AHDB College Lecturers Day 2019

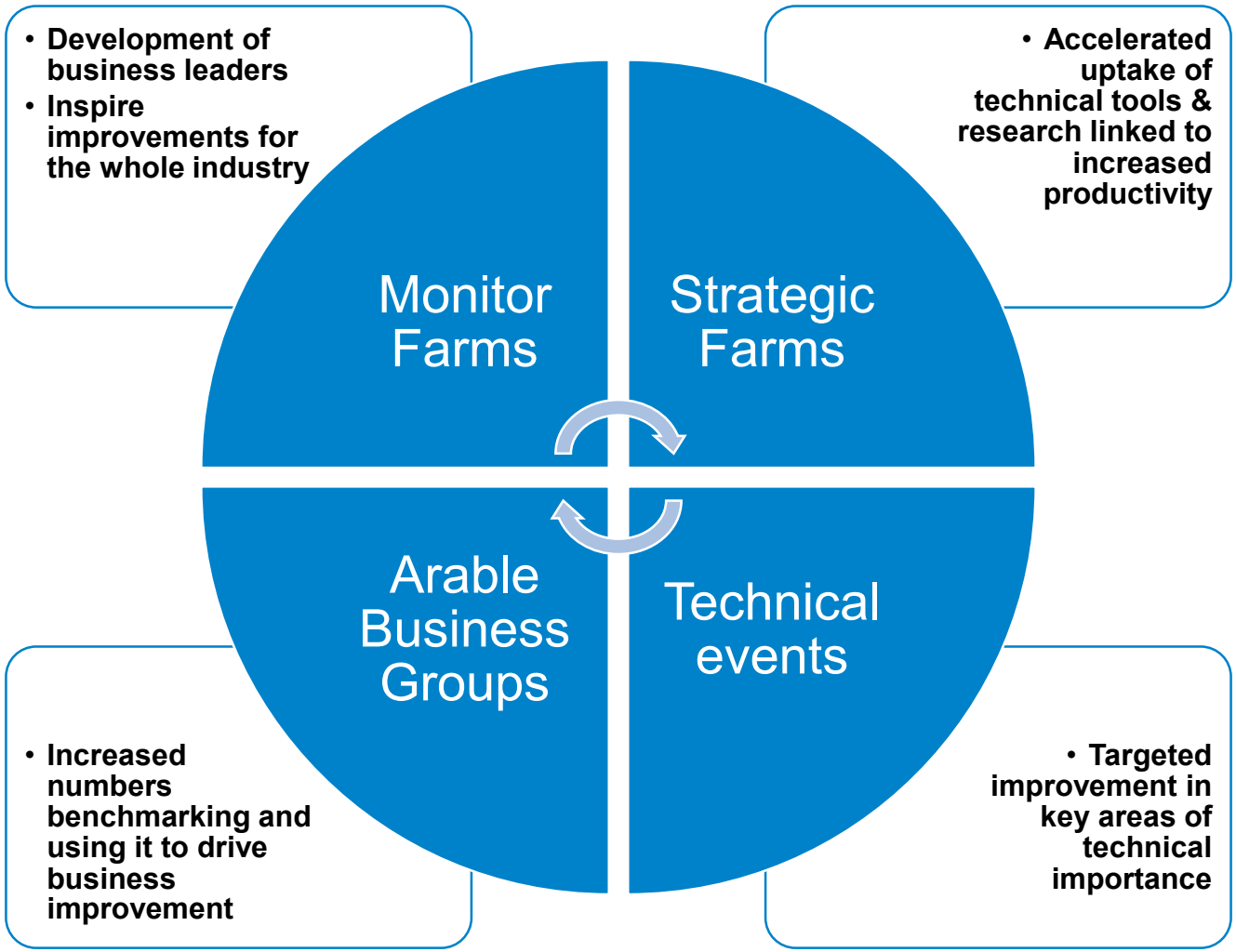
These slides are not for wider circulation

Arable focus

Emily Pope – Knowledge Transfer Manager, Arable

CEREALS & OILSEEDS

FARMEXCELLENCE



FARMEXCELLENCE

AHDB Monitor Farms and Strategic Arable Farms

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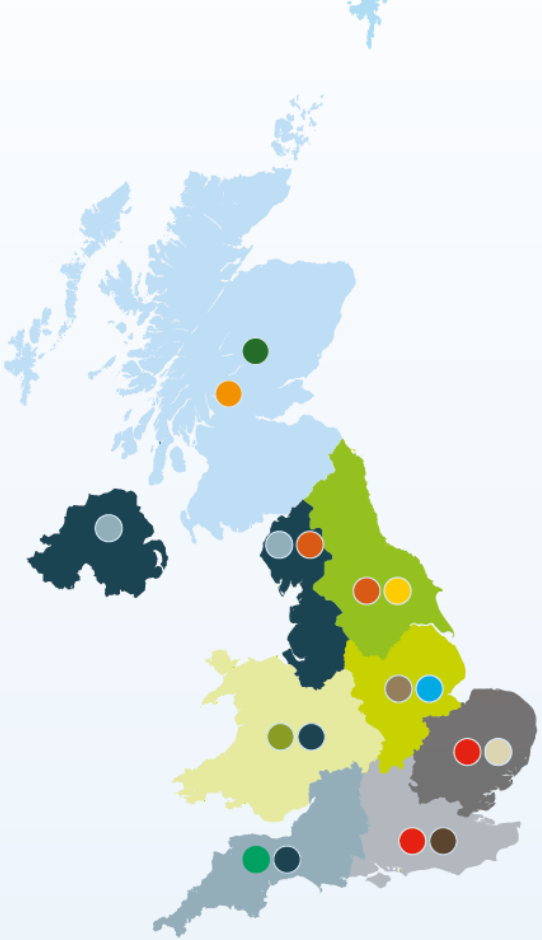


Top 10 Monitor Farm meeting topics

	2016/17	2017/18	2018/19
1	Soils	Cover crops	Labour & machinery
2	Fixed costs	Weeds	Soils
3	Yields	Precision farming	Fixed costs
4	Cultivations	Soils	Business resilience
5	Weeds	Marketing	Fungicides
6	Rotations	Machinery	Crop nutrition
7	Marketing	Risk management	Crop establishment
8	Fungicides & pests	Fixed costs	Precision farming
9	Precision farming	Yields	Collaboration
10	Business resilience	Rotations	Diversification

Strategic Cereal Farms

Putting research into practice

Brian Barker, Stowmarket

Tuesday 26 November, Newmarket

Rob Fox, Leamington Spa

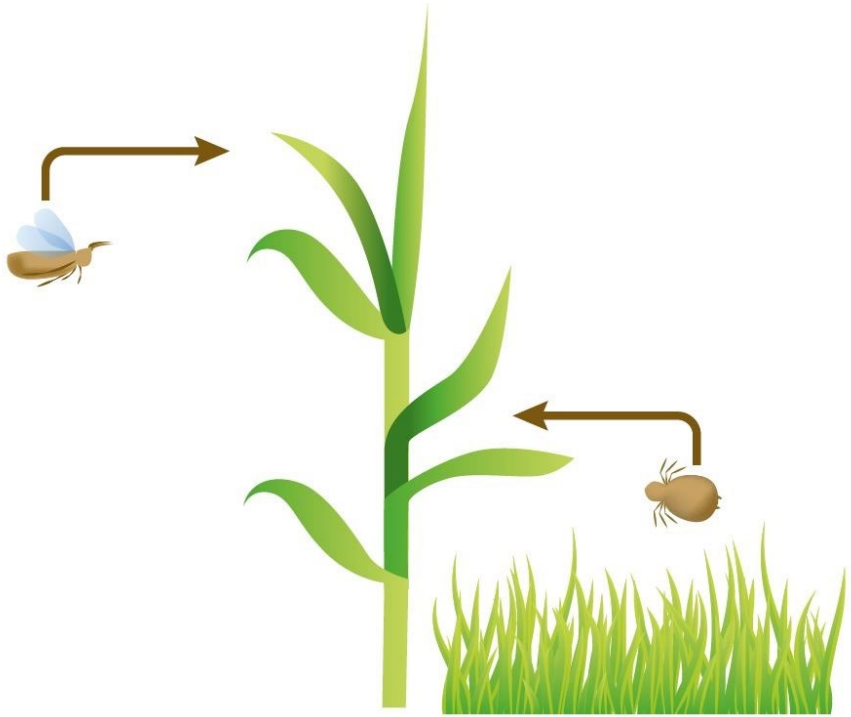
Wednesday 27 November, Daventry
Wednesday 11 December, Gloucester

Book now: ahdb.org.uk/events

Strategic Cereal Farms

Biopesticide CSFB PhD
Harper Adams University

Barley yellow dwarf virus
ADAS

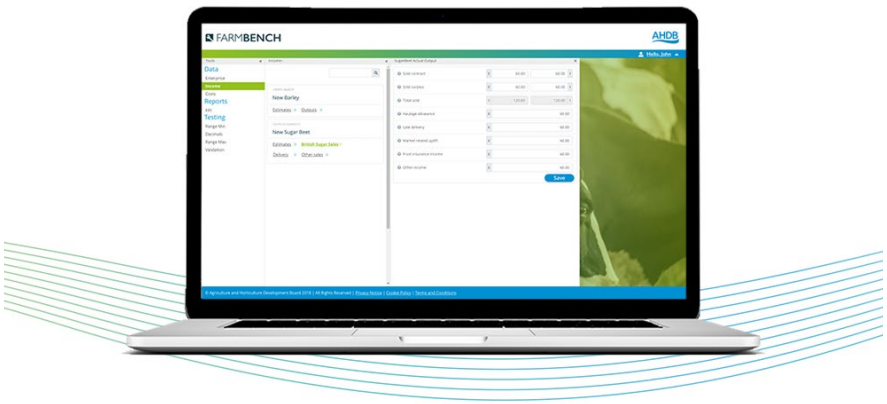


Yield Enhancement Network
yen.adas.co.uk

- Connects agricultural organisations and farmers who are striving to improve crop yields
- Open to any interested individual or organisation - commercial, academic or other
- AHDB will sponsor one college/university entry from each institute to the cereals or oilseeds YEN
- Currently working with RAU, Sparsholt, University of Nottingham

