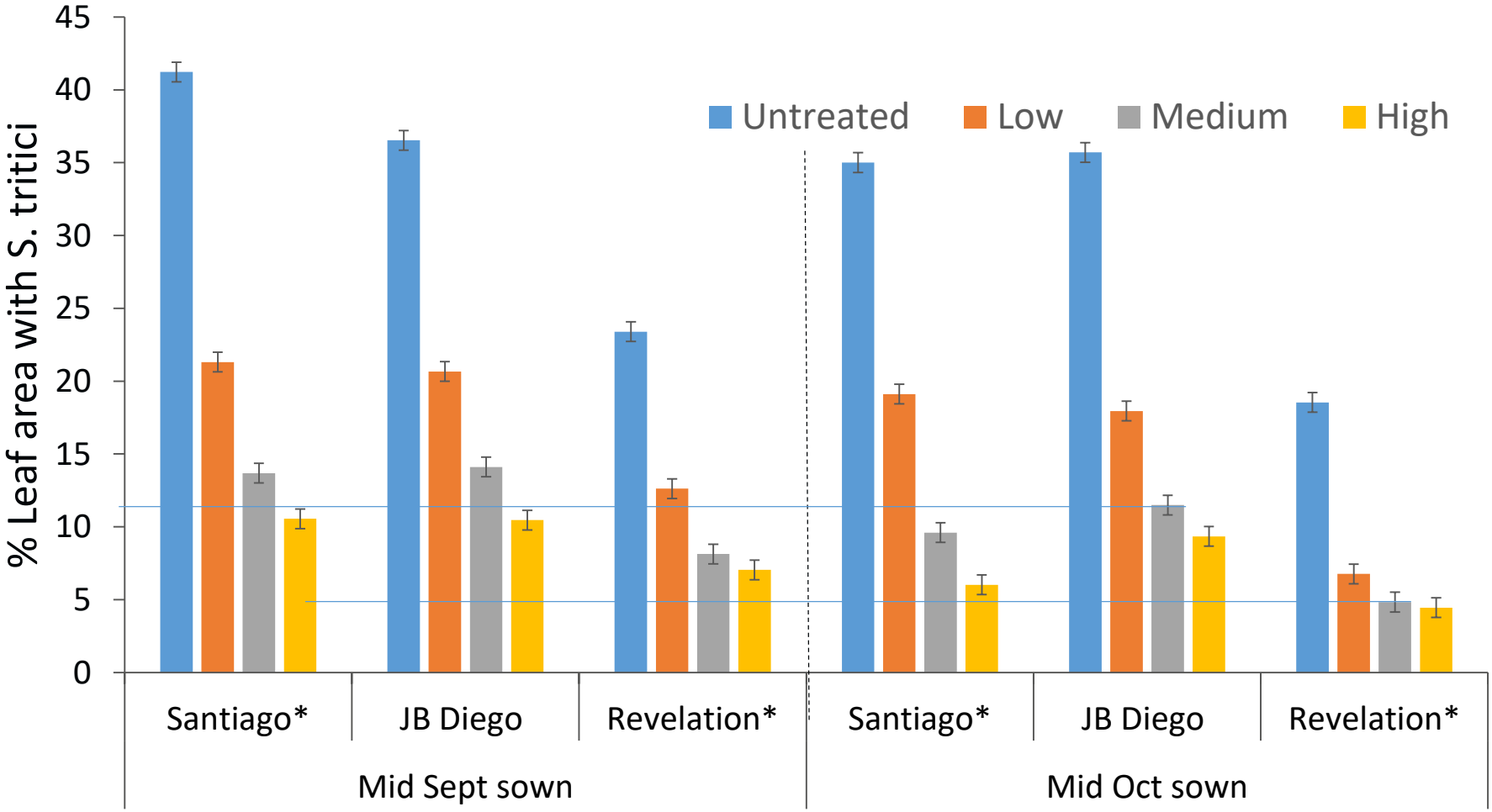
Brutus = epoxiconazole + metconazole Imtrex = fluxapyroxad CTL = chlorothalonil
Low, Medium and High input strategies also received T0 – CTL 1.0, and T3 – Folicur
Additionally to control rusts, strobilurins were applied across all plots when rust was detected

Sowing date, Variety and fungicide impact on Septoria 3-4 weeks post T2 (Mid June)



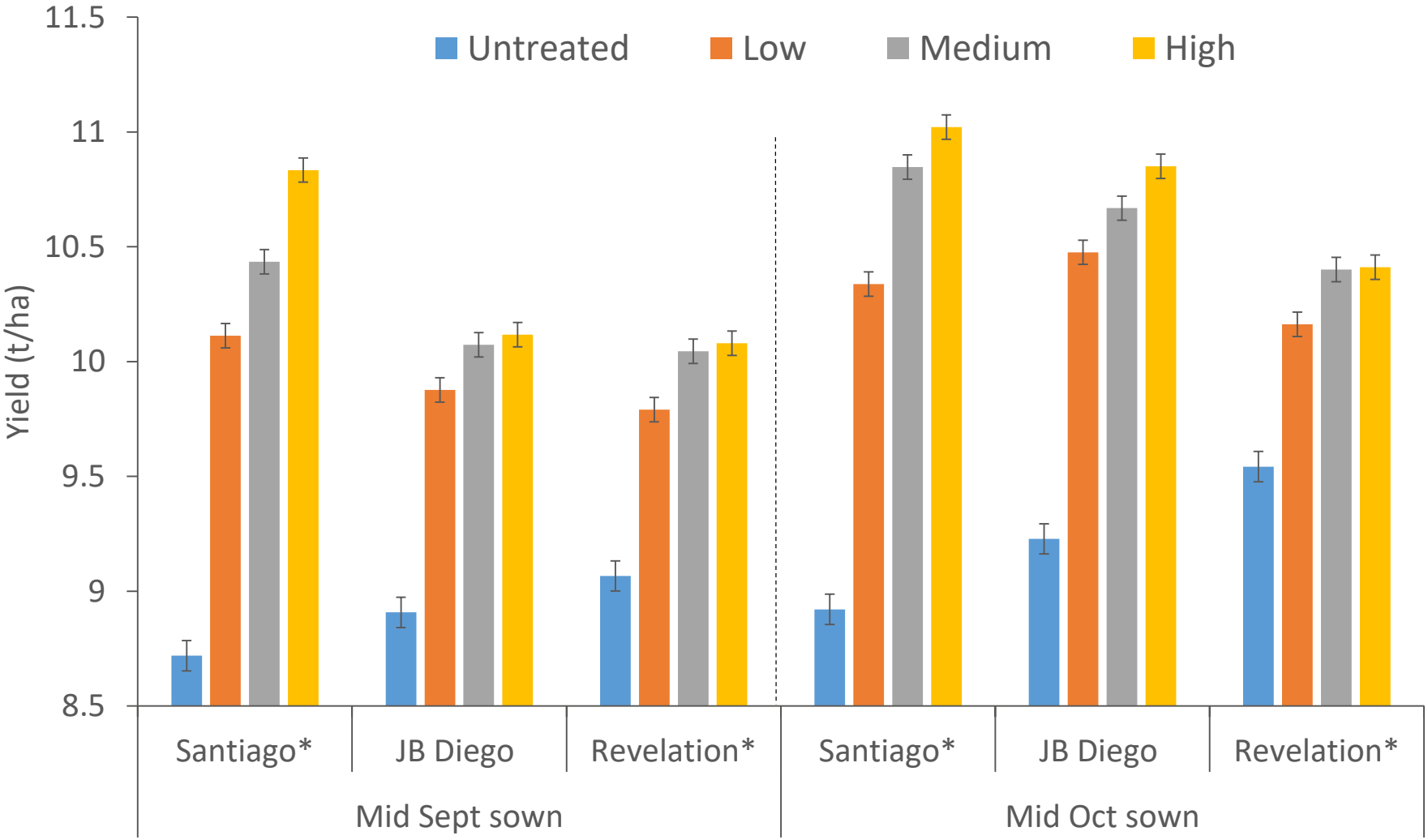
Mean levels of Septoria on leaf 2 at T2 + 3-4 weeks2016 and 2017 total of 10 sites)

Sow date, Variety and fungicides impact on Septoria 6-8 weeks post T2 (Early July)



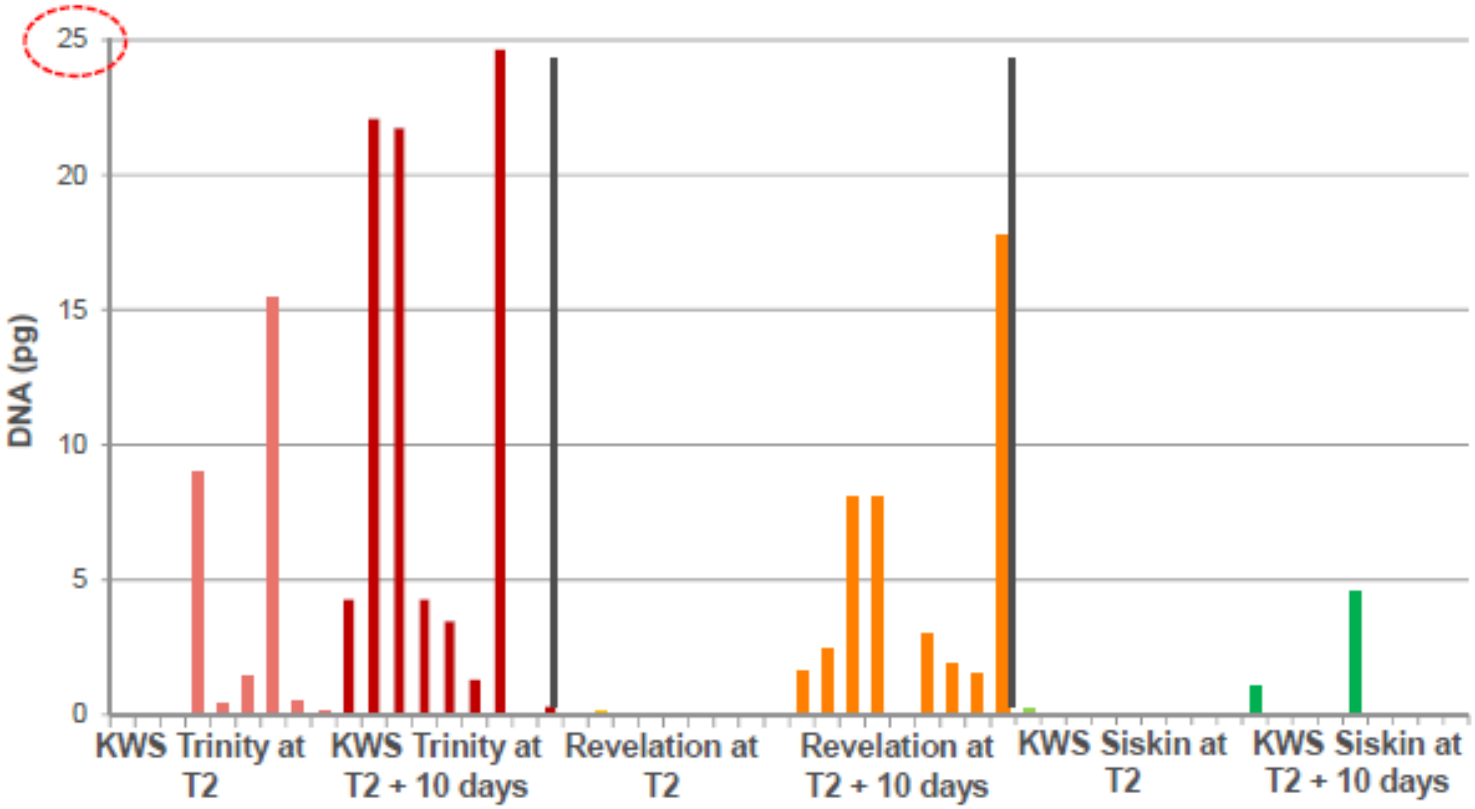
Mean levels of Septoria on leaf 2 at T2 + 3-4 weeks 2016 and 2017 total of 10 sites)

Yield response t/ha by agronomic factor (9 sites) 2016 &2017



Progression of Septoria in 2017

…How much time does varietal resistance buy you

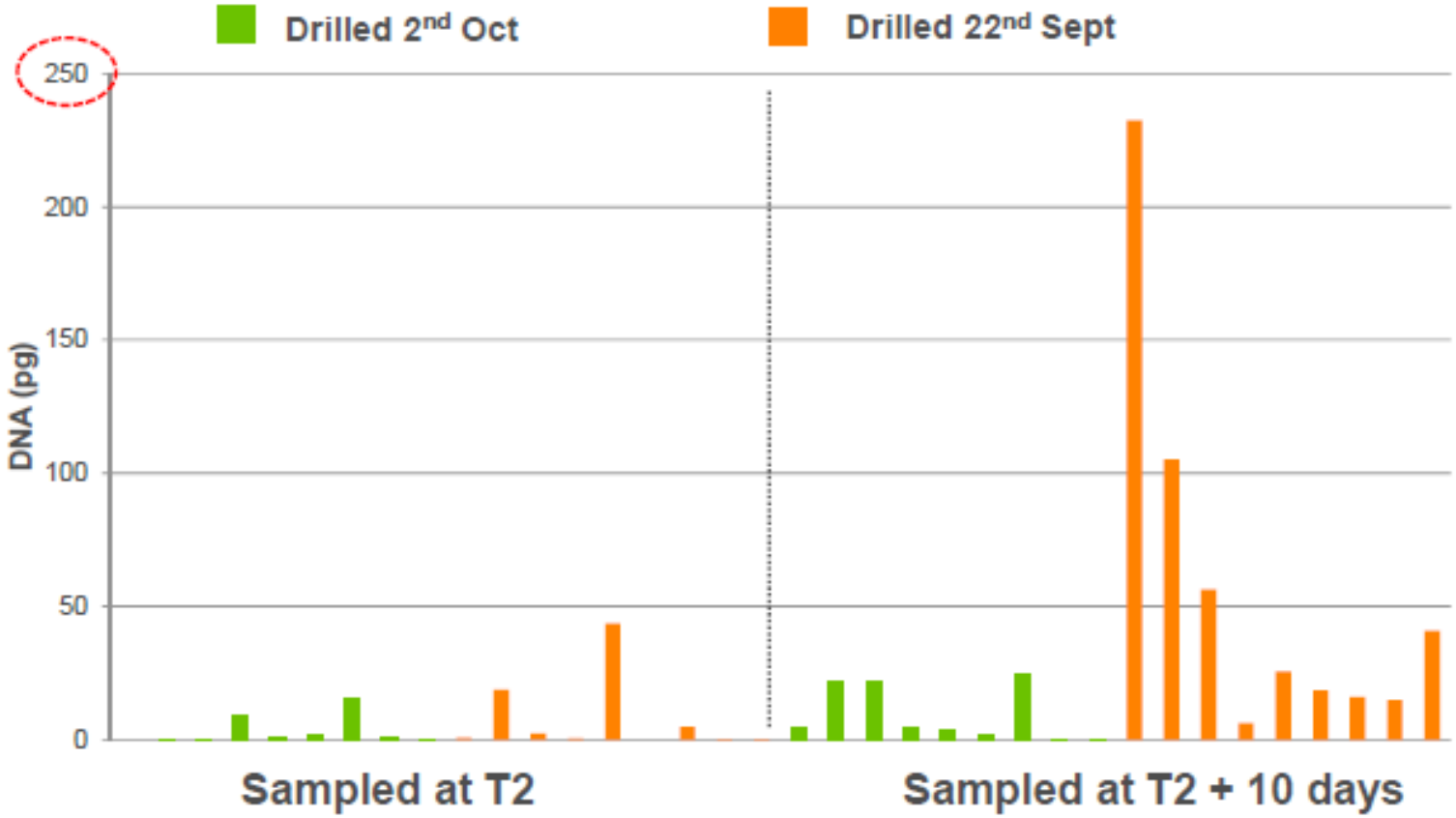


Callow. Leaf 2 sampled from untreated plots immediately prior to T2 application and 10 days later

Wheat

Impact of drilling date and the latent period on disease pressure in 2017

KWS Trinitiy Septoria rating 5.3



Callow. Leaf 2 sampled from untreated plots immediately prior to T2 application and 10 days later

Wheat

2021 Septoria control and role of more resistant varieties

- More choice with exciting new levels of resistance (6-8)
- Varieties with resistance of 6 and above offer opportunities to save some fungicide costs especially in lower risk seasons and localities, later drillings.