Farmbench
ahdb.org.uk/farmbench

- Easy to use online benchmarking tool that helps to identify where strengths and weaknesses lie within a farm business
- Live reports
- Allocate costs to help budget and track performance
- Straightforward registration process
- Key performance indicators



Agronomists' Induction

Tuesday 22 – Wednesday 23 October 2019

ahdb.org.uk/events/agronomists-induction

Introducing new agronomists to AHDB staff and services

Providing information on:

- Integrated pest management
- Pest, weed and disease management
- Monitoring and forecasting
- Soil health
- Crop nutrition

Agronomists' Conference 2019

Tuesday 3 – Wednesday 4 December 2019

Leicester Marriott Hotel, Grove Park, Smith Way, Enderby, Leicester, Leicestershire LE19 1SW

ahdb.org.uk/events/agconf19

Day 1: Cereals & Oilseeds | Day 2: Potatoes

Providing presentations and workshops on:

- Crop protection
- Crop nutrition
- Resource use

Agronomy 2020

Bringing the learnings from the Agronomists' Conference to your region

Discuss latest research with experts from across the arable industry

South East: 14 January

South West: 15 January

North West: 28 January

East Midlands: 5 February

West: 11 February

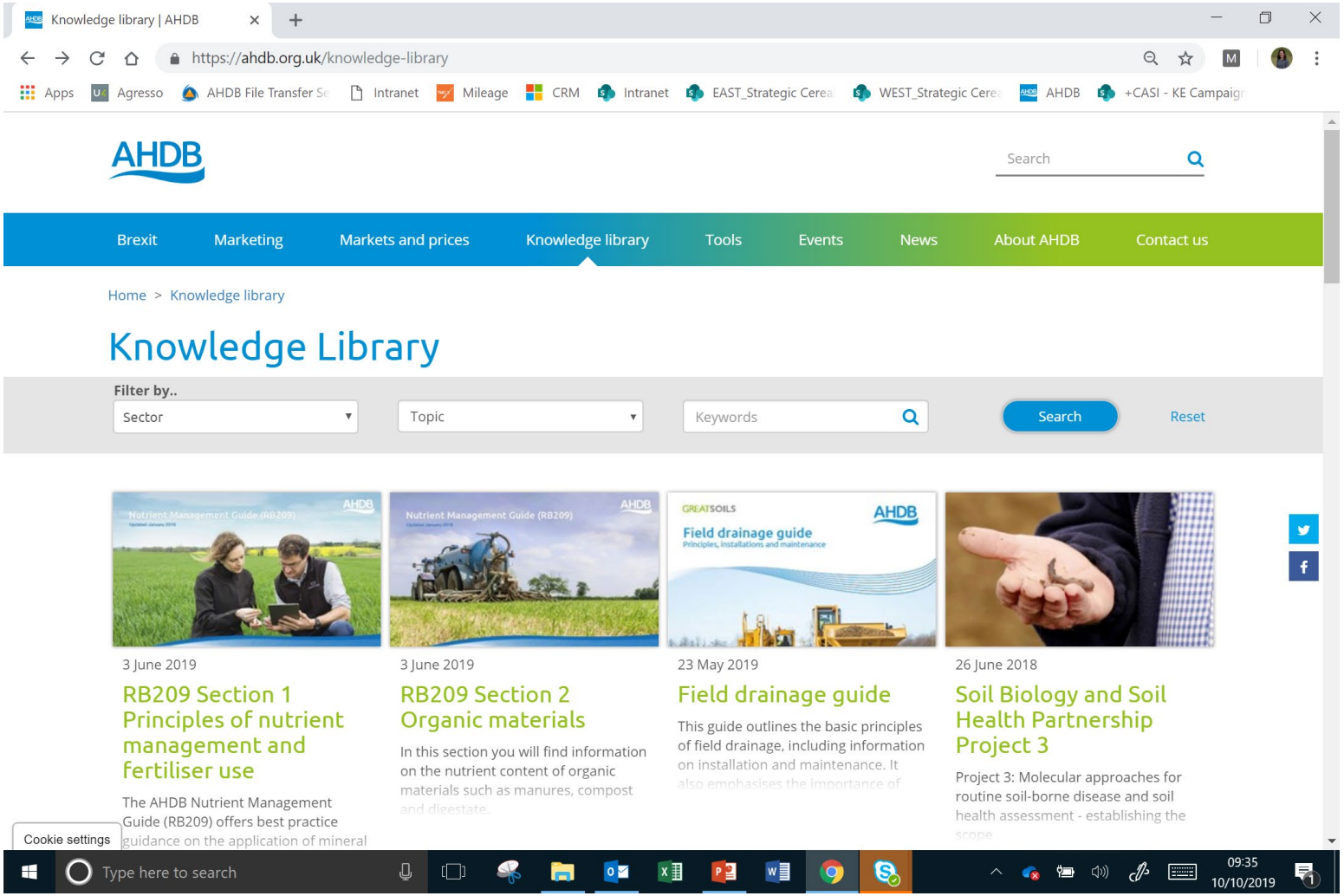
East Anglia: 12 February

Wales: 13 February

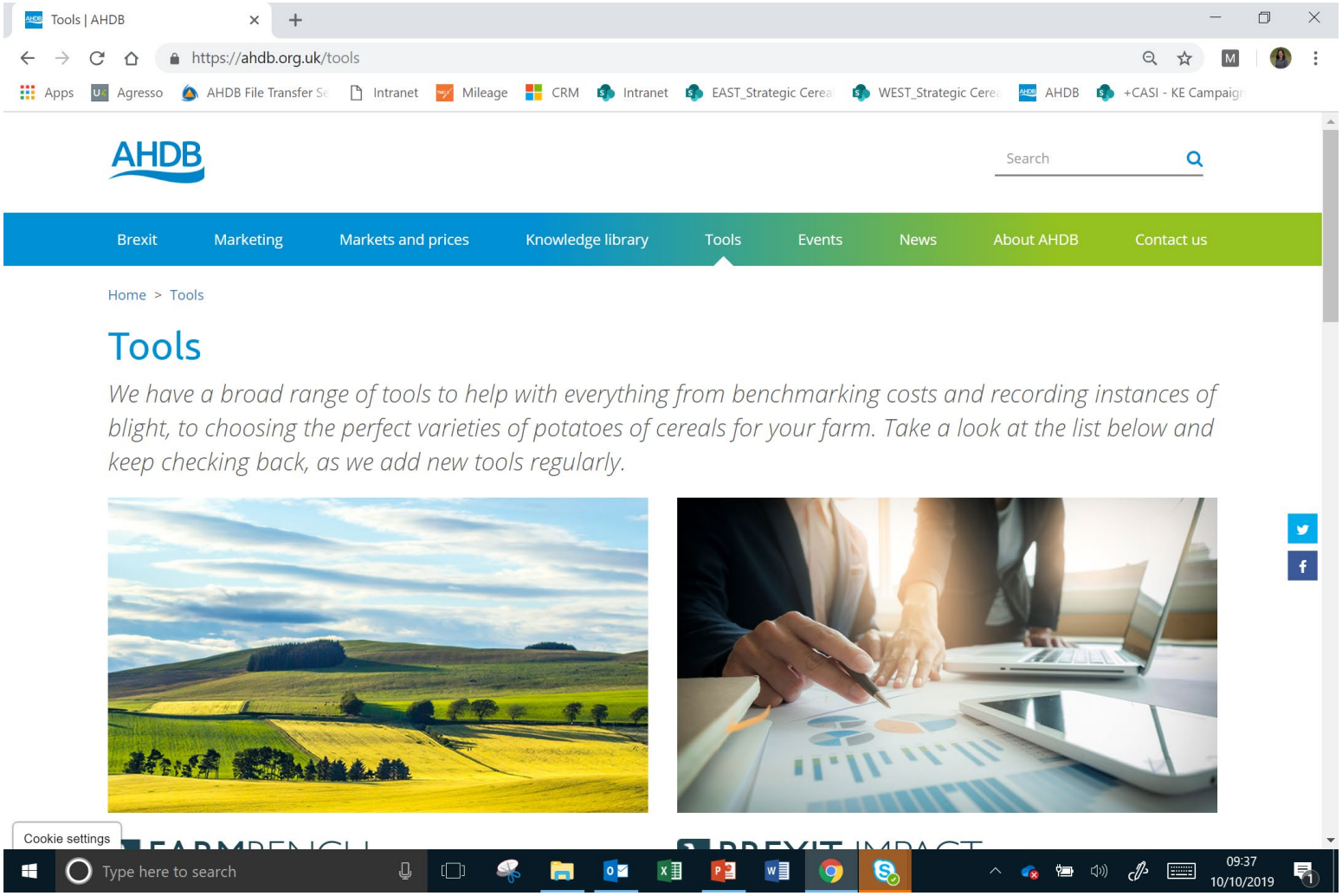
North East: 19 February

ahdb.org.uk/agronomy-2020

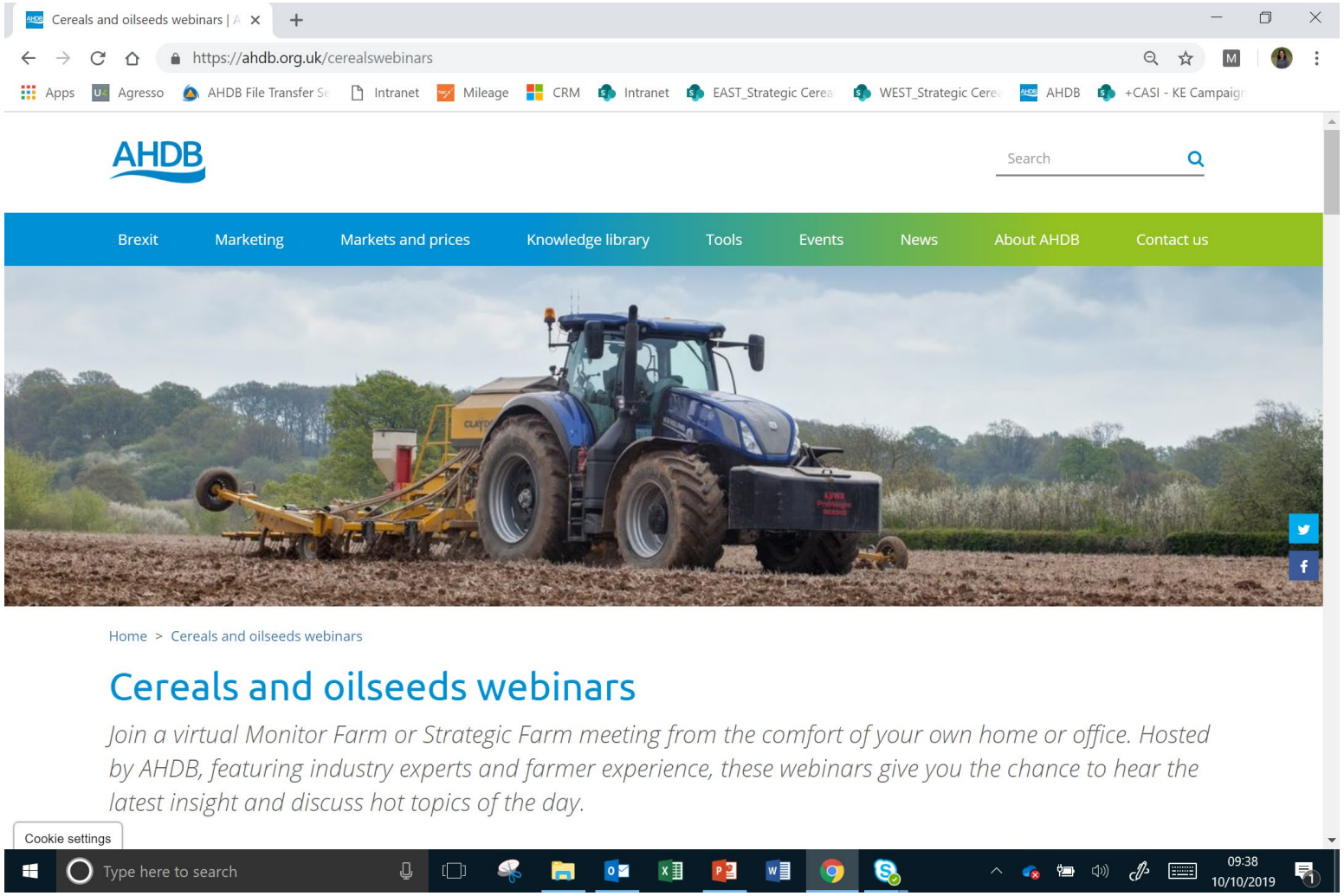
Knowledge Library
ahdb.org.uk/knowledge-library



Tools
ahdb.org.uk/tools



Webinars
ahdb.org.uk/cerealswebinars



Arable research update

- Summary of research projects for Cereals & Oilseeds and Potatoes
- Help provide a clearer, stronger and more united resource across the arable sector
- Integrated pest management is a key part of our work – front & centre of arable activity

GREATSOILS

AHDB

ahdb.org.uk/greatsoils

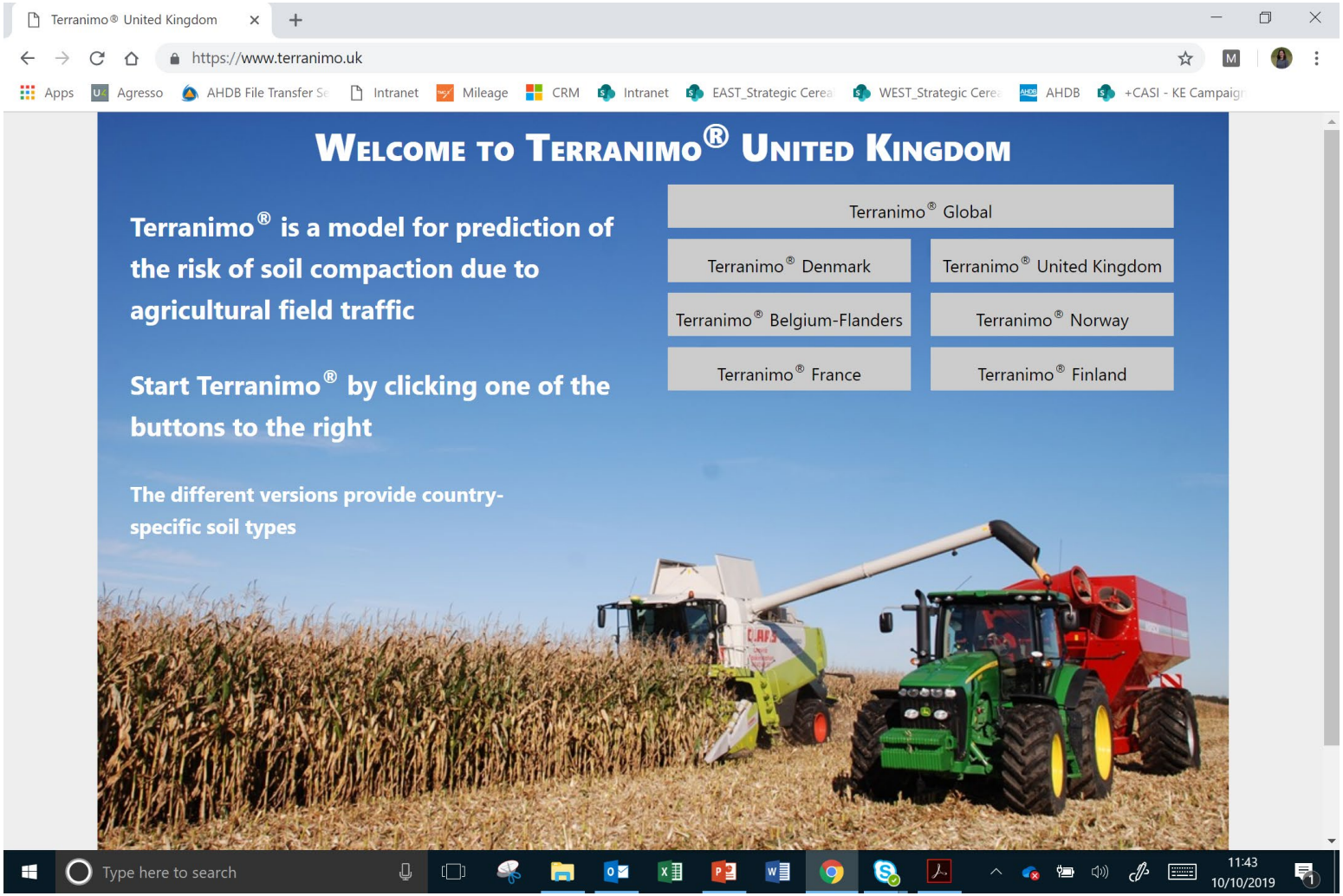
- Understanding soil biology
- Developing a soil health scorecard
- Increasing diversity in the rotation
- Reducing risk of soil compaction
- Rotational planning
- Precision farming technologies

Attribute*	Field A; Farm 1	Field B; Farm 2	Field C; Farm 3
SOM (%)	3.4	2	2.2
pH	6.7	6.9	7.0
Ext. P (mg/l)	40.6	59.6	37.2
Ext. K (mg/l)	158	106	148
Ext. Mg (mg/l)	82	89	144
VESS score	2	2	2
Earthworms (Number/pit)	13	8	1

Investigate Monitor No action needed

Soil health scorecard results from three fields with the same soil type and in the same rainfall region, highlighting different areas for attention in each production system

Reducing risk of soil compaction



Get in touch

Amanda Bennett

Resource Management Scientist – Soils

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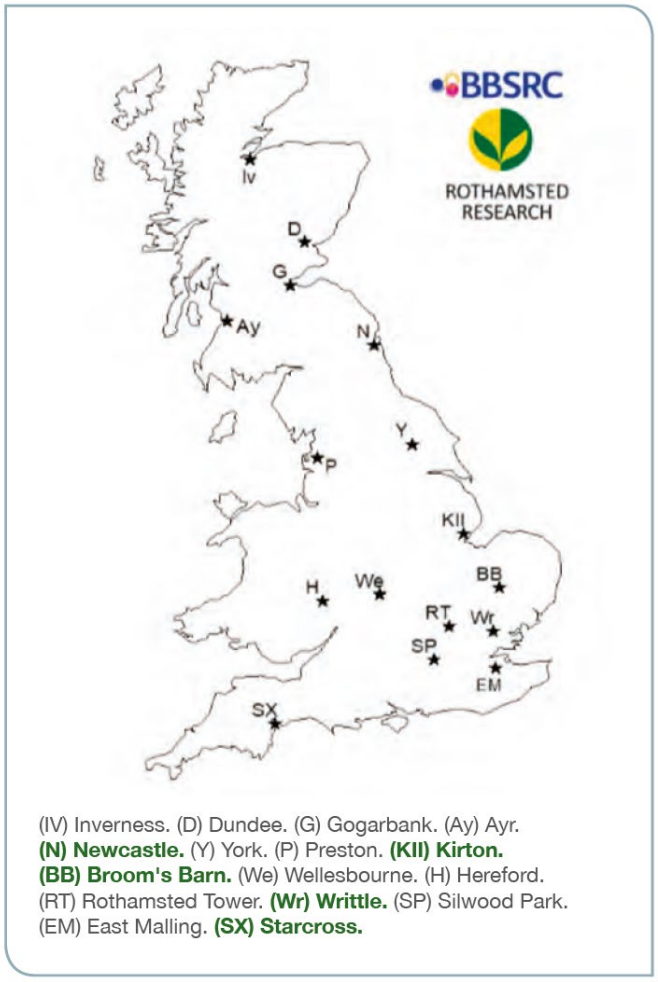
Integrated pest management

- Monitoring
- The future of pest control
  - Trap cropping
  - Defoliation
  - Genetic basis of resistance to pests
  - Biopesticides
- Stepping up integrated pest management



(IV) Inverness. (D) Dundee. (G) Gogarbank. (Ay) Ayr. **(N) Newcastle.** (Y) York. (P) Preston. **(KII) Kirton. (BB) Broom's Barn.** (We) Wellesbourne. (H) Hereford. (RT) Rothamsted Tower. **(Wr) Writtle.** (SP) Silwood Park. (EM) East Malling. **(SX) Starcross.**