- Help deliver effective disease control in high disease seasons when critical fungicide timings might be compromised
- Variety resistance will help fill the role of lost multisite chemistry
- Don’t forget rusts!

Barley Yellow Dwarf Virus

- Challenges
  - Aphid resistance
  - Loss/restriction of chemistry
  - Need to start sowing in September
- Solutions
  - Varieties
    - Tolerance
  - Delay drilling

Yd2 -BYDV tolerance

- Discovered in several Ethiopian spring barley accessions in 1950's.
- Been used for the past 50 years in many varieties

- True 'tolerance'. BYDV virus grows and multiplies in plant just as in a susceptible line.
- No (or very little) effect on plant growth and yield
- Any yield penalty is disappearing with new material

Amistar- early sown natural infection trials, Thriplow 2018

2018	+ Insecticide	- Insecticide	% yield secured
ORWELL REDIGO DETER	11.6	10.6	91.6
FUNKY REDIGO DETER	11.3	10.6	93.6
AMISTAR REDIGO DETER	11.3	10.9	96.6
ORWELL SINGLE PURPOSE RAXIL	11.5	9.6	83.8
FUNKY SINGLE PURPOSE RAXIL	11.1	9.9	89.2
AMISTAR SINGLE PURPOSE RAXIL	11.1	10.6	95.6

- Very little visible infection, located next to breeding nursery
- Large amounts of BYDV nearby in breeding material

Amistar- early sown natural infection trials, Thriplow 2019

2019	+ Insecticide	- Insecticide	% yield secured
Orwell (Redigo Deter)	10.2	10.2	99.2
Orwell (SPD)	10.4	10.1	97.4
Amistar (SPD)	10.7	10.6	99.1

- No visible infection
- BYDV present in nearby in breeding material

- In three years of naturally infected field trials with low infection levels
  - KWS Orwell has lost on average 9% yield without Insecticide protection.
  - Amistar has lost 3% yield.
  - Tolerance offers protection for 6% of yield

Gross margins

Gross Margin Analysis -			
	Amistar	Orwell	Orwell
Price (£/t)	£135	£135	£135
Yield (% controls)	98	100	100
ave controls (t/ha)	10	10	10
	9.80	10.00	10.00
Total Output / ha	£1,323.00	£1,350.00	£1,350.00
Variable costs	1 x spray	2 x spray	3 x spray
Seed SPD	112	87	87
Sprays Insecticides	13	26	39
Total Variable Costs	584	572	585
Gross Margin / Ha	**£739.00**	**£778.00**	**£765.00**
Margin over input	£1.27	£1.36	£1.31

How do we use BYDV Tolerance

Aphids control will be required in :

- High risk sites and seasons
- Aphid numbers are likely to create significant 2nd generation wingless offspring
- Over wintered aphid numbers are likely to create a significant generation of winged aphids.

BYDV Tolerance offers an option to reduce insecticidal inputs in some situations

BYDV Tolerance is a risk reduction tool for aphid prone areas such as headlands beside margins or areas of application difficulties such as water courses

BYDV Tolerance offers growers the opportunity to drill earlier or continue with traditional September sown by mitigating risk


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

Agronomy 2020 – East Midlands

Policy update – preparing for change

Sarah Baker

Strategic Insight Manager

Agriculture policy in England

- Public money for public goods
- Phasing out of direct payments 2021-2027

First £30,000	5%
£30,000 - £50,000	10%
£50,000 - £150,000	20%
£150, 000 and above	25%

- Year 1 reductions:

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028 onwards
Business as usual		**Agricultural Transition Period** -Reduction in direct payments -Testing new public good schemes							No direct payments
		Agri-environment Countryside Stewardship High Level Stewardship Piloting of new Environmental Land Management system				Environmental Land Management Contracts			

A multi-annual budget

Spending plans for England will be issued by the Secretary of State and must cover a minimum of 5 years, giving farmers more **certainty** and **stability**.

- The initial plan will cover the 7 year transition period, starting in 2021.
- Funding allocation for devolved regions is still to be decided.

New financial assistance powers

The bill gives Government the power to provide financial assistance for specific purposes.

The overriding principle is that **public money** will only be awarded for **public goods.**

Additions to the list of purposes

- Conserving agricultural animals and plants, and their genetic resources.
- Protecting/improving soil quality
- Farm processing, packaging and marketing of agricultural goods.

Food production is now mentioned.

The secretary of state must "have regard to the need to encourage the production of

Regular reporting on food security

Defra must report to parliament on UK food security at least every five years. This will include analysis of:

- Global food availability
- Sources of food
- Supply chain resilience
- Household expenditure
- Food safety

Changes to farm tenancies

Tenancy agreements covered by the Agricultural Holdings Act 1986 typically contain restrictions on making changes to land or buildings which may prevent tenants from taking part in the new ELMS.

The Agriculture Bill now grants tenants the **right to object** to such **restrictive clauses**, with disputes resolved through arbitration or third-party determination.

In succession:

- The commercial unit test is removed
- The suitability test is amended
- The age at which a tenant may serve a retirement notice is removed.

In rent reviews:

Additional powers

- Enhanced regulation of the fertiliser industry.
- A new Livestock Information Service to collect livestock identification, movements and health data.
- Power to amend and make new regulations on organic produce.

Our latest report

- Examine the characteristics of a top performing farm
- Set out ways in which farmers/growers can achieve top performance
- In collaboration with Andersons

The eight key factors

- Minimising overheads
- Set goals & budgets
- Focus on details
- Mindset for change & innovation
- Compare yourself with others & gather information
- Understand the market
- Continually improve people management
- Specialise

Results by sector

Cereals

Mean of top performers	Mean of matched bottom performers	Difference
£157,500	£58,900	£98,600

Selected variables	Mean of top performers	Mean of matched bottom performers
Agricultural output (£'000)	365.4	268.2
Wheat yield (t/ha)	8.6	7.6
Cereals as a % of total SLR	83.0%	72.7%
AES payments per ha	24.4	42.2
Owned land as % of total land	80.8%	59.5%
Unpaid labour as % of all labour	67.9%	55.2%
Total agricultural costs (£'000)	298.5	350.5

General cropping

Mean of top performers	Mean of matched bottom performers	Difference
£168,900	£66,800	£102,100

Selected variables	Mean of top performers	Mean of matched bottom performers
Farm assurance members	68%	92%
Total agricultural costs (£'000)	490.3	524.1

Summary of common traits from case studies

	Vegetables	Cereals	Beef	Dairy	Pig	Poor farm
Clear business objectives	✔	✔	✔	✔	✔	
Collaboration with other farms	✔			✔	✔	
Budgeting	✔	✔	✔	✔	✔	
Benchmarking	✔	✔	✔	✔	✔	
Innovative ideas	✔		✔	✔	✔	
Care for soils and environment		✔	✔	✔	✔	
Working with buyers			✔	✔	✔	
Outstanding staff management	✔	✔		✔		
Remarkable attention to detail	✔	✔		✔	✔	
Enjoy working on the farm business	✔	✔	✔	✔	✔	
Ruthless cost removal where possible	✔	✔	✔	✔		

Eight key factors - details

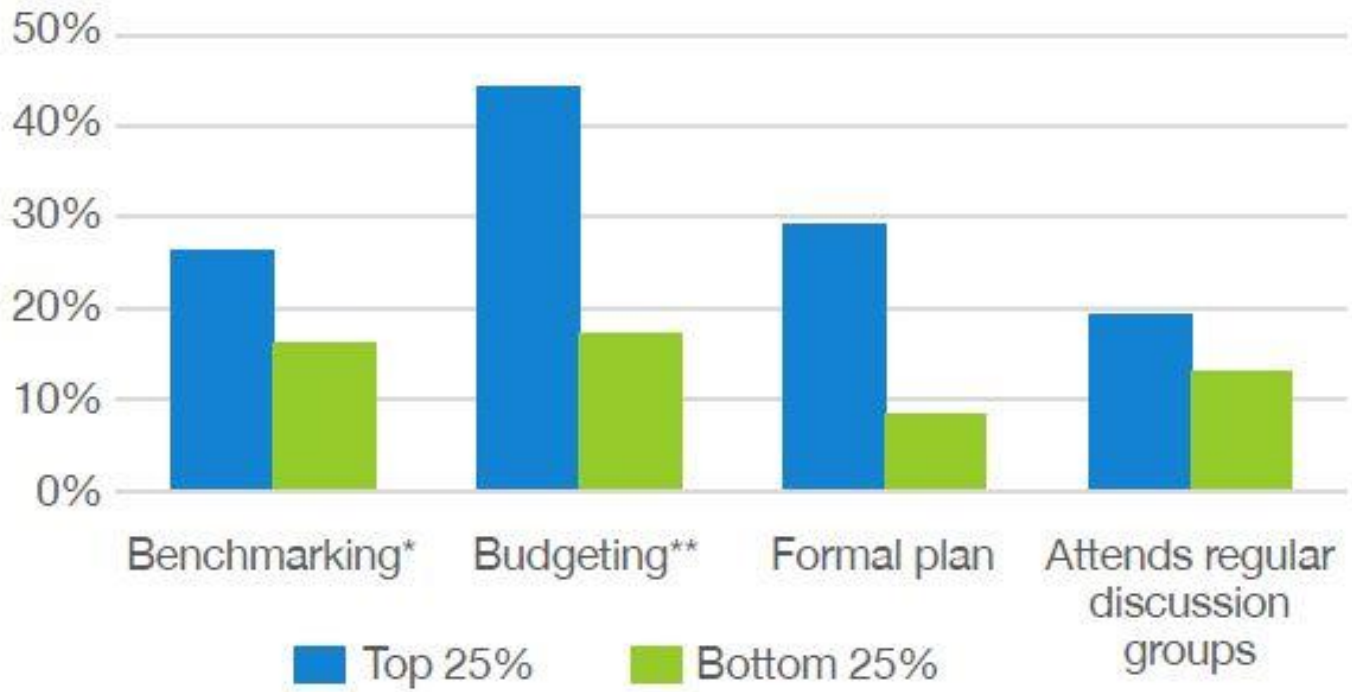
1. Minimise overhead costs

Farmer to farmer advice - top tips for success		
What key advice would you give?	**High performers**	**Improved performers**
Control costs	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓
Pay attention to detail/focus on key things	✓ ✓ ✓ ✓	✓ ✓ ✓
Be flexible/open to change/look for new opportunities/react to change fast	✓ ✓	✓ ✓
Look after cows and they will give you profit	✓	✓ ✓
Get the right people around you	✓	✓
Do not buy in livestock as it leaves you open to disease		✓
Develop a range of income streams		✓

"Higher output accounts for just ten to 30 per cent of higher profits in top-quartile farm businesses but lower costs contribute 65 to 90 per cent"

G. Redman, Andersons

2. Set goals & budget



Source Defra, data from 2016/17
*Benchmarking is either Enterprise level, Balance sheet, or international
**Budgeting is creating a predicted spend allowance, then monitoring gross margins including profit and loss.

3. Compare yourself with others and gather information

> We should not expect to achieve different results by doing the same thing
>
> **Albert Einstein**

FARMBENCH

ahdb.org.uk/farmbench

4. Understand the market

Steps for success
Talk to your main customer and ask them what you could do to make your output even more desirable than others. Then do it
Check you have the right breeds or crop varieties for your customers' requirements and your farm system
Make sure your are producing the right constituents in milk for the markets it is being used in
Know the cost of crops dropping into livestock feed category

5. Focus on detail

6. Have a mindset for change and innovation

Steps for success
Identify how livestock health can be improved further through considering changes to their housing and handling areas
Identify your local monitor farm and attend meetings, discussions groups and farm walks
Attend local small business (non-farming) discussion groups and seek new ideas and collaborations
Listen to others more than you talk to them. Come home with ideas and try them out
Enjoy what you do

7. Continually improve people management

Steps for success
Calculate your staff turnover. What should it be? How can you address that?
Thank your staff at the end of each day's work
Spend time with staff exploring work processes. Make them more
Listen to others more than you talk to them. Come home with ideas and try them out
Enjoy what you do

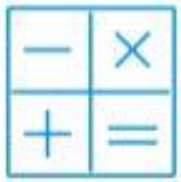
8. Specialise

Working on the things you do well

Working with others on things they do well

Sharing knowledge and ideas

Brexit tools



Brexit Impact Calculator

Resilience checklist

Brexit toolkit

Honing your skills

Consumer insight


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

AHDB Introduction

Amber Barton

Knowledge Exchange Manager (Potatoes)

Wireworm biology & management - without insecticides

Dr Bill Parker

Head of Technical Programmes

AHDB

There is NO silver bullet….

- In the absence of insecticides:
  - **Avoidance** is by far the best method of control
- To do this you need to:
  - Understand the biology – larvae & adults
  - Think ahead
  - Use a range of risk assessment methods
  - Look at the landscape
- The equipment needed is not expensive:
  - Time commitment & attention to detail is vital

What you need to consider….

- Biology
  - Species & recognition in the field
  - Life cycle
- Risk Assessment
  - Field history & characteristics
  - Soil sampling
  - Pheromone trapping
  - Bait trapping
  - In-crop checks
- Control
  - Variety choice & lifting date
  - Chemical control - history
  - Biocontrols

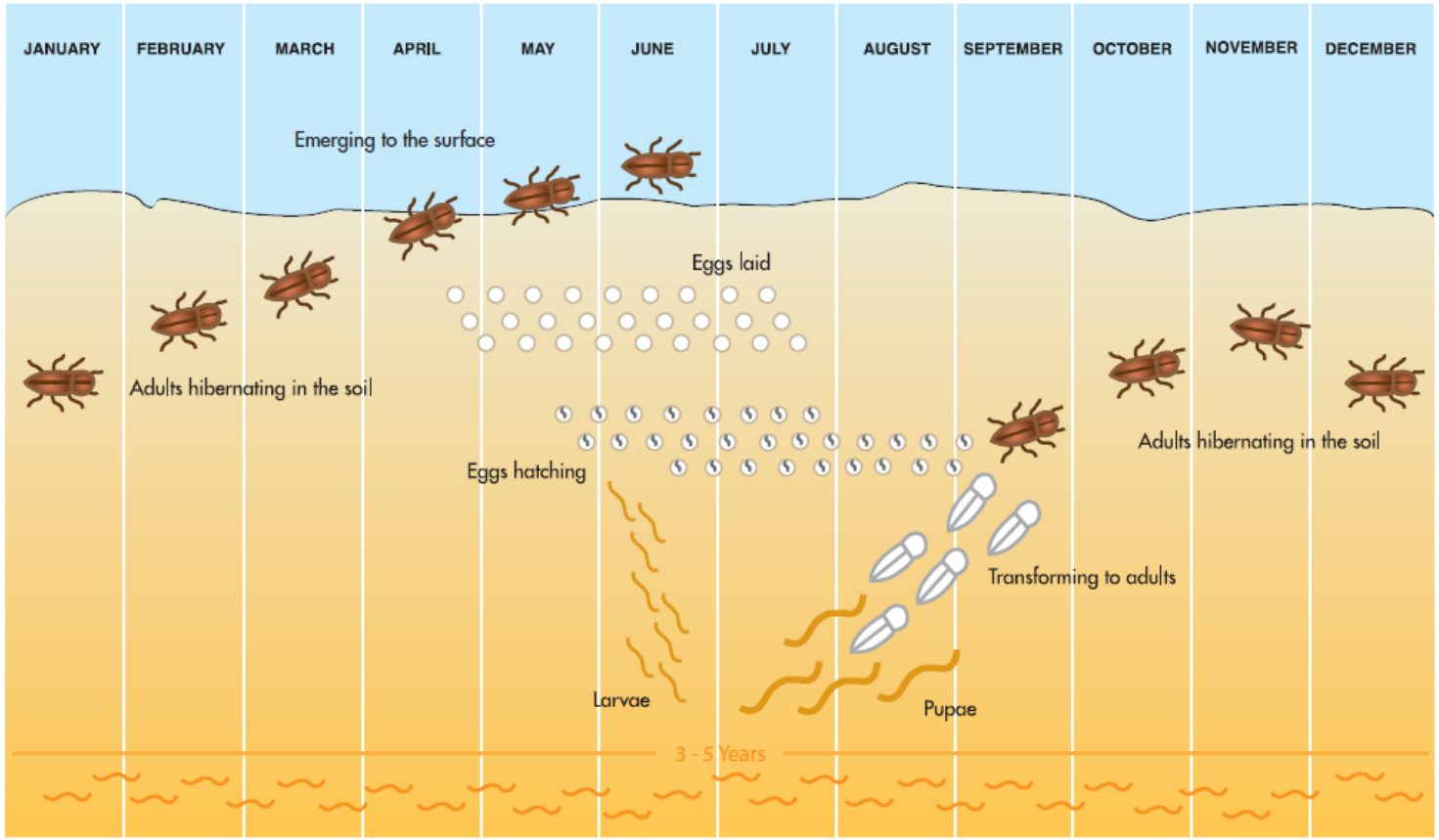
AHDB POTATOES

Biology

What are wireworms?

- Larvae of click beetles
- Primarily a grassland insect
- Long-life cycles (4 years)
- Ubiquitous across the UK, but can be localised ‘hot-spots’

Typical Wireworm Life cycle



Duration species dependent but normally 4 years in the UK

AHDB POTATOES

Click beetle species in the UK

- Dominated by three *Agriotes* species
  - Beetles easy to ID
  - Larvae difficult
- Often occur in mixed populations in the same field
  - One species usually dominates (UK geography)
  - Population age structure usually varied
- Non-*Agriotes* species
  - Can safely ignore for practical purposes

Agriotes lineatus

Agriotes sputator

Agriotes obscurus

Recognising wireworm larvae

Agriotes species

Athous (and other) species

Pointed tails (& ‘pits’)

Fork tails

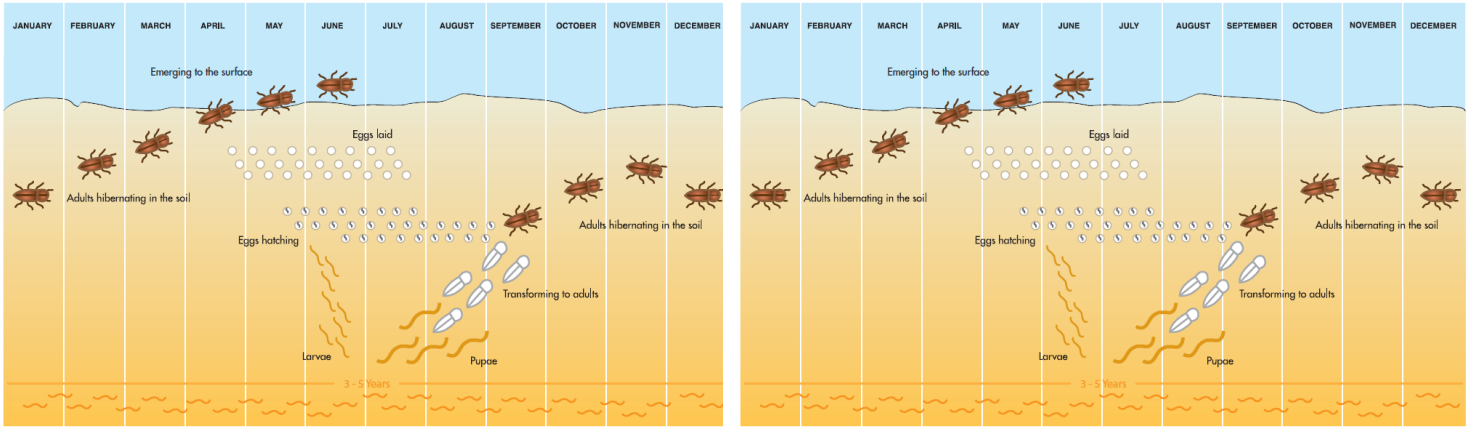
NB: they have the same front end!

Risk assessment

Risk assessment timeline

You need to be thinking 12-14 months ahead of planting

Risk assessment window | Potato crop



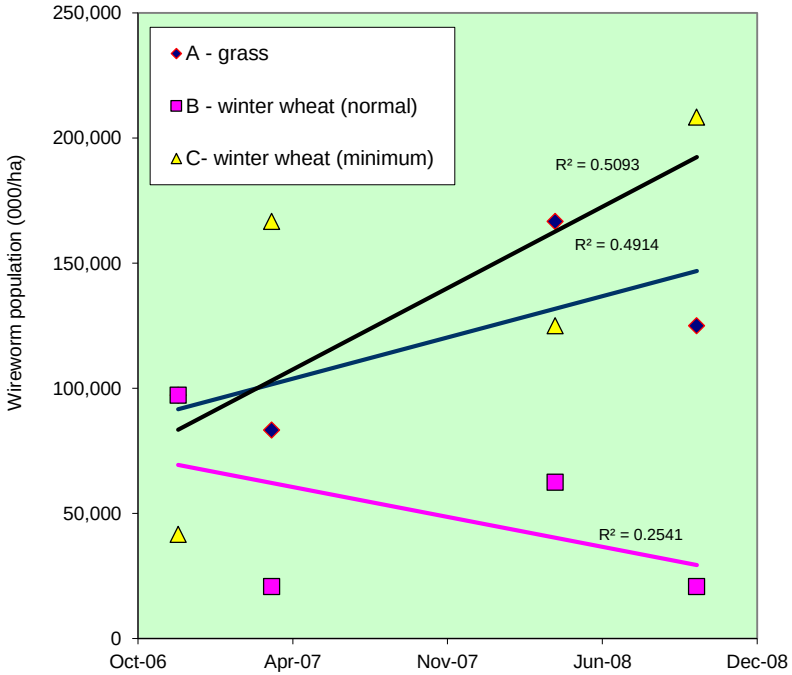
<<<<<<<<<<<<<<<< 24 month period >>>>>>>>>>>>>>

AHDB POTATOES

Field history & characteristics

- Field in grass for > 4 years or significant grass weed issue
  - Not all long-term grass fields are infested (*c*. 60-70%)
  - Rare for short-term leys to have high populations
  - ‘Arable’ wireworm?
- Minimal or no cultivation in recent years
  - Soil disturbance, particularly ploughing, reduces populations
- History of wireworms or wireworm damage in the locality
  - Could indicate a local hot-spot (e.g. meadows in river valleys)
- Other things you could consider
  - Organic matter content - above 5% = increased risk
  - The local landscape – a lot of grass in the vicinity?

Long-term field experiment (Cambs 2006 – 2009)



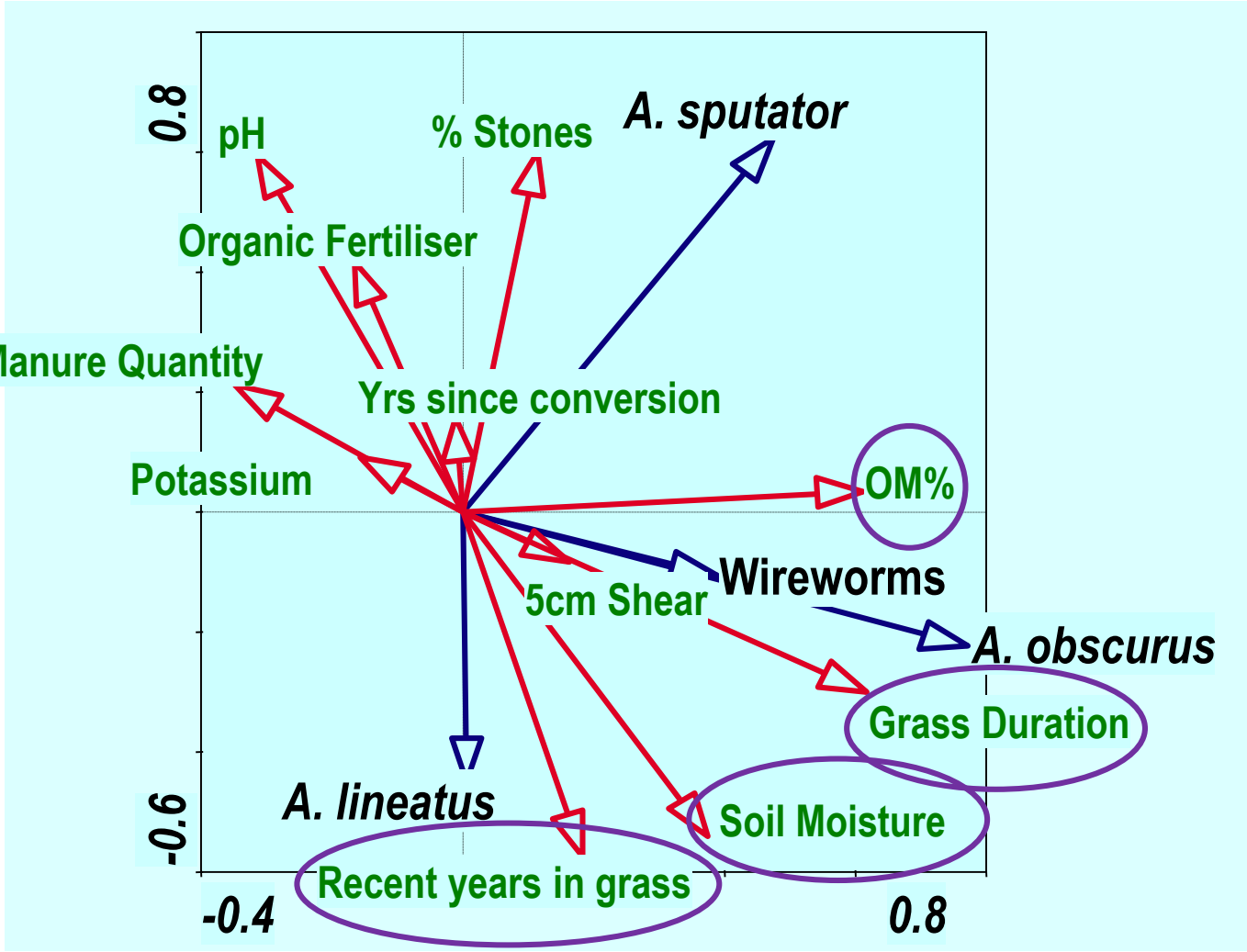
Populations tended to increase under grass & min-till wheat plots

Data source: SA-LINK Project LK 0982

AHDB POTATOES

Other field characteristics

(based on sites in Devon)



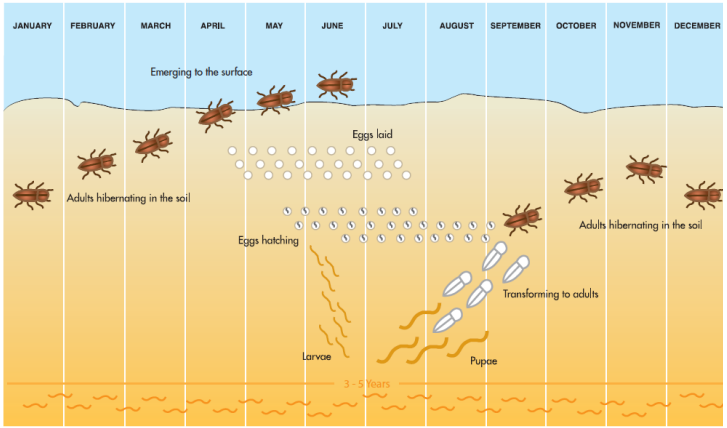
Data source: Helen Hicks, PhD Thesis, University of Plymouth, 2009