Position of suction traps. Those in green are undergoing virus testing

Get in touch

Charlotte Rowley

Crop Protection Scientist – Pests

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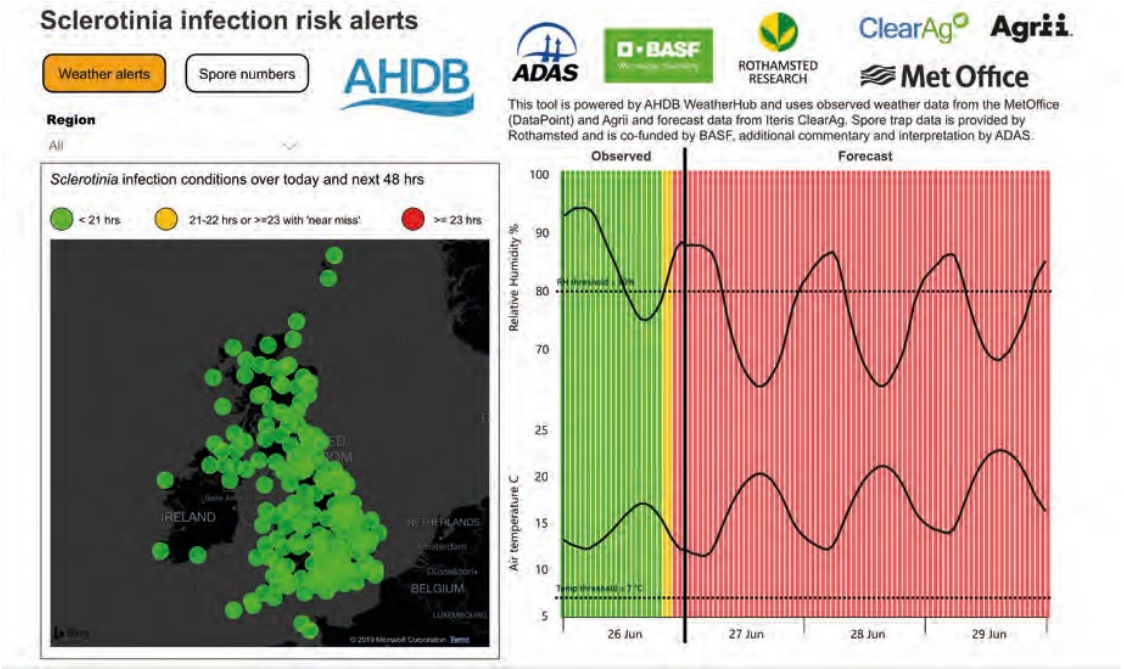
Disease decision support

- Ramularia leaf spot
- Yellow rust
- Sclerotinia
- Blight



Get in touch

Catherine Harries

Crop Protection Scientist – Diseases

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Reviewing weed control options and opportunities in the UK

- Reviewing future options
- Weed control solutions on Strategic Potato Farms

Get in touch

Joe Martin

Crop Protection Senior Scientist – Weeds

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Nutrition

- Changes in phosphorous management for 2020
- High yield and grain protein in milling wheat: are the two mutually exclusive?
- Malt specifications in spring barley
- Oat nutrition
- Sulphur deficiency in potato crops
- Improved N recommendations in potatoes
- Determinacy

Get in touch

Sajjad Awan

Resource Management Scientist - Nutrition

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Potato storage research

- Sprout control post-CIPC
- Integrating CIPC alternative sprout suppressants for the processing sector and fresh market
- Optimisation of maleic hydrazide as a sprout suppressant
- Understanding dormancy
- CIPC contamination
- Tackling diseases in stores
- Integrated agronomy and storage
- Latent infection of tubers during storage and transit

Get in touch

Laura Bouvet

Knowledge & Innovation Facilitator – Crop Storage Research

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

College Lecturers Day 2019

Know your soils; principles to improve soil health

Siwan Howatson

All soils are different

What do we need to consider?

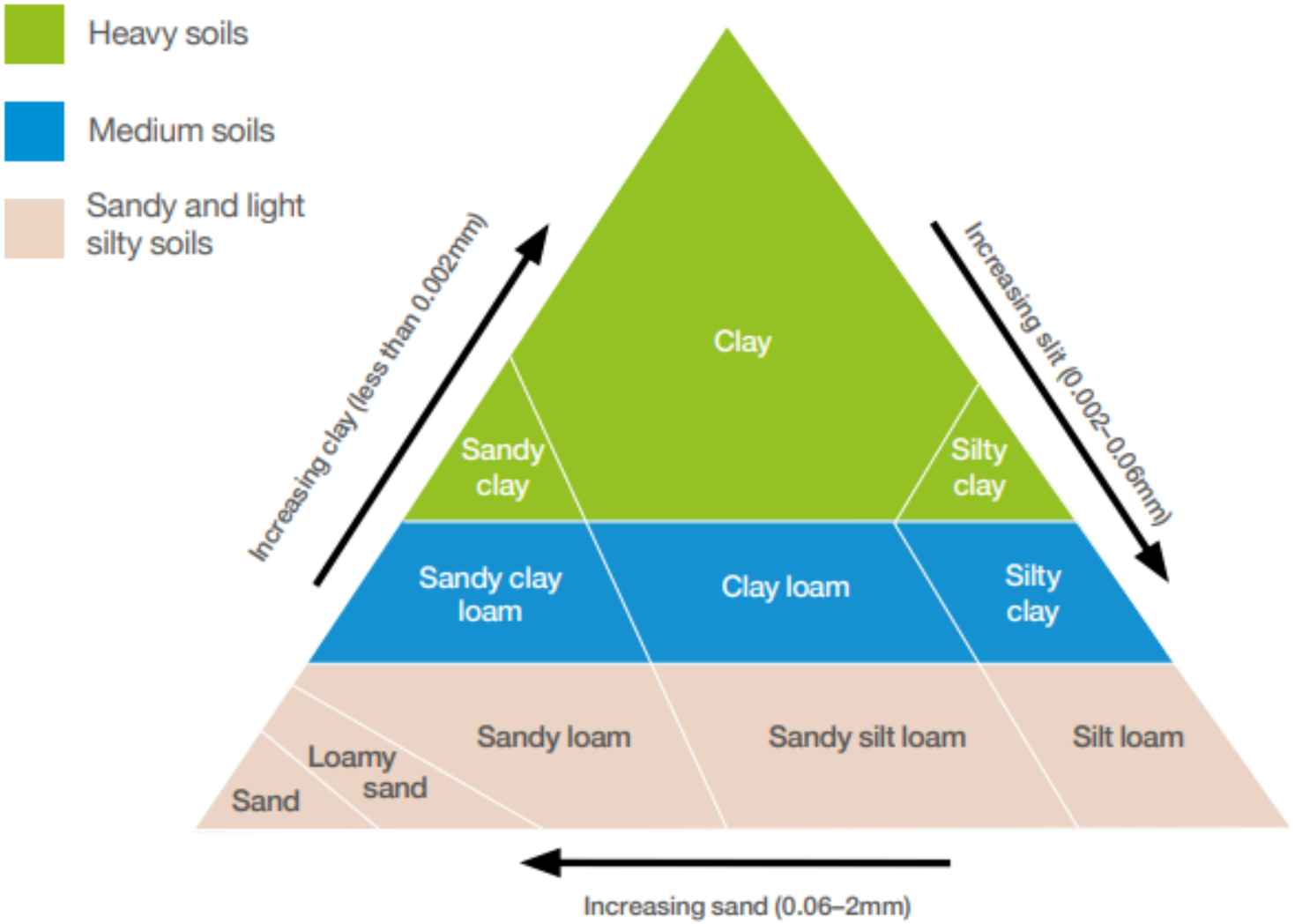
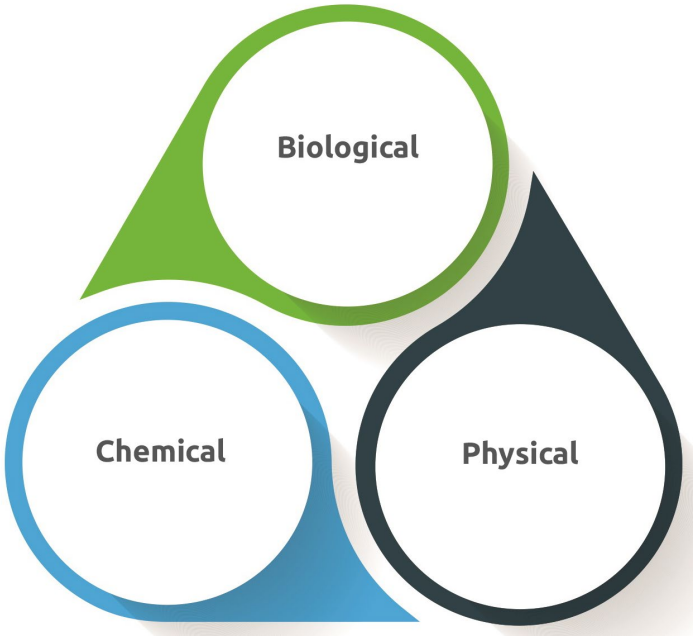


Figure 1. The UK soil texture triangle

Source: Controlling soil erosion (Defra, 2005)

Principles to improve soil health

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



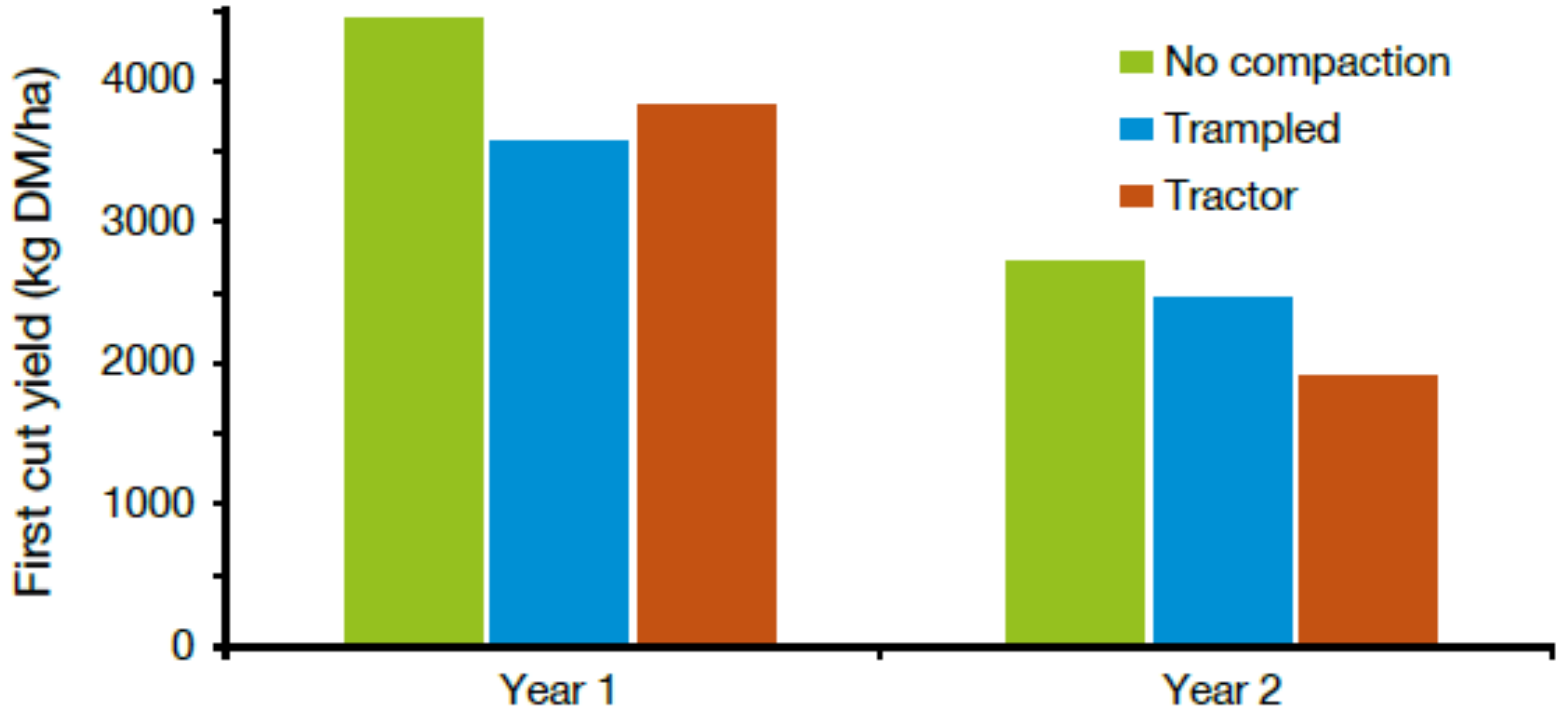
- ✓ Maintain optimum pH
- ✓ Provide plant nutrients – right amounts in the right place at the right time
- ✓ Know your textures and minerals – buffering capacity, free supply!

- ✓ 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

Grassland, forage and soils RP 2011 - 2016

Assessing the impact of soil compaction

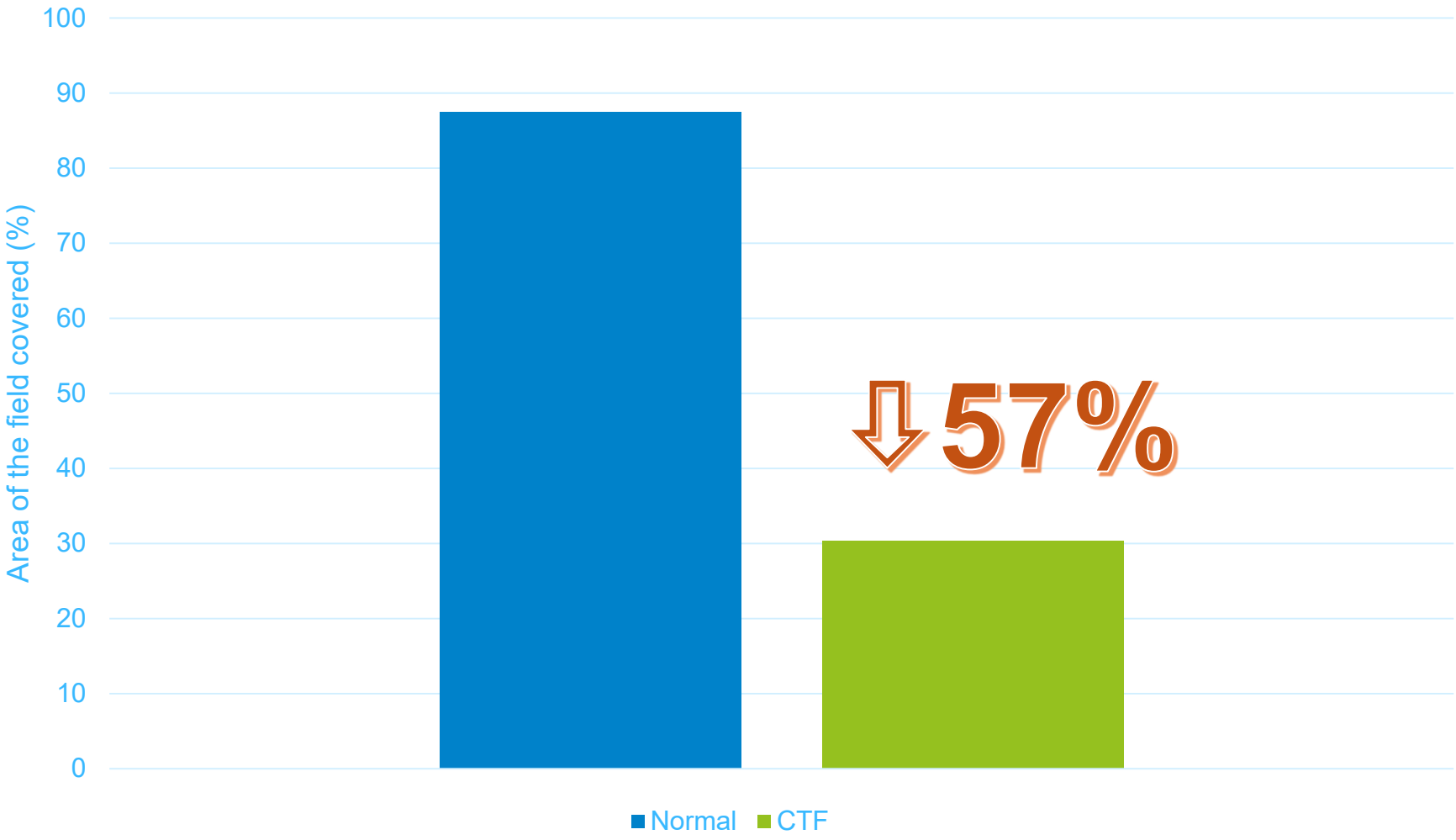
Key results – 1st cut grass DM yield



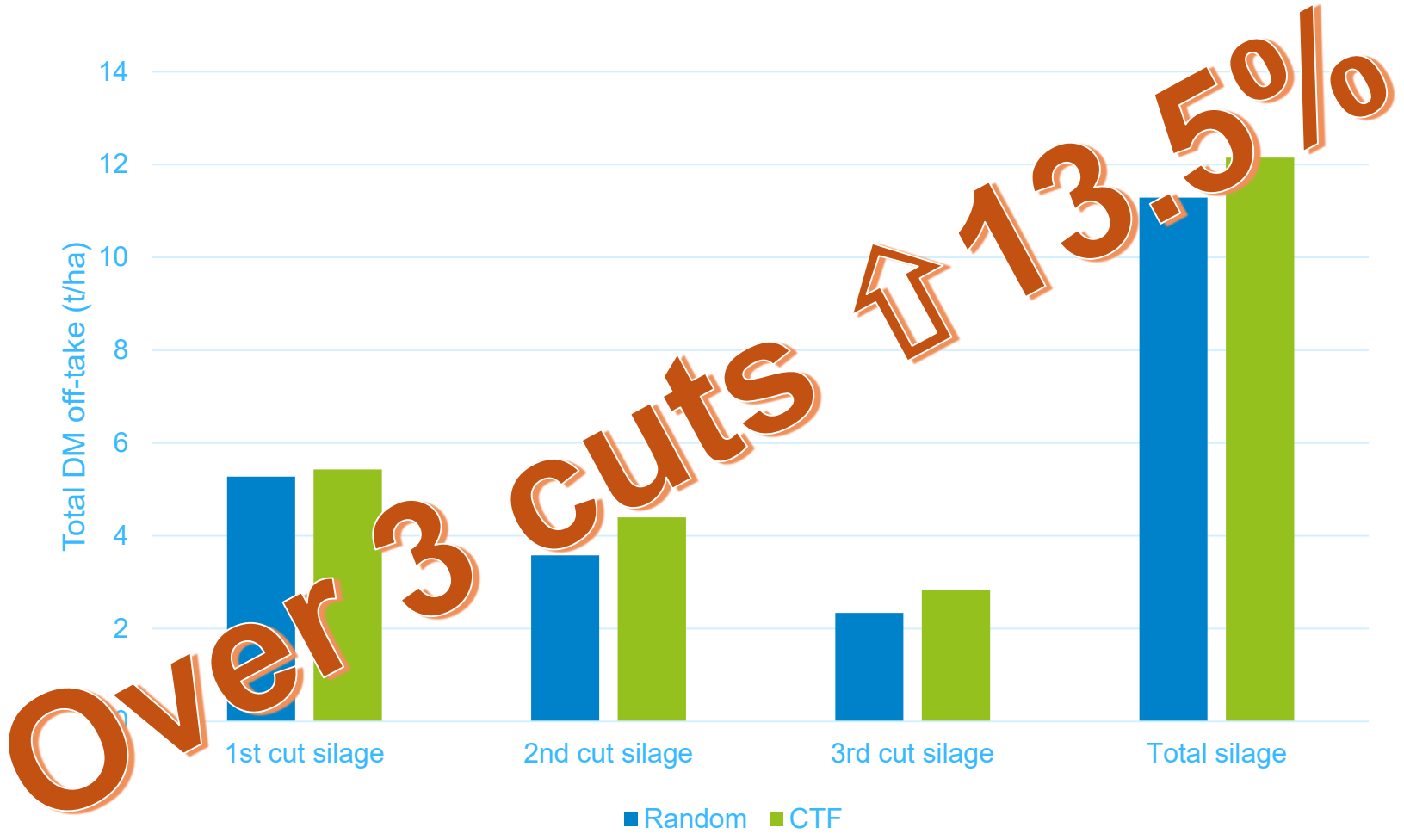
Trampling compaction ⇩ grass DM yield by 14%
Tractor compaction ⇩grass DM yield by 22%