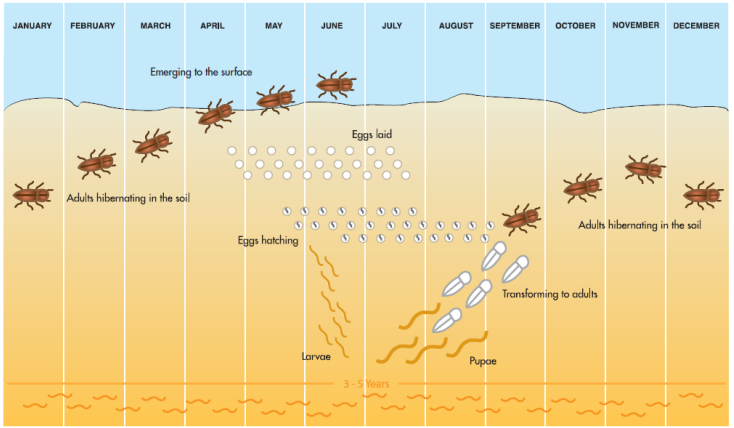
AHDB POTATOES

Risk assessment timeline

Risk assessment window

Potato crop





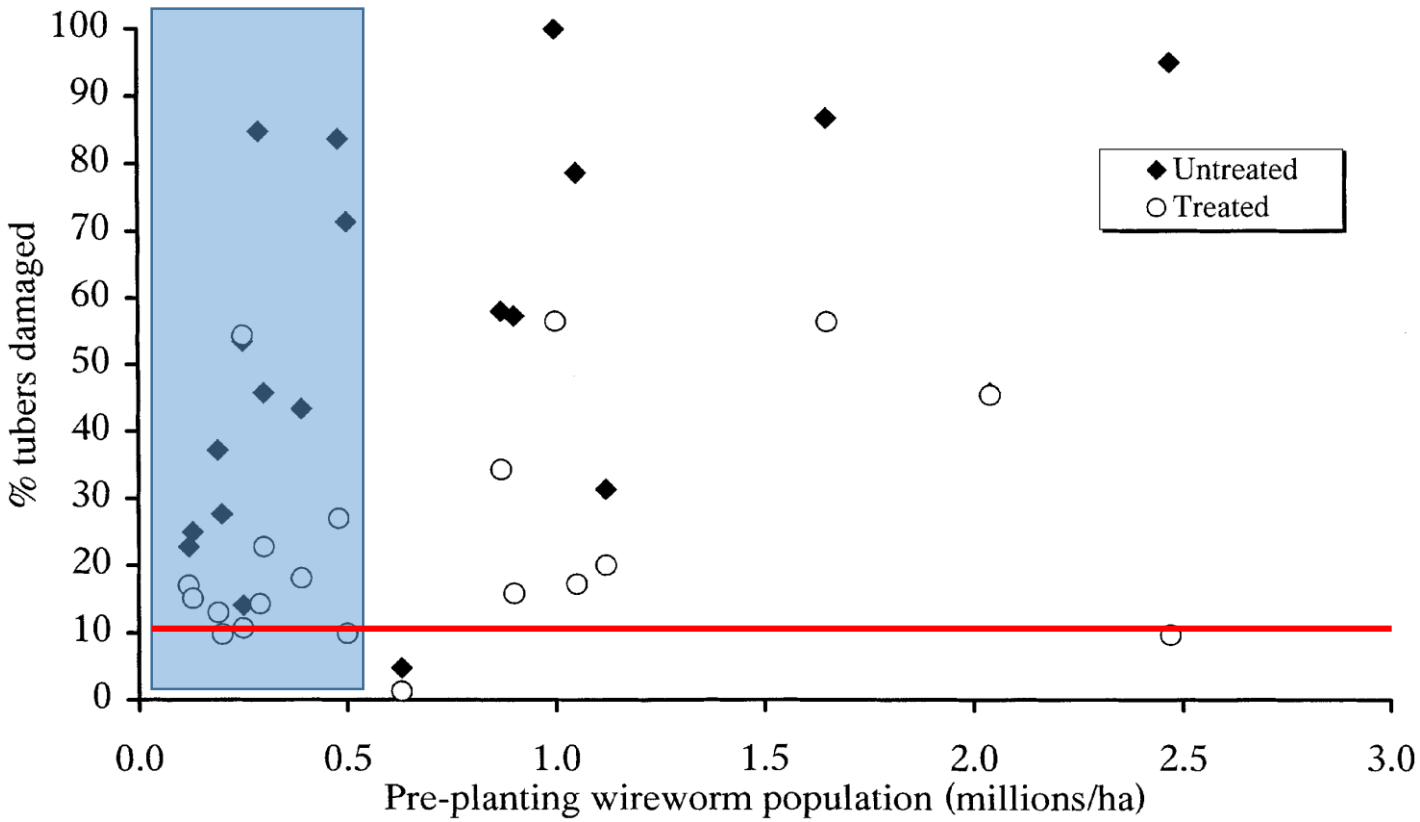
Site characteristics

AHDB POTATOES

Soil sampling – the traditional approach

- Developed in 1940s
  - OK for high populations
  - Very unreliable for low populations
- Can do this at any time…
  - Best to do early autumn or early spring
- There is a lot of soil out there!
  - Big sampling issue
  - Ideally needs lab processing
  - Just go out with a spade?
- A presence/absence test
  - Poor correlation between what you find and subsequent damage levels

Relationship between soil population assessment & damage



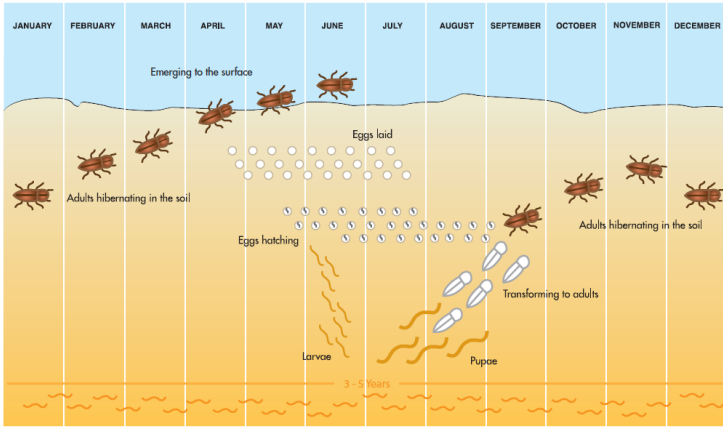
Data source: Parker & Howard, Agricultural and Forest Entomology (2001) 3, 85-98

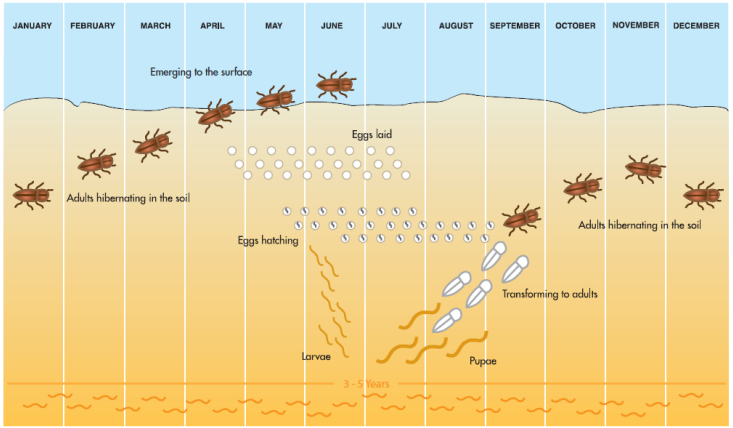
AHDB POTATOES

Risk assessment timeline

Risk assessment window

Potato crop





Site characteristics

Soil sampling

AHDB POTATOES

Pheromone trapping

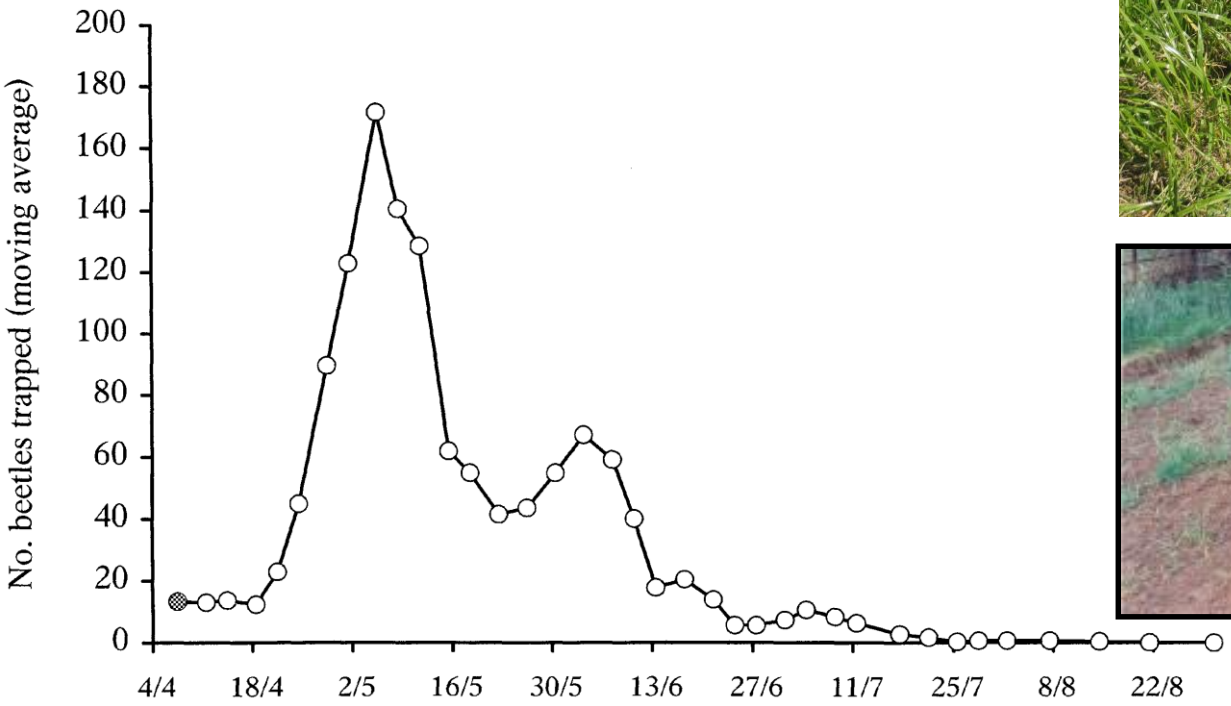
- Has some serious advantages
  - Much more sensitive than soil sampling – can detect low populations
  - Much easier to do - very little labour
  - Traps are commercially available
- **But** also needs care:
  - Remember traps catch adults
  - Need to trap for all 3 main species
  - Trap location & duration of trapping critical
  - Can only be used as an <u>EARLY WARNING TOOL</u>
  - Should be backed up by other methods

Traps available from: www.csalomontraps.com

AHDB POTATOES

Seasonal pheromone catch profile

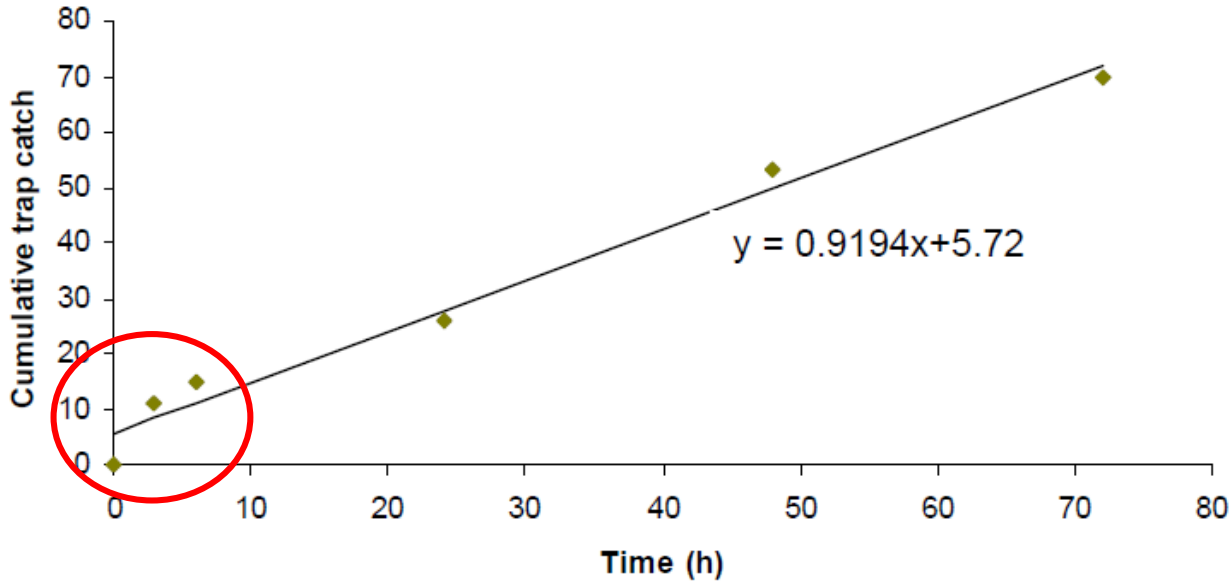
Llanafan (2000)

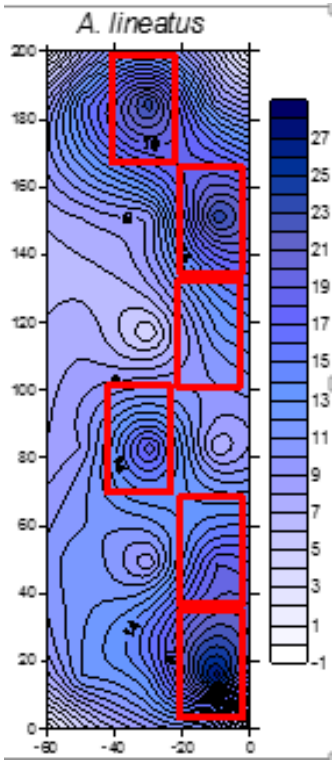


Season-long trapping is NOT the best way of doing it

Data source: Parker & Howard, Agricultural and Forest Entomology (2001) 3, 85-98

Traps catch beetles quickly…..