Grassland controlled traffic farming

Key results – Area covered



Key results – Silage DM yield



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GREATsoils Partnerships

Research and Knowledge Exchange

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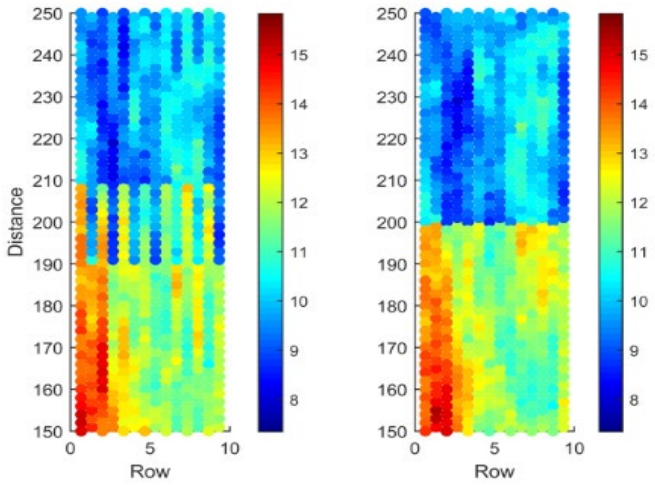
Integrated programme of research and knowledge exchange



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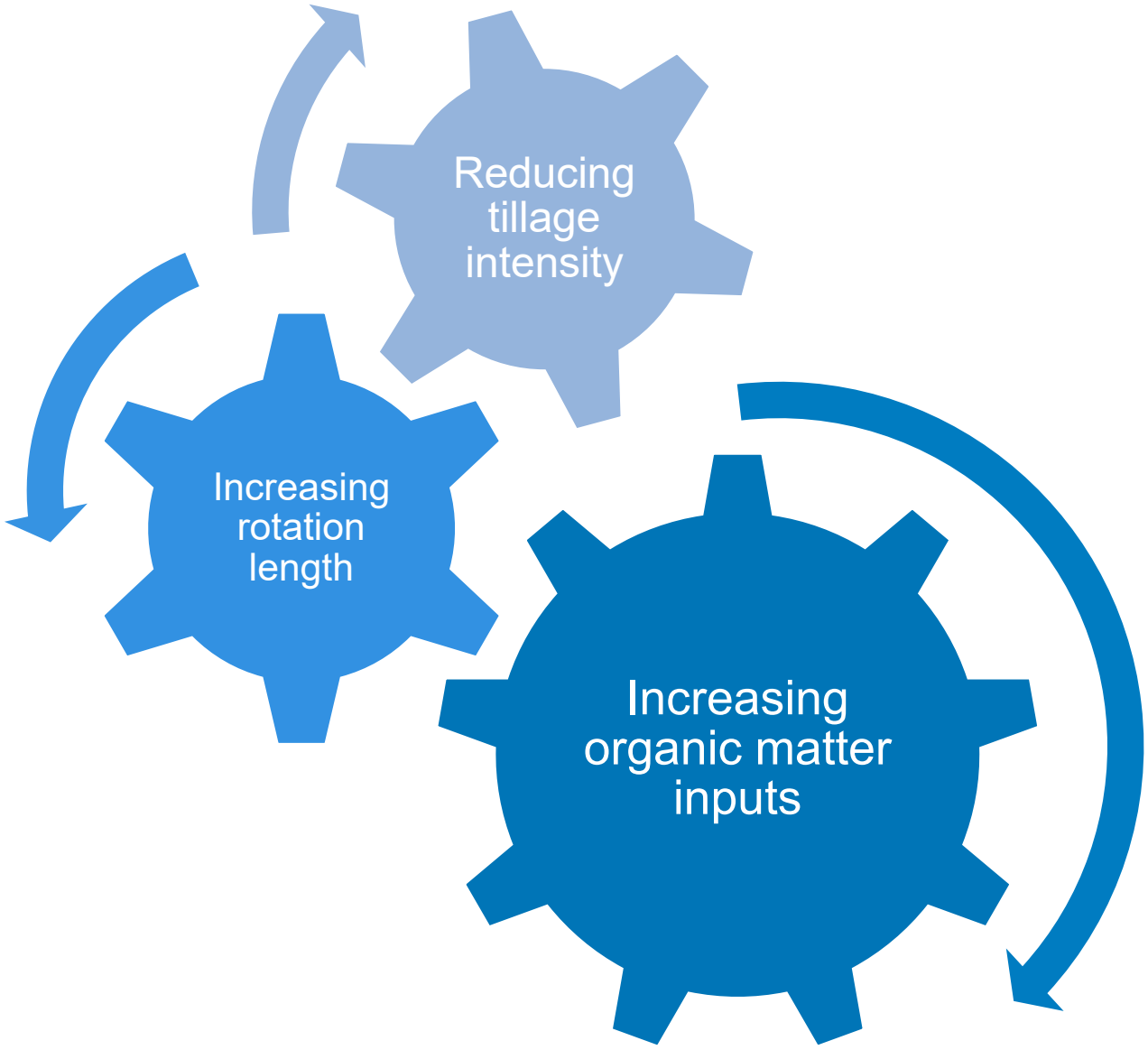

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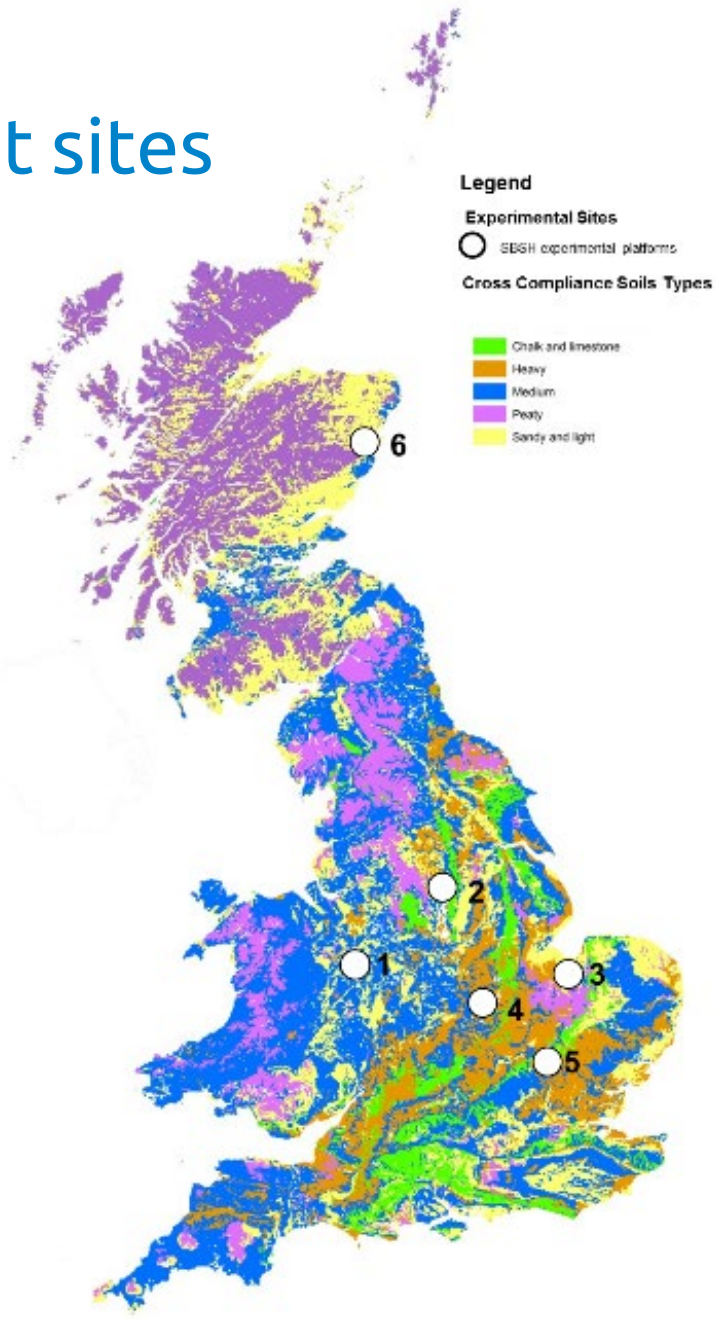
Soil Biology and Soil Health Research Partnership 2017 - 2021

GREATSOILS

Soil health score card assessment sites

1. Harper Adams
2. Gleadthorpe
3. Terrington
4. Loddington - Tillage
5. Boxworth - Drainage
6. Craibstone
   a. Crop rotation x fertiliser; 90+yrs
   b. Crop rotation x pH; 60+yrs.

10-20 years of repeated organic material additions



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Soil health assessments

- Establish relations with:
  - Yield and crop quality
  - Disease and weeds

- Timing:
  - Post harvest/pre-cultivation

- Bulk soil sample for:
  - Physics: VESS, Bulk density, penetrometer resistance
  - Chemistry: NRM soil health index; SOC and total N; potentially mineralisable N
  - Biology: earthworms, microfauna, nematodes; microbial biomass/respiration
    - DNA/eDNA
  - Archive sample

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Initial 'scorecard' results

Samples taken October 2017 in 2 year G/C ley before spraying & cultivation for WW in 2018

Attribute	Control	FYM (23yrs)	Slurry (23 yrs)	Green compost (13 yrs)	Green/food compost (6 yrs)	Food-based digestate (9 yrs)	*P*
pH	6.4	7.0	6.4	7.0	6.2	6.5	*<0.001*
Ext. P (mg/l)	56	73	53	60	59	65	*<0.05*
Ext. K (mg/l)	80	311	194	187	140	167	*<0.001*
Ext. Mg (mg/l)	44	87	75	63	66	48	*<0.001*
LOI (%)	3.0	4.1	3.6	4.0	3.7	3.4	*<0.01*
Bulk density (g/cm^3)	1.40	1.34	1.40	1.29	1.46	1.43	*NS*
VESS score	1.2	1.4	1.3	1.1	1.3	1.5	*NS*
PMN (mg/kg)	29.8	90.2	23.8	43.1	37.7	45.5	*<0.01*

High risk – need to investigate urgently

Moderate risk – need to investigate further

Low risk – continue to monitor

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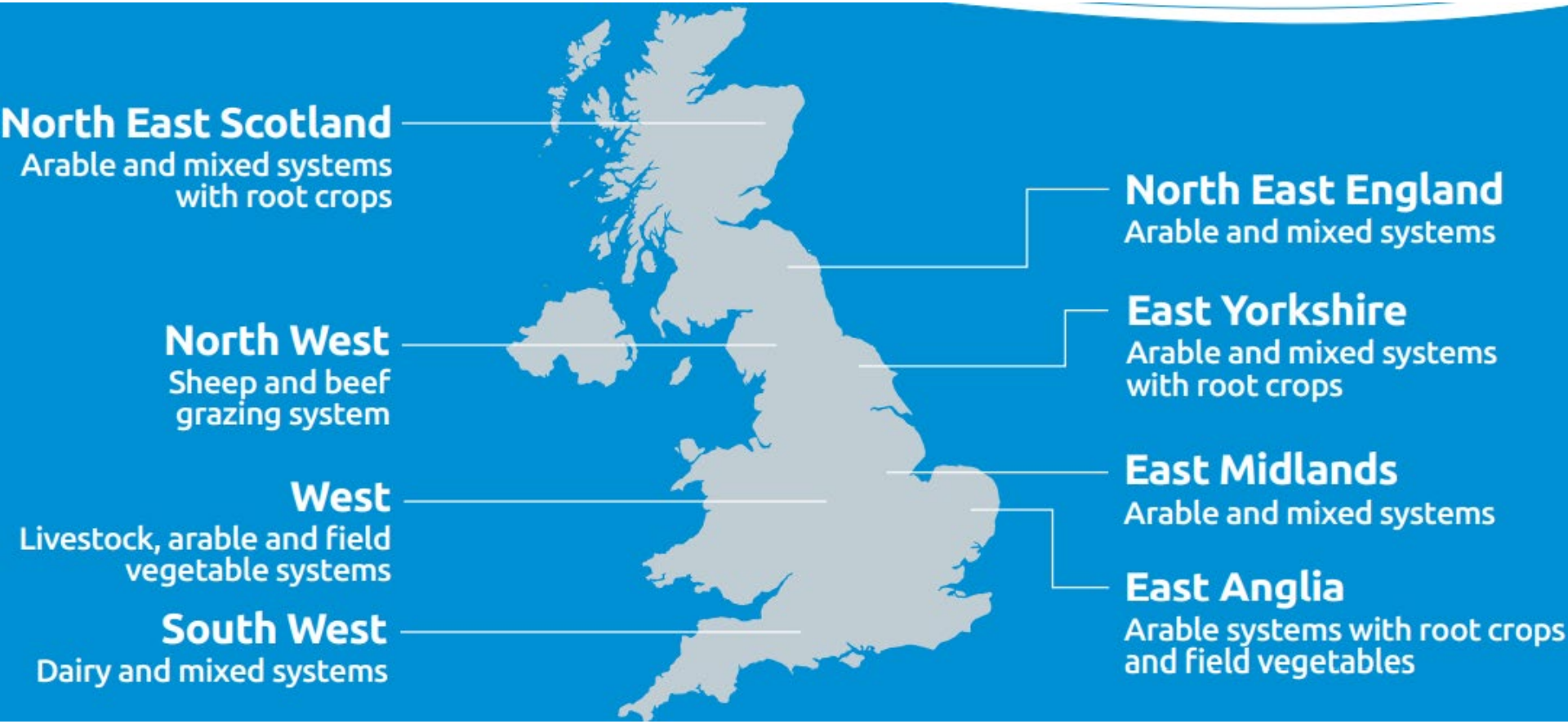
On-farm soil health assessment



Valuing and working with farmer innovation developing locally adapted practices

Example scorecards on light soils in mid-rainfall regions

Attribute*	Field A; Farm 1	Field B; Farm 2	Field C; Farm 3
SOM (%)	3.4	2	2.2
pH	6.7	6.9	7.0
Ext. P (mg/l)	40.6	59.6	37.2
Ext. K (mg/l)	158	106	148
Ext. Mg (mg/l)	82	89	144
VESS score	2	2	2
Earthworms (Number/pit)	13	8	1

Investigate Monitor No action needed

Assessing soil health using DNA

- Can we replace many of the biological assays with analysis of a single DNA sample?

- Issues being addressed:
  - representative sample size
  - Cost
  - interpretation

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Field drainage guide

Principles, installations and maintenance

GREATSOILS

Healthy grassland soils Four quick steps to assess soil structure

Step one: Surface assessment

Look at the quality of the sward to identify potentially damaged areas that require further assessment. Where the sward is moderate or poor, this may indicate that further investigation of the soil quality is required.

Good
- Sward intact
- No poaching
- Few wheelings

Moderate
- Surface poached
- Wheelings in places
- More weed species

Poor
- Surface capping
- Soil exposed
- Severe poaching
- Poor sward quality

Step two: Soil extraction

- Dig out one spade-sized block of soil (depth approx. 30cm). Cut down on three sides and then lever the block out, leaving one side undisturbed
- Lay the soil block on a plastic sheet or tray

Tip: When starting out, it is useful to dig in an area where you know there may be a problem (eg a gateway) and get familiar with signs of soil structure damage.

Remember: Sample when the topsoil is moist – if the soil is too dry or too wet, it is difficult to distinguish signs of poor soil structure.

Step three: Soil assessment

Gently open the soil block like a book to break it up.

- If the structure is uniform – assess the block as a whole
- If there are two or more horizontal layers of differing structure, identify the layer with the poorest structure (the limiting layer)
- Carry out the rest of the assessment on this limiting layer

Step four: Soil scoring

Break up the soil with your hands into smaller structural units or aggregates (soil crumbs).

- Assign a score by matching what you see to the descriptions and photos overleaf
- A score of 1 or 2 is Good; a score of 3 is Moderate and 4 or 5 is Poor and requires management action

GREATSOILS

Soil pH – how to measure and manage it based on an understanding of soil texture

Audrey Litterick, Earthcare Technical

Figure 1. Lime spreading

Action points for Farmers and growers

- Know the texture and type of soils on your holding
- Test your soil pH regularly (at least once every four years and ideally once every two years if you are a high value crop grower on a light soil) and interpret the results correctly for your own soil types
- Choose an appropriate sampling strategy for your own farm and be prepared to spend money on more samples where you find evidence that soil pH could be impacting on crop yield or where you suspect big differences in soil pH within fields
- Be aware that some organic materials applied to improve soil health (e.g. composts, digestates and some types of paper crumble) have a liming (or neutralising) value. It is easy to test these materials for their liming value so that you can determine the likely effect of using them at different application rates on soil pH
- Be aware of the differences between different types of liming agents and their relative advantages and disadvantages. As well as bearing in mind price, choose those appropriate for your own soils

Background

Maintaining optimum soil pH values in all parts of the field is essential in order to maintain soil quality and health, crop quality and yield. This guidance document explains why soil pH is important and outlines the impact of soil type and texture on pH. It describes how and when to test soils for pH, how to calculate the amount of lime or other neutralising and

Soil pH is a measure of the relative acidity or alkalinity of a soil. While the scale goes from 0 to 14 (with a neutral pH represented by 7.0) most agricultural soils have pH values of between 5.5 and 7.5. The pH scale is logarithmic; that is a pH of 5 is ten times more acidic than a pH of 6. The natural pH of a soil is determined by its chemical composition, but most agricultural soils with natural pH values of less than 7 will gradually acidify over time and regular applications of lime will be needed to maintain soil pH at target (Figure1).

Soil pH has a profound effect on nutrient availability to crops, with most essential plant nutrients being most available to most crop plant species within the pH range of 6.0 to 6.5. Crop quality and yield can be severely affected where soil pH is not maintained close to target for the soil and crops in question and total crop failure is possible in vegetable crops where trace element deficiency has resulted from inappropriate soil pH. Soil pH also affects uptake of potentially toxic elements (PTEs), with PTEs such as cadmium made more available for crop uptake at lower pH values. Soil pH also affects the numbers, diversity and functions of beneficial and pathogenic micro-organisms as well as the larger organisms including both soil-dwelling pest species and beneficial macrofauna species. For example, the soil-borne pathogen *Plasmodiophora brassicae*, which causes clubroot in vegetable brassicas and oilseed rape, prefers more acidic soils, and liming to raise the soil pH is a management option for clubroot control. Earthworms are most abundant and active in soils with pH values between 5.5 and 7 and most species cannot function well in soils with pH values lower than 5.0.

Failure to correct soil acidity can cause substantial yield losses and a decline in soil quality and health. Over-use of lime (or certain organic materials which have neutralising values) can create problems with trace element availability. A survey

GREATSOILS

Compost is good news for soil health

Case Study 1 – Audrey Litterick, Earthcare Technical

Figure 1. PAS 100 compost

Action points

- **Aim to increase your Soil Organic Matter (SOM) levels, as this can have multiple benefits for soil health. Adding compost to your soil is an effective way of increasing SOM. In trials, compost increased SOM in half the time of farmyard manure**
- **Check guidelines before using compost. Most UK farm assurance schemes now permit the use of quality PAS 100 composts*, as do most produce buyers, but some have rules governing their use**
- **Determine if adding compost to your soil is cost-effective by comparing the costs of buying, hauling and spreading compost with the financial value of the nutrients compost supplies and the yield benefit**
- **Bear in mind that soil quality and yield benefits can take several years of continued compost use to develop**

*Nearby compost suppliers can be found by entering the holding's postcode at the UK Compost Certification Scheme website qualitycompost.org.uk/producers

Background

Soil Organic Matter (SOM) is the organic component of soil, consisting of three main parts:

- Fresh plant residues and small living soil organisms
- Decomposing (active) organic matter and
- Stable organic matter (humus).

Organic matter is important for soil fertility and crop productivity; building and maintaining it is a vital component of sustainable soil management. The amount of organic matter in soils depends on soil texture, climate, the input and composition of organic materials, decomposition, and the type of farming system employed.