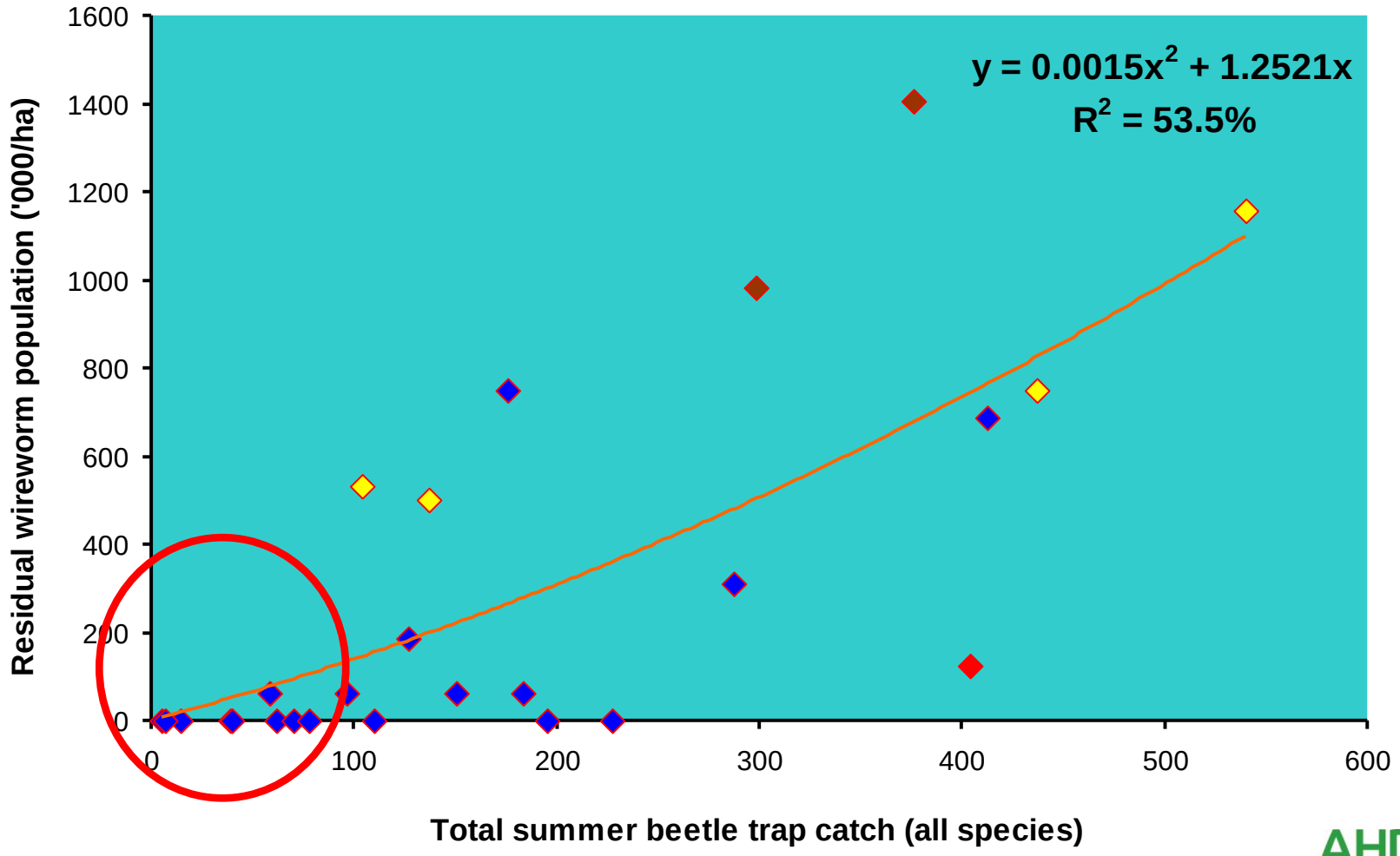


For various reasons – short trapping periods (3-4 days) are best

Data source: SA-LINK Project LK 0982

AHDB POTATOES

Relationship between pheromone trap catch and residual wireworm population (1999-2003)

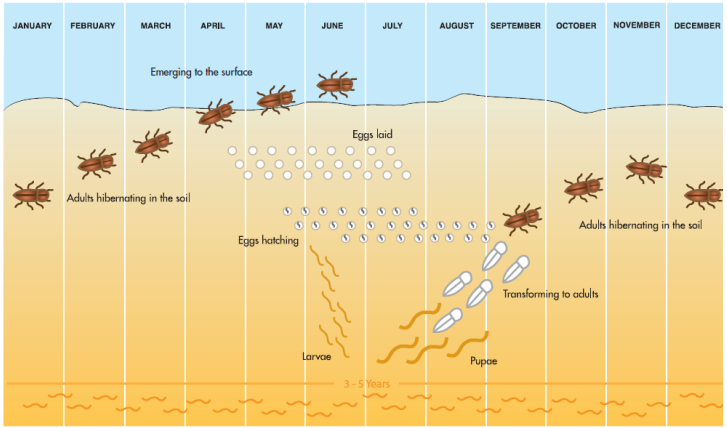


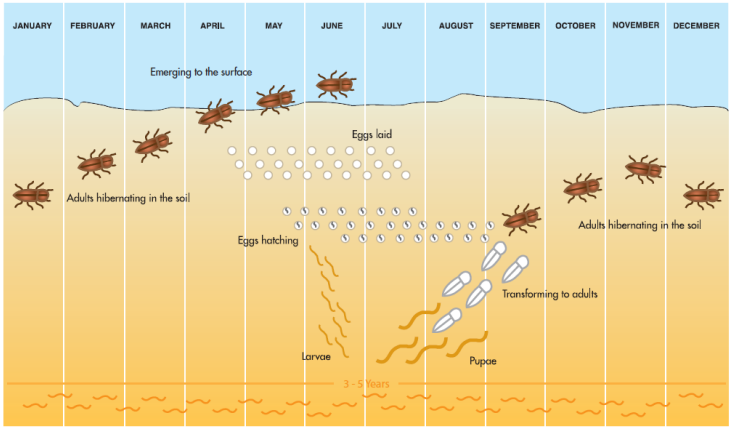
AHDB POTATOES

Risk assessment timeline

Risk assessment window

Potato crop





Site characteristics

Pheromones

Soil sampling

AHDB POTATOES

Bait trapping

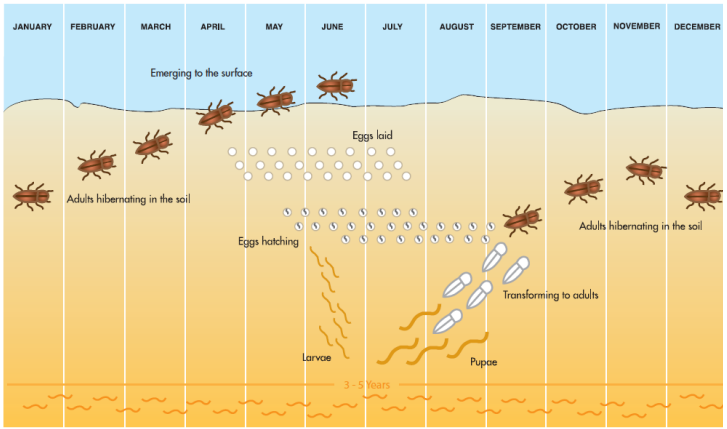
- An alternative to soil sampling
  - Wireworms are attracted to the CO_2 released by germinating grain
  - Various ways of doing it
  - Best done in early spring
  - Easy to make 'home-made' traps
- Points to watch
  - Soil temperatures should ideally be above 10°C
  - Count wireworms in traps & surrounding soil
  - Very localised result – presence/absence test only

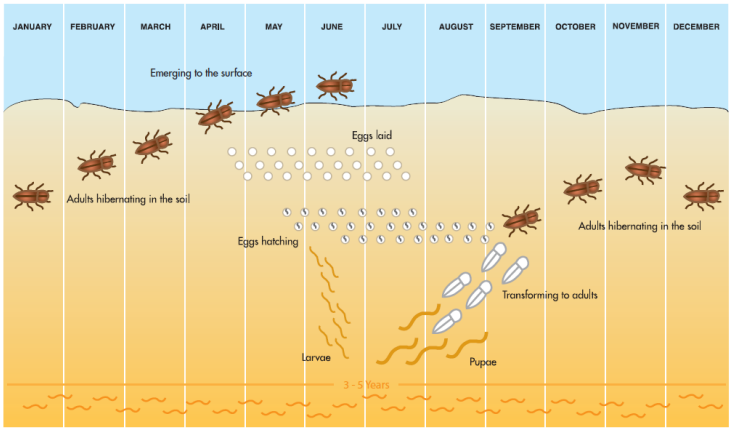
AHDB POTATOES

Complete risk assessment timeline

Risk assessment window

Potato crop





Site characteristics

In-crop checks

Pheromones

Soil sampling

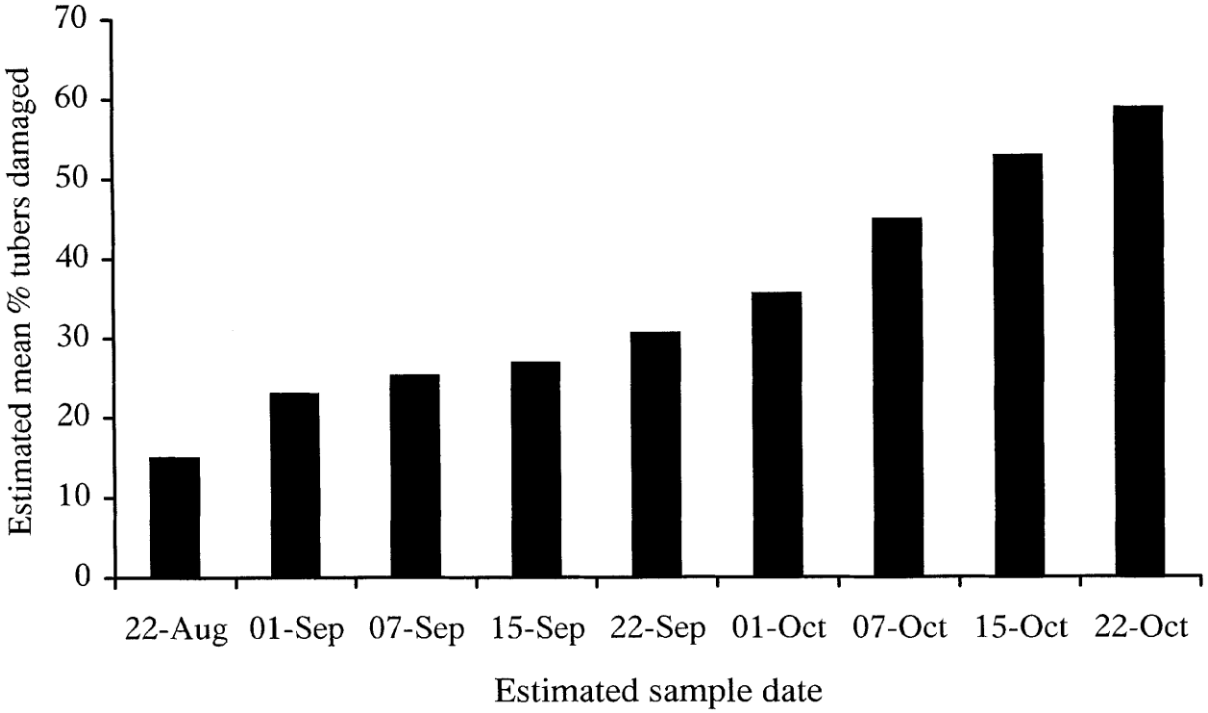
Baits

Use a range of methods to build up a risk picture

AHDB POTATOES

Control

Effect of harvest date on damage



…and variety choice?

Data source: Parker & Howard, Agricultural and Forest Entomology (2001) 3, 85-98

AHDB POTATOES

Chemical control – will not be an option for long

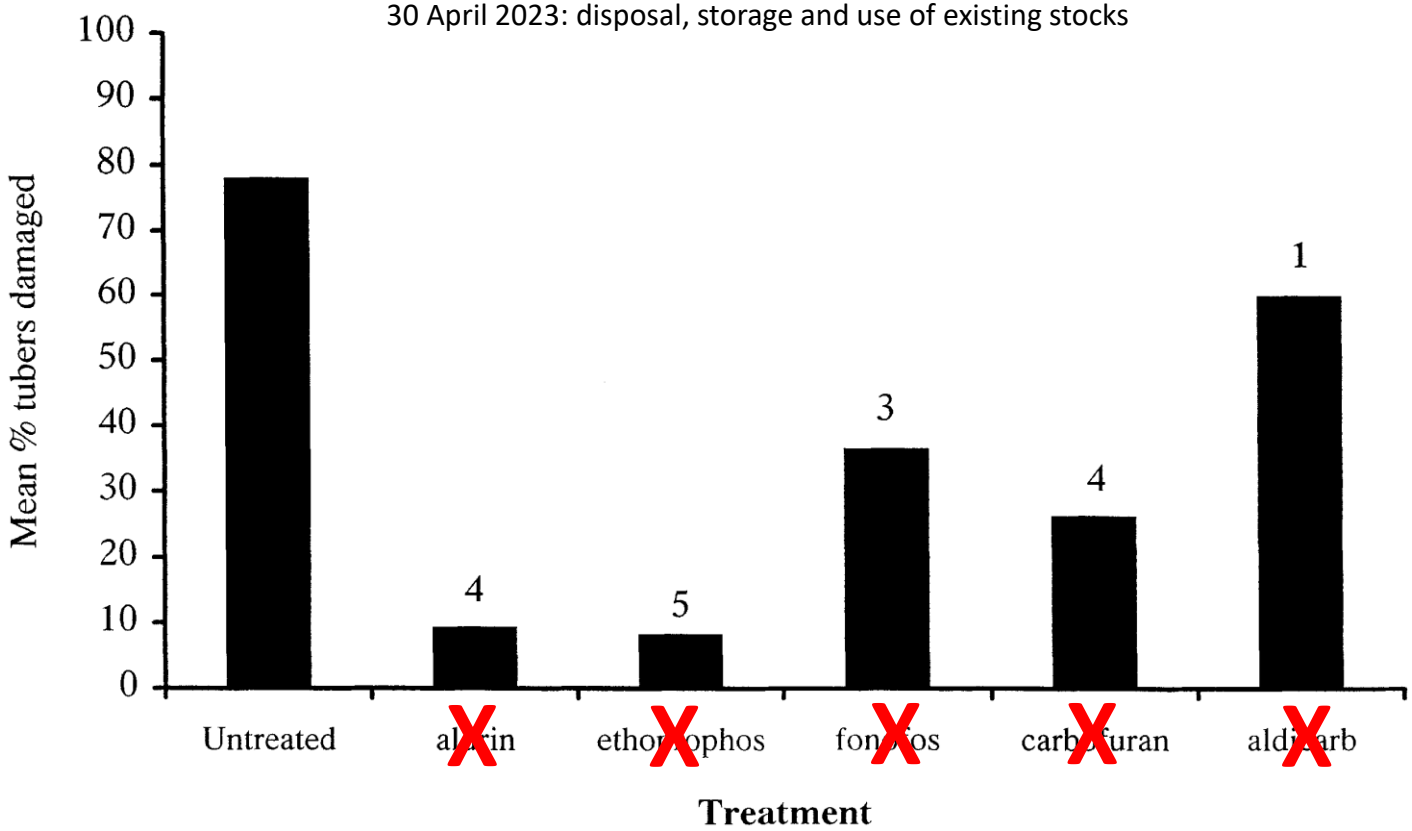
The only currently approved treatment is:

Nemathorin (fosthiazate) – this **reduces** damage only

Authorisation ends 31 October 2021 except for:

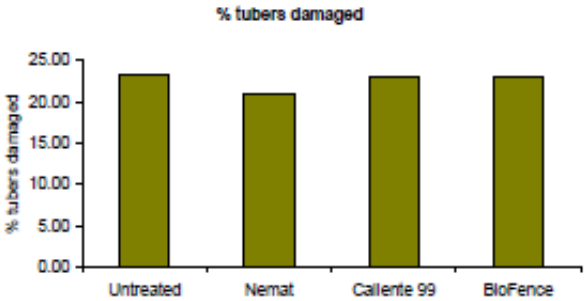
30 April 2022: sale and distribution of existing product

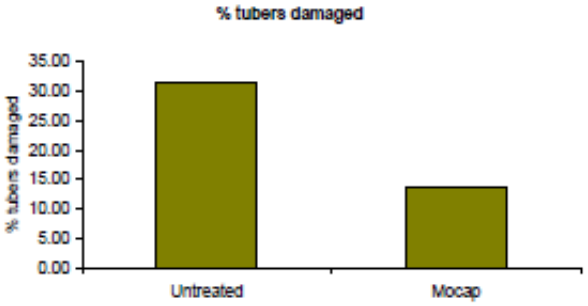
30 April 2023: disposal, storage and use of existing stocks

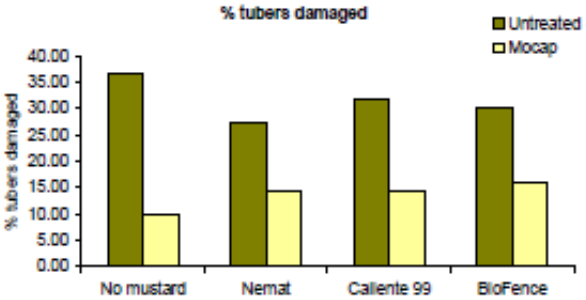


Data source: Parker & Howard, Agricultural and Forest Entomology (2001) 3, 85-98

Biofumigation with mustards







AHDB
POTATOES

Other biocontrols?

- Plant parasitic nematodes
  - Generally not effective
- Biopesticides
  - *Metarhizium anisopliae,* could emerge in the longer-term
- Trap/distraction cropping
  - e.g. inter-cropping with wheat, some effect in specific circumstances

There is NO silver bullet….

- In the absence of insecticides:
  - **Avoidance** is by far the best method of control
  - In-crop cultural control carries a significant risk
- Risk assessment is therefore very important:
  - Understand the biology – larvae & adults
  - Think ahead
  - Use a range of risk assessment methods
  - Look at the landscape
- The equipment needed is not expensive:
  - Time commitment & attention to detail is vital

Sustainable Long-Term Management of Wireworm on Potato (Sustainable Arable LINK Project LK 0982)

defra
Department for Environment Food and Rural Affairs

ADAS

Greenvale AP

Solanum
growing trust

Bayer CropScience

University of Plymouth

syngenta
UK & IRELAND

J Sainsbury plc

British Potato Council

farmcare
part of the Co-operative Group

BECKER UNDERWOOD

Babraham Farms


Thank you

Alternaria risk and control strategies

Mark Stalham, Jane Thomas & Marc Allison

POTATOES

Main potato diseases

Pathogen	Disease or disorder	Rot	Blemish	Foliage	Virus
Alternaria solani / alternata	**Early blight**	**Y**		**Y**	
Colletotrichum coccodes	Black Dot		Y		
Pectobacterium spp (Erwinia)	Soft Rot	Y			
Pectobacterium spp (Erwinia)	Blackleg			Y	
Fusarium spp.	Dry rot	Y			
Helminthosporium solani	Silver scurf		Y		
Phoma exigua	Gangrene	Y			
Phytophthora infestans	Late blight	Y		Y	
PLRV	Leaf roll				Y
PMTV	Spraing, mop top				Y
Polyscytalum pustulans	Skin spot		Y	Y	
PVX	Mild mosaic				Y
PVY	Severe mosaic, leaf drop streak				Y
Rhizoctonia solani	Black scurf and stem canker		Y		
Spongospora subterranea	Powdery scab		Y		
Streptomyces scabiei	Common scab		Y		
TRV	Spraing, mottle		Y		Y

What is Alternaria?

- Early blight
- Caused by *Alternaria solani* or *A. alternata*
- Serious worldwide, early defoliation disease
- Depends on
  - Frequency of wetting of foliage
  - Cultivar susceptibility
  - Nutrient status of foliage
  - Root system size (PCN, compaction)
- Can cause yield losses of 20 %
- Despite name, occurs late in season

Symptoms confused with late blight (*P. infestans*)

- Botrytis cinerea
  - Grey mould, favors humid moist conditions
- Early blight
  - Alternaria spp.
  - ‘Target spot’
- Scorch
  - N top dressing
  - Irrigation
- Wind damage
- Heat necrosis

Early blight

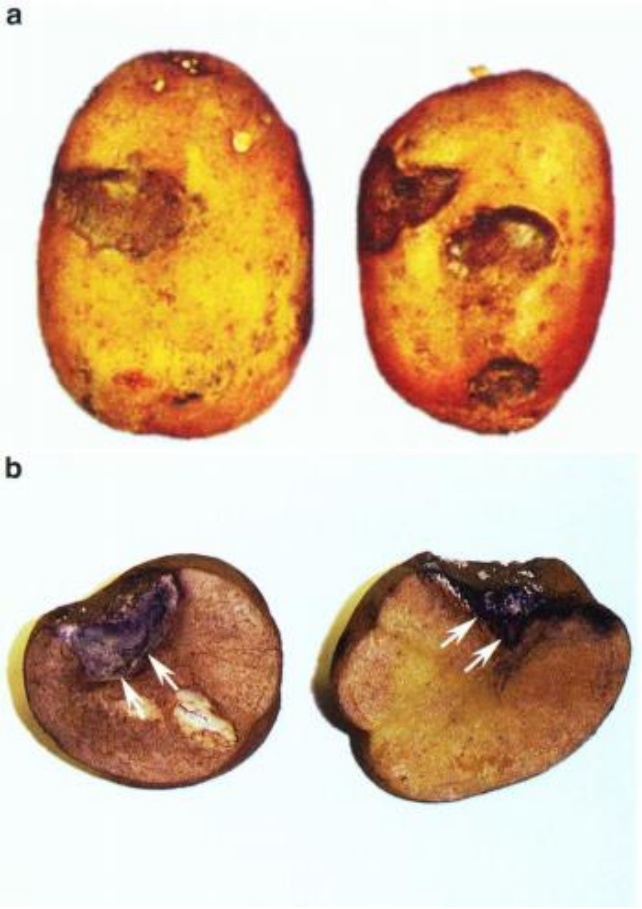
- *A. alternata*, thought to be more saprophytic
- *A. solani*, thought to be more pathogenic
- Attacks mid to late season; developing on older leaves and in 'stressed' plants
- Initially, small irregular to circular dark brown spots on lower leaves and progress into characteristic dark, alternating, concentric rings that are generally restricted by large veins
- Favours hot / moist conditions
- Sporadic problem on particular varieties – e.g. Markies, Vivaldi, King Edward
- Some control from late blight fungicides, but other specific fungicides may be more effective

Importance of early, accurate detection: *A. alternata, A. solani,* or physiological reaction?

A. alternata lesions may coalesce across whole leaf, with necrotic areas to leaf margins
A narrow band of chlorotic tissue often surrounds each lesion, before extensive chlorosis occurs
Leaves eventually wither and die, but remain attached to the plant (see arrow)

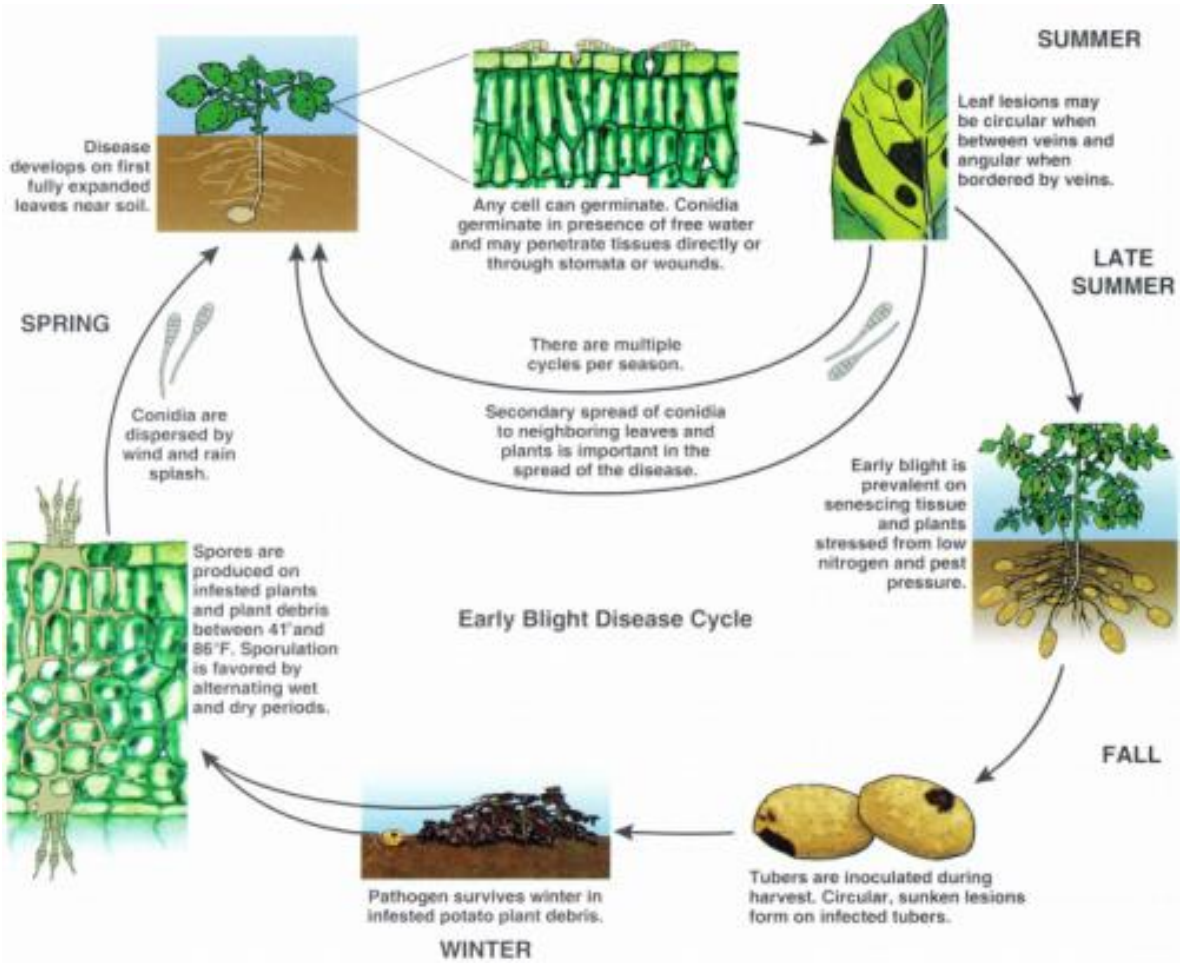
Tuber symptoms

- Circular to irregular slightly sunken lesions, often surrounded by raised purple to dark brown border (a)
- Underlying tissue is leathery to corky, often surrounded by a yellow halo (b)
- Infection by both *A. solani* and *A. alternata* possible at harvest from contaminated soil
- No secondary spread in store
- Weight loss in store



Diease cycle

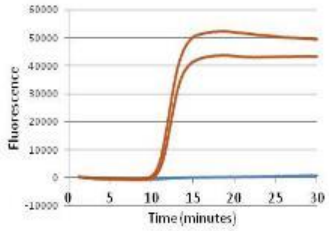
Main source of inoculum is overwintered spores (distribution: air, soil, rainsplash, irrigation)



Conducive conditions

- Alternating dry (spore release) and wet (infection) periods
- 5-30 °C, with optimum of 20 °C
- Few spores produced on permanently wet or dry tissue
- Multiple cycles possible (within-field spread from infected plants)
- Infection to visible symptoms 6-8 days, shorter on older leaves
- Stressed plants (nutrient, water, pest)

Imaging and diagnostics:

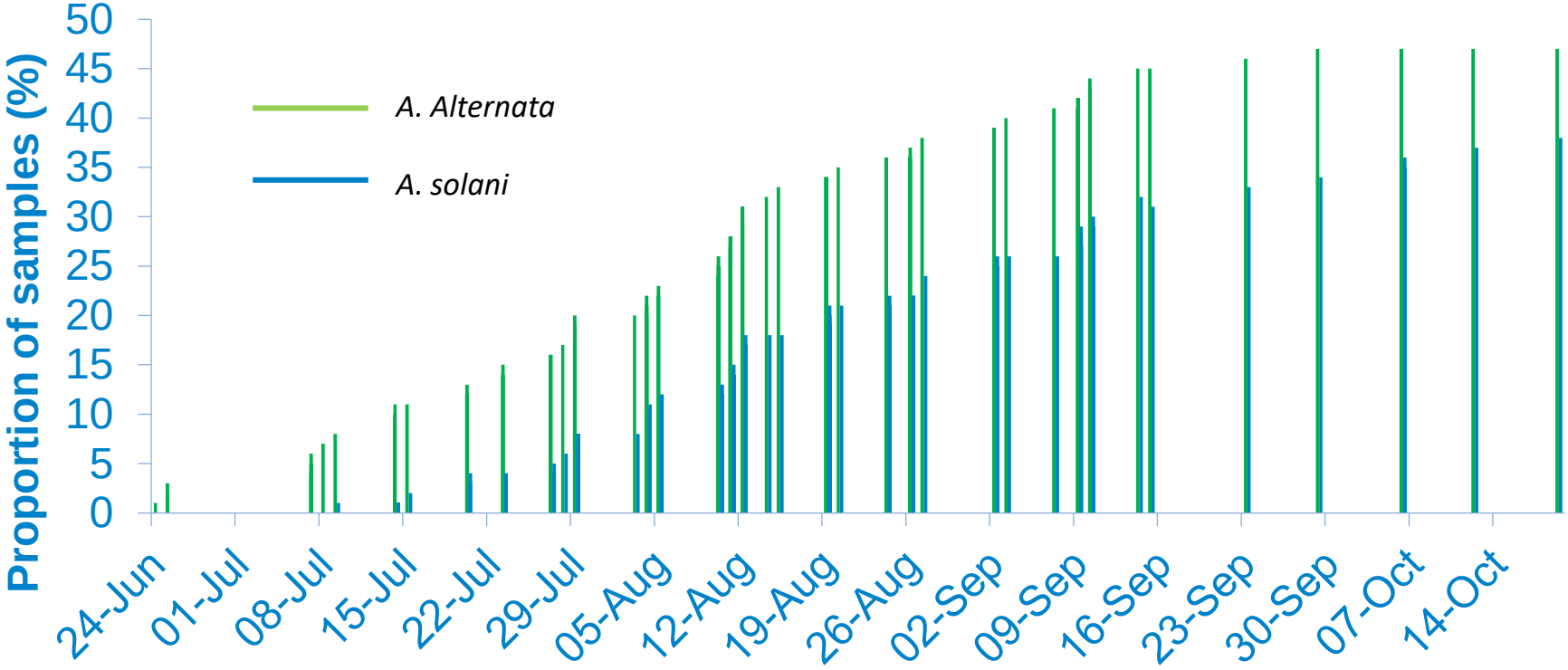


alkaline lysis
(5-10 minRT)

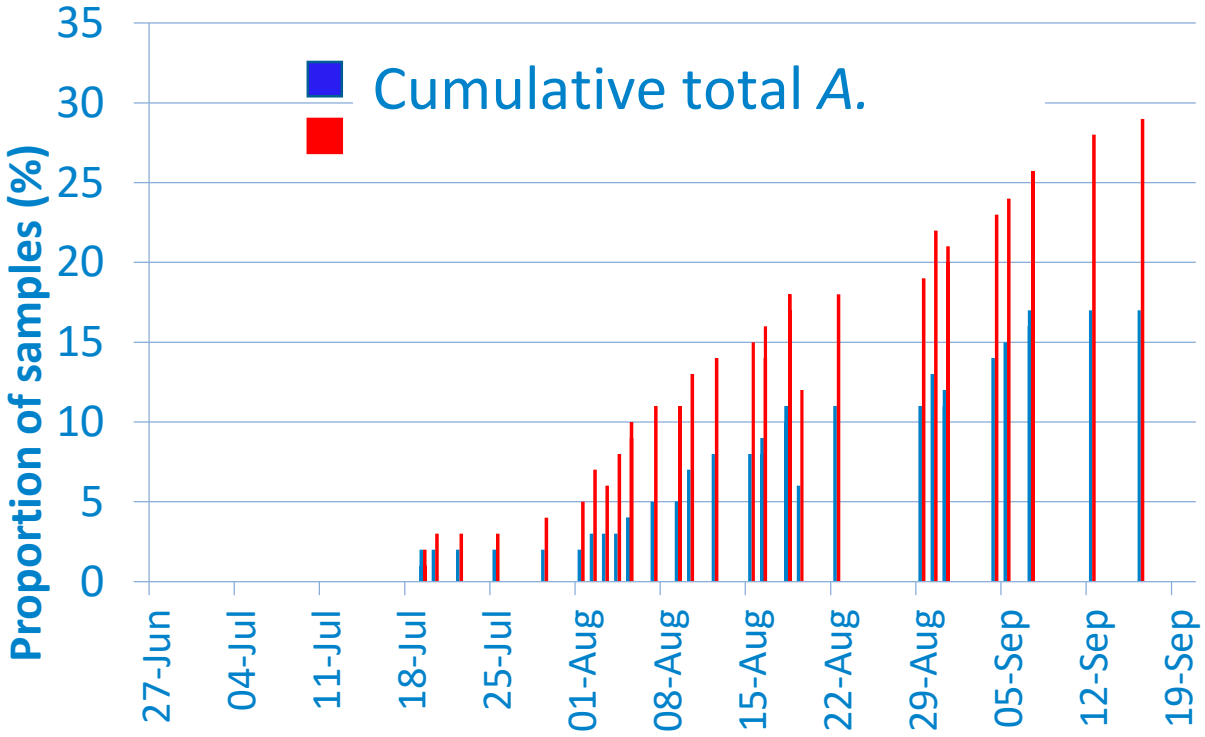
Confirming Alternaria species using Loop mediated Isothermal PCR (LAMP)

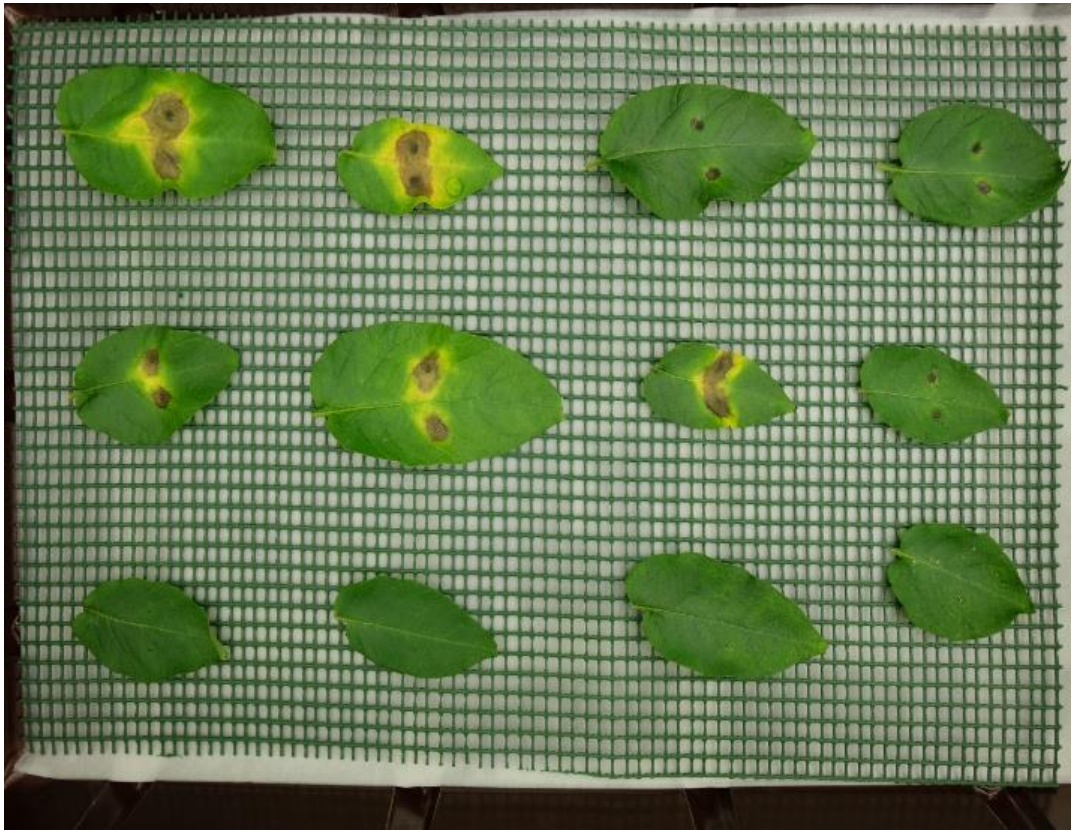
Rapid laboratory or in-field test (Genie II machines)

Cumulative incidence *A. solani* and *A. alternata* 70 samples, 2015

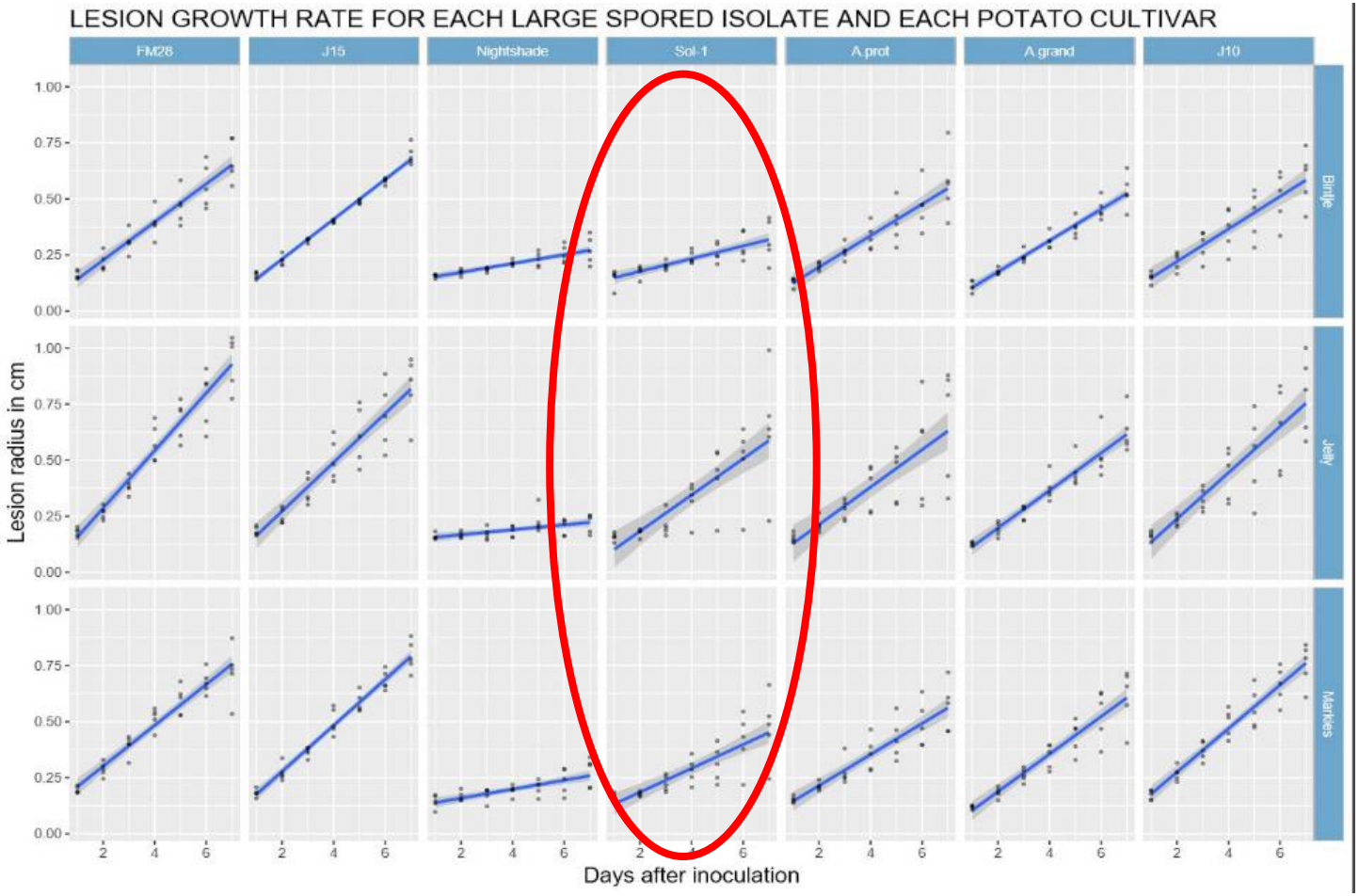


Grower samples 2016

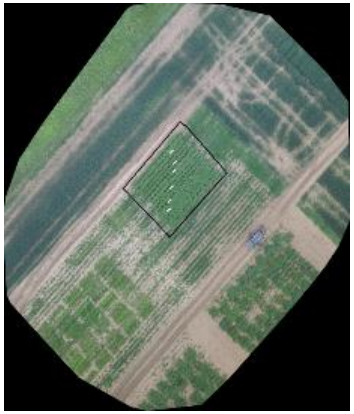


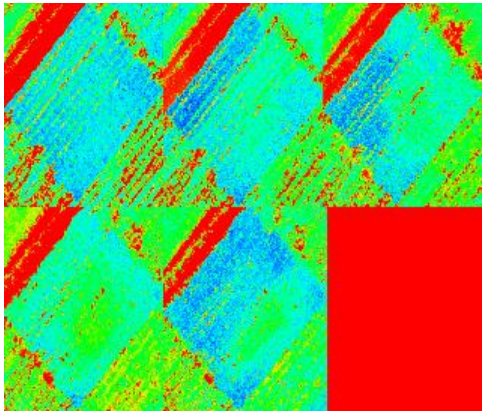


Variation in pathogenicity on Bintje, Jelly and Markies



Scouting for potato early blight?





Multispectral imaging by drone (NDVI) identified areas of stressed plants, but not the Alternaria foci – larger scale experiment needed and ground truthing of Alternaria spectral signature, plus hyperspectral imaging

Control measures

- Integrated disease management
- Cultural agronomy
  - Resistant varieties
  - Fungicides
  - Rotation length (as long as possible!)
  - Removal of host weeds (e.g. nightshade)
  - Irrigation management
  - Nitrogen management

Variety

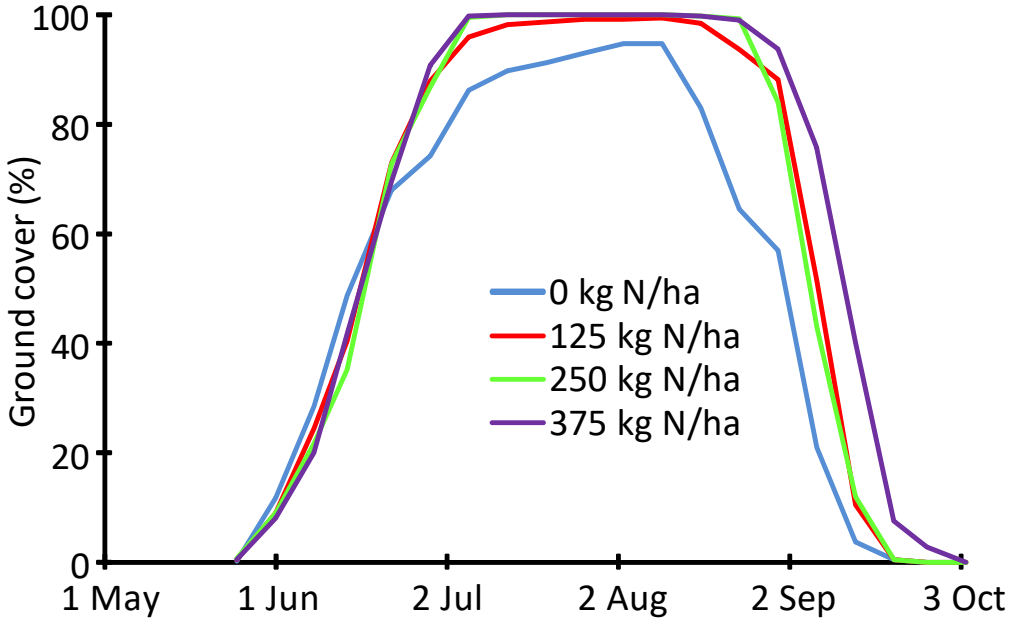
- Susceptible
  - Markies
  - Vivaldi
  - King Edward

Fungicides

- Multiple applications needed as many reproductive cycles
- Protectants and prophylactics (spray at first signs of disease and shorten intervals as season progresses)
- Continue (as long as we can) using mancozeb-containing late blight fungicides
- Dual (early and late blight) activity
  - Famoxadone (e.g. Tanos)
  - Fenamidone (e.g. Consento)
  - Fluazinam (e.g. Shirlan)
- Best control (largely restricted to *A. solani* and susceptible varieties)
  - Difenoconazole + mandipropamid (e.g. Amphore Plus)
  - Azoxystrobin + chlorothalonil (e.g. Olympus)
  - Pyraclostrobin + boscalid (e.g. Signum, Filan)

N management and desiccation

Effect of season length on N requirement of Russet Burbank



CUF, 2010

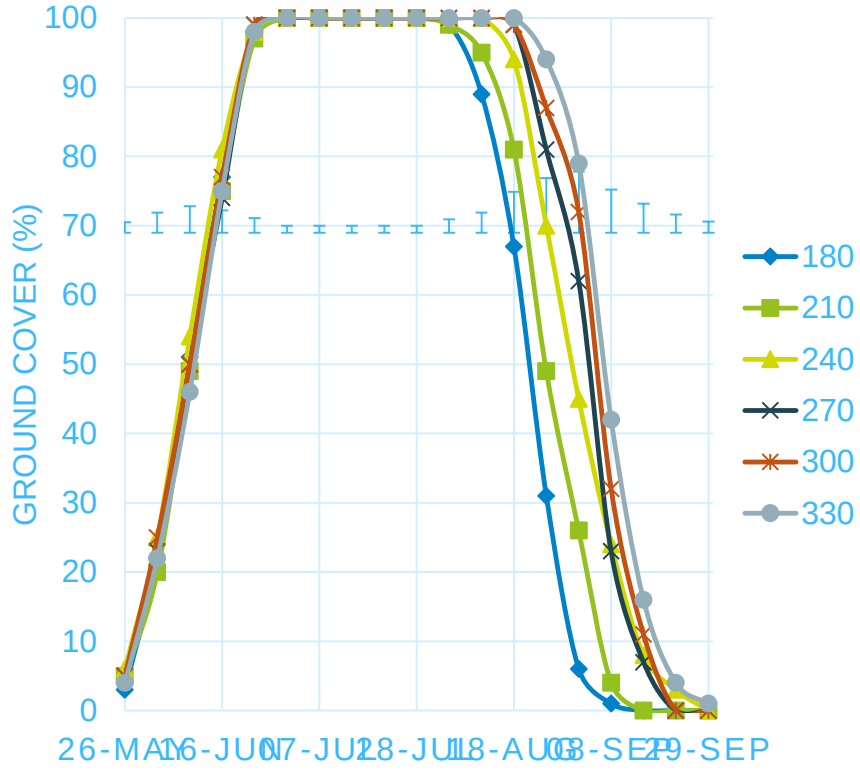
Effect of intended season length and variety on N requirement

	4 Cara Markies Vales Sovereign	3 Desiree Maris Piper Russet Burbank	2 Charlotte Lady Rosetta Nadine	1 Courlan Estima Premiere
Short season				
Medium season				
Long season				

Making N fertilizer recommendations for Markies

Step	Process	Factors	Outcome
1	Calculate soil nitrogen supply (SNS)	Cereals, sand soil in a low rainfall area (500-600 mm)	SNS Index = 0 (soil will supply 40 kg N/ha)
2	Identify determinacy group	Markies	Variety group = 4 (indeterminate)
3	Calculate season length	Mid May (emergence) to end September (crop death)	Season length = 140 days
4	Calculate initial N requirement of crop		180 kg N/ha
5	Calculate supply from organic manures	Nothing applied	Supply from FYM = 0 kg N/ha
6	Fertilizer required		**180 kg N/ha**

Effect of N rate on ground cover duration and yield in Markies with *A. solani* infection



N rate (kg/ha)	Yield (t/ha)
180	**48.8**
210	52.3
240	55.4
270	55.2
300	53.2
330	50.9
S.E.	2.99

2 weeks later

Ground cover (%) for Maris Piper SPot North

T1 (5 September)	05-Sep	12-Sep	19-Sep	26-Sep
Control (None)	**99**	**87**	**46**	**32**
Reglone	99	7	0	0
Pelagonic acid	99	38	2	0
Spotlight/Gozai	99	15	1	0
Flail	98	0	0	0
Saltex	99	2	0	0
S.E. (30 D.F.)	0.5	3.0	2.0	1.1

Virtually no leaf after 14 days

Skinning (% surface area removed in barrel) Maris Piper

Treatment	19-Sep	26-Sep
Control (None)	**8.3**	**3.0**
Reglone	5.0	0.9
Pelargonic acid	6.5	1.8
Spotlight/Gozai	5.8	1.1
Flail	5.4	0.9
Saltex	5.7	0.9
S.E. (30 D.F.)	0.56	0.37

Skin-set after 14 days


1-2
75cm

2 weeks later

Ground cover (%) for Royal SPot East

Treatment	4-Sep	11-Sep	18-Sep	25-Sep	02-Oct
Control (None)	**98**	**92**	**72**	**47**	**33**
Reglone	97	27	0	0	0
Pelargonic acid	100	**95**	**52**	**10**	**0**
Spotlight/Gozai	98	78	22	3	0
Flail	98	0	0	0	0
Saltex	99	78	3	0	0
S.E. (30 D.F.)	0.7	5.8	6.2	4.9	2.1

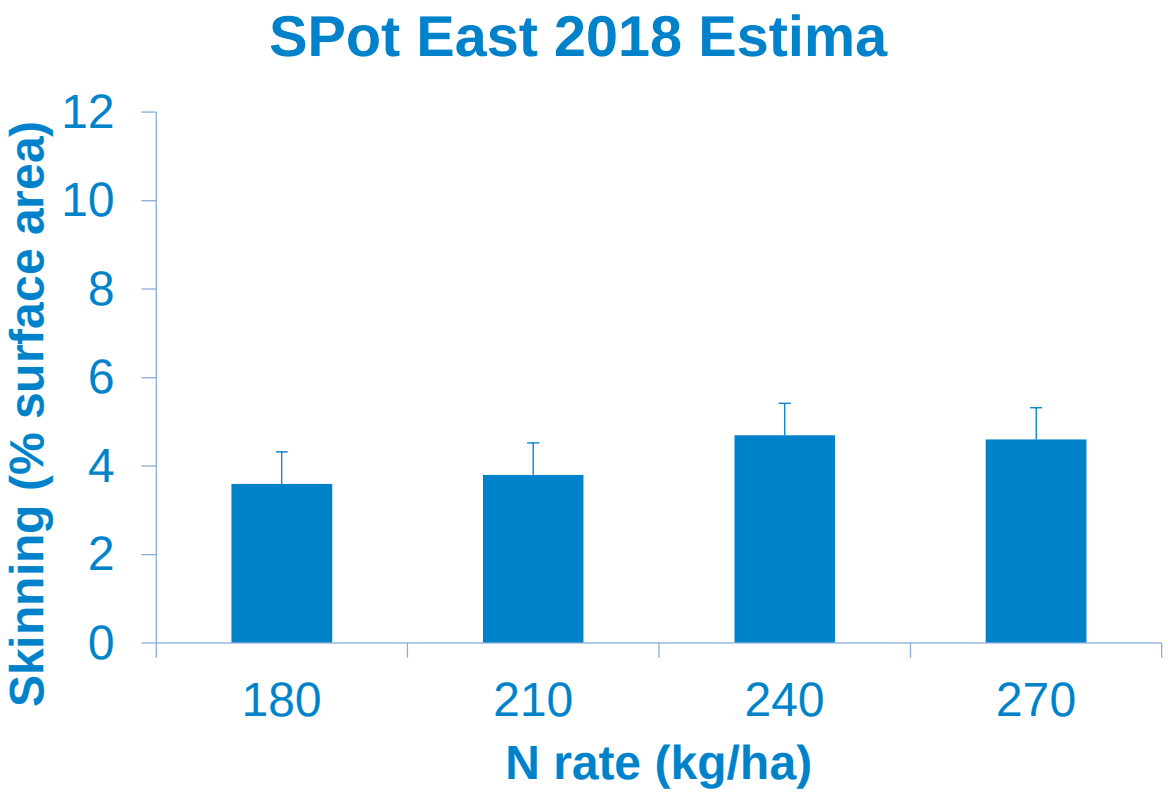
Slower kill with Spotlight/Gozai and pelargonic acid compared with Reglone

Skinning (% surface area removed in barrel) in Royal

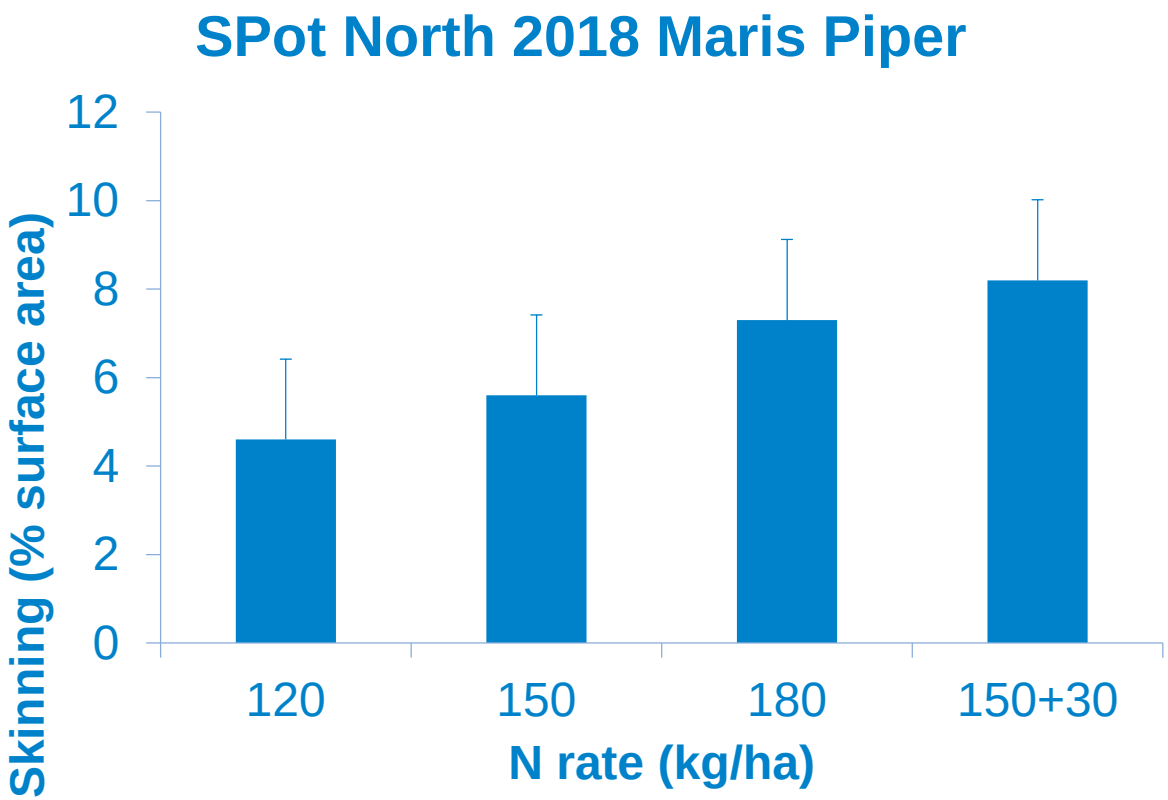
Treatment	18-Sep	25-Sep	02-Oct
Control (None)	**55**	**23**	**26**
Reglone	44	11	9
Pelargonic acid	58	16	12
Spotlight/Gozai	50	12	11
Flail	54	12	12
Saltex	57	13	13
S.E. (30 D.F.)	3.8	2.4	1.1

Skin-set after ≈ 21 days

Increased N delays skinset

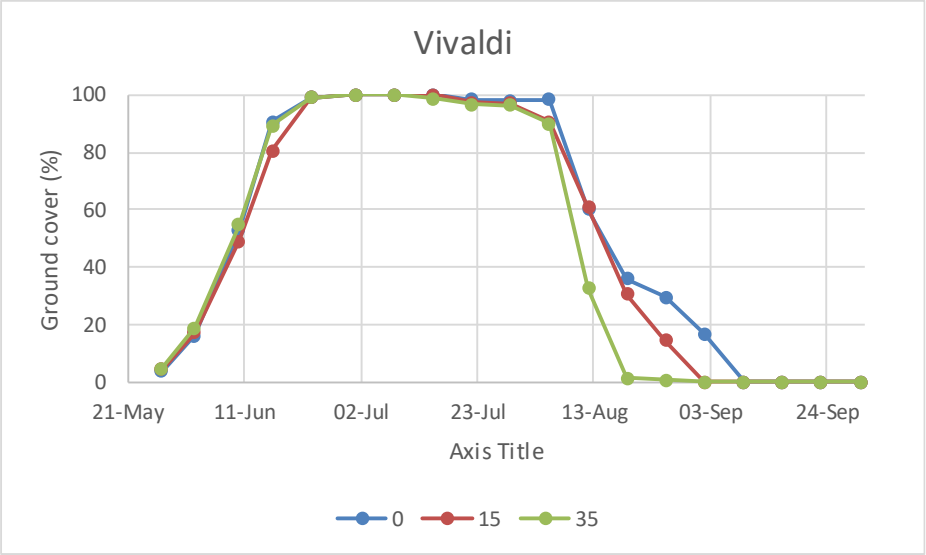


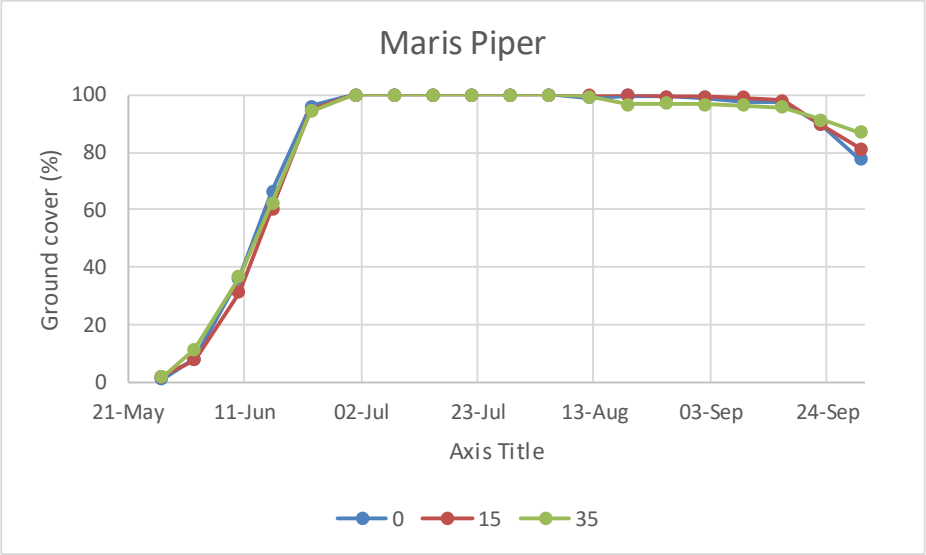
Increased N delays skinset



Effect of irrigation regime and variety

Frequent irrigation at low SMD protects against Alternaria





Summary

- Unpredictable disease incidence
- Integrated disease management
- Avoid susceptible varieties (e.g. Markies, Vivaldi, King Edward)
- Fungicides (multiple applications, but only active against *A.solani*)
- Rotation length (long) and removal of host weeds (e.g. nightshade)
- Irrigation management (frequent, low-dose)
- Avoid restricting root growth (PCN, compaction)
- Nitrogen management (fire-fighting with high rates)
- Risks from over-fertilizing when no disease occurs:
  - Difficult-to-kill crops
  - Reduced yield
  - Delayed harvest


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