Soils used for arable and vegetable production typically contain 1–3% organic matter (generally higher in Scottish soils). In general, for any one cropping system, the natural level of SOM in a clay soil will be higher than in a sandy soil, and grassland soils usually contain more relative to a continuous arable rotation. Therefore, whilst it is generally good to increase your SOM content, vegetable growers on a sandy soil should not expect to achieve and maintain the same SOM content as pasture-fed livestock-producing neighbours on a heavier soil.

Many soils are suffering from a lack of organic matter. Farmers and growers often want to maintain or enhance SOM content as this can have a range of benefits for soil health. However, recent work has shown that, where improved soil quality is concerned,

FACTSHEET

GREATSOILS

Soil structure and infiltration

Figure 1. Mini Disk Infiltrometer measuring effect of compost on soil infiltration

This factsheet outlines a simple method for measuring infiltration in the field. It also explains how adding organic matter to soil can improve soil structure and water infiltration.

Action points

- **Improve soil structure to increase the ability of soil to absorb and retain water**
- **The use of organic materials such as compost and green manures can improve infiltration and the ability of soil to absorb increasingly intense winter rainfall**
- **Use the drainpipe test as a cheap and simple way to measure the infiltration of water into soil. When combined with the spade test, the causes of reduced infiltration (eg compaction at depth) can be quickly identified**
- **Improved infiltration of rainfall helps to reduce soil erosion and the loss of nutrients from land to water**

Challenges

Although average annual rainfall for England and Wales hasn't changed significantly since records began in 1776, all regions of the UK have experienced an increase in heavy rainfall events in winter. These events are not restricted to winter: the spring of 2012 saw exceptionally wet weather which affected all of England, Wales and eastern Scotland.

An increase in the intensity of single-day rainfall events could lead to an increase in soil erosion and the associated loss of nutrients such as phosphate to drains and rivers. Managing soil health, in particular maintaining good soil structure, is an essential part of the strategy to improving resilience to changing rainfall intensity. Improving the ability of soil to absorb water during intense rainfall events (infiltration) reduces the risk of erosion. Improved infiltration also retains more water within the soil rooting zone for use by crops and reduces the risk of subsurface flow and leaching.

There are several ways to assess the rate of infiltration of water into soil (the hydraulic conductivity), with the more sophisticated methods giving more detailed information. For example, a Mini Disk Infiltrometer (Figure 1) not only

FACTSHEET

GREATSOILS

How to count earthworms

Importance

Earthworms improve plant productivity, are principally responsible for engineering the soil environment and are an important food source for native birds such as the song thrush. There are up to 10 common earthworm species in agricultural soils and these can be grouped into three ecological types: epigeic, endogeic and anecic earthworms – each group having a unique and important function. Earthworms are an indicator of soil health, being impacted by pH, waterlogging, compaction, tillage, rotation and organic matter management.

What do earthworms tell us?

- A good presence of earthworms across a field means the benefits are likely to be widespread
- High numbers of earthworms indicate the potential for significant benefits to plant productivity
- The presence of each ecological group indicates the potential for specific earthworm benefits, such as carbon cycling, nutrient mobilisation and/or water infiltration

How to identify earthworms

Epigeic (litter-dwelling earthworms)

- Dark red-headed worms
- Small (<8cm) in size, typically about the length of a matchstick
- Often fast-moving (most likely to escape from the worm pot!)

Sensitive to: Tillage (detrimental) and organic matter management such as manure applications (beneficial)
Roles: Carbon cycling and prey for native birds

Endogeic (topsoil earthworms)

- Pale-coloured and green worms (not red)
- Small to medium size
- Often curl up when handled, and green worms may emit a yellow fl
- The most common earthworm group found in arable fields

Sensitive to: Organic matter management (beneficial)
Roles: Soil aggregation and nutrient mobilisation for plants

Anecic (deep burrowing earthworms)

- Dark red or black-headed worms
- Large size (>8cm), typically similar size to a pencil
- Make deep vertical tunnels, up to 2m
- Often found below surface earthworm casts or midden residue piles
- Feed at night, foraging the soil surface around their burrow for litter
- Commonly found in grassland but often absent from ploughed fields and where there is no surface litter

Sensitive to: Tillage (detrimental) and organic matter management such as manure applications and straw return (beneficial)
Roles: Deep burrows that improve aeration, water infiltration and root development

FACTSHEET

GREATSOILS

Soil assessment methods

Soil health

Many farmers and growers are concerned about the health of their soils. They understand the importance of soil health for the productivity, sustainability and profitability of their business, but many face significant challenges when interpreting results from laboratory analysis or when choosing suitable methods for assessing the health of soils beyond the standard pH, phosphorus (P), potassium (K), magnesium (Mg) analysis.

To be of value to farmers and growers, methods for soil assessment should not only measure soil health, but they should also provide information that can be used to inform decision making in relation to soil management. This factsheet provides an overview of the various methods of soil testing that are currently available.

Indicators of soil health

The functioning of soil depends upon a complex interaction between organisms large and small, chemical reactions in solution and on surfaces of clay particles; all within a structure determined by natural processes and modified by soil management.

A broad range of appropriate indicators of soil health are therefore needed to evaluate the effects and sustainability of agricultural practices. The most commonly agreed and used indicators can be grouped in the three categories of (1) biological, (2) chemical and (3) physical parameters.

Assessment methods

During a series of regional consultation meetings in autumn 2015, horticultural growers in Great Britain discussed different approaches to soil assessment - methods they found useful and reasons why others were not commonly used. Growers rated the methods and the results are given overleaf.

Further information

This factsheet is an output of the AHDB Horticulture GREATsoils project CP 107b.

More information on soils and soil management is available on the AHDB website at **ahdb.org.uk/greatsoils**

Action points

- **New methods of assessing soils are available, but they require careful consideration and interpretation**
- **Assess soils beginning with methods which you understand, before progressing to those that are more complex**
- **Assess soil texture and structure in several locations representing 'good' and 'bad' areas within a field and compare results with those of un-cropped field margins.**
- **Develop a soil management plan which takes into account physical, chemical and biological indicators of soil health**

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Testing soil health

Action points

- **Develop a five-year soil health testing action plan for your farm**
- **Be clear on the reasons for testing soil health**
- **Prioritise fields for soil health testing, especially where money and time are limited**
- **Compare the best performing field areas with the worst performing or field margins**
- **Choose soil physical, chemical and biological tests based on the main priorities and concerns**
- **Keep good records to track changes in soil health over time**
- **Collect additional weather data and information on crop yields, quality, health and ease of cultivation**

What is soil health?

Soil health is the ability of a soil to sustain, in the long term, its most important functions. A healthy soil will be able to sustain crop and livestock productivity and maintain or enhance environmental benefits. It requires a good balance of physical, chemical and biological soil properties, many of which can be tested.

Why test soil health?

A field's soil health can often be improved and many farmers and growers consider adopting new approaches to achieve these improvements.

When planning major changes to a production system (eg a move to reduced tillage systems, an increased use of composts, green manures and cover crops, reintroduction of livestock or incorporation of crop residues), it is particularly important to gather good baseline data on soil health.

By testing a range of soil physical, chemical and biological properties, a good overall picture of how they affect the productivity of the land will be obtained. Over time, baseline information can be used to make management decisions that meet your objectives and help you measure success.

The following flow chart summarises the main considerations when planning and managing the health of your soil.

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AHDB

Unearth a wealth of information on soil management at

www.ahdb.org.uk/greatsoils


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

Horticulture Focus

AMBER

Joe Martin

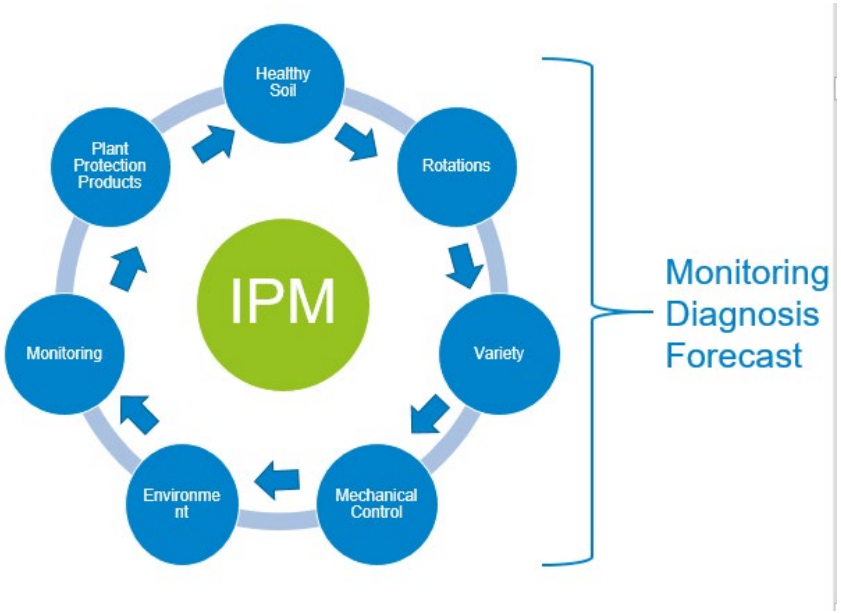
HORTICULTURE

Key priorities in horticulture

£8.8m levy invested in 2017/18

Four key areas of activity:

1. Plant health & crop protection
2. Addressing the labour challenge
3. Practical tools
4. Improving engagement & communications



IPM

Integrated Pest Management (IPM) is an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimize the use of pesticides

Why AHDB and IPM?

- Market Failure –
  - limited opportunities for business to develop IPM approach since largely reliant on pesticide sales
  - Levy payers lack awareness, understanding and confidence to implement
  - Chemical control is the “easy” option – little incentive to change in short term
- We already do it
- Knowledge intensive so the Knowledge Exchange is key to delivering information to industry
- Uniquely positioned with current networks, initiatives and knowledge to deliver IPM to the industry

AMBER

Application & **M**anagement of **B**iopesticides for **E**fficacy and **R**eliability

The aim of this work is to have UK growers adopting new practices that have been demonstrated to improve the performance of individual biopesticide products within commercial integrated pest and disease management (IPDM) programmes

- 5 year program conceived & funded by UK growers
- protected edible & ornamental crops.
- Develop management practices to improve biopesticide performance, grower confidence & uptake.
- Consortium (WCC, RSK-ADAS, Silsoe Spray Application Unit, Roma Gwyn, Rob Jacobson)
- Project Lead – Dave Chandler
- Industry representatives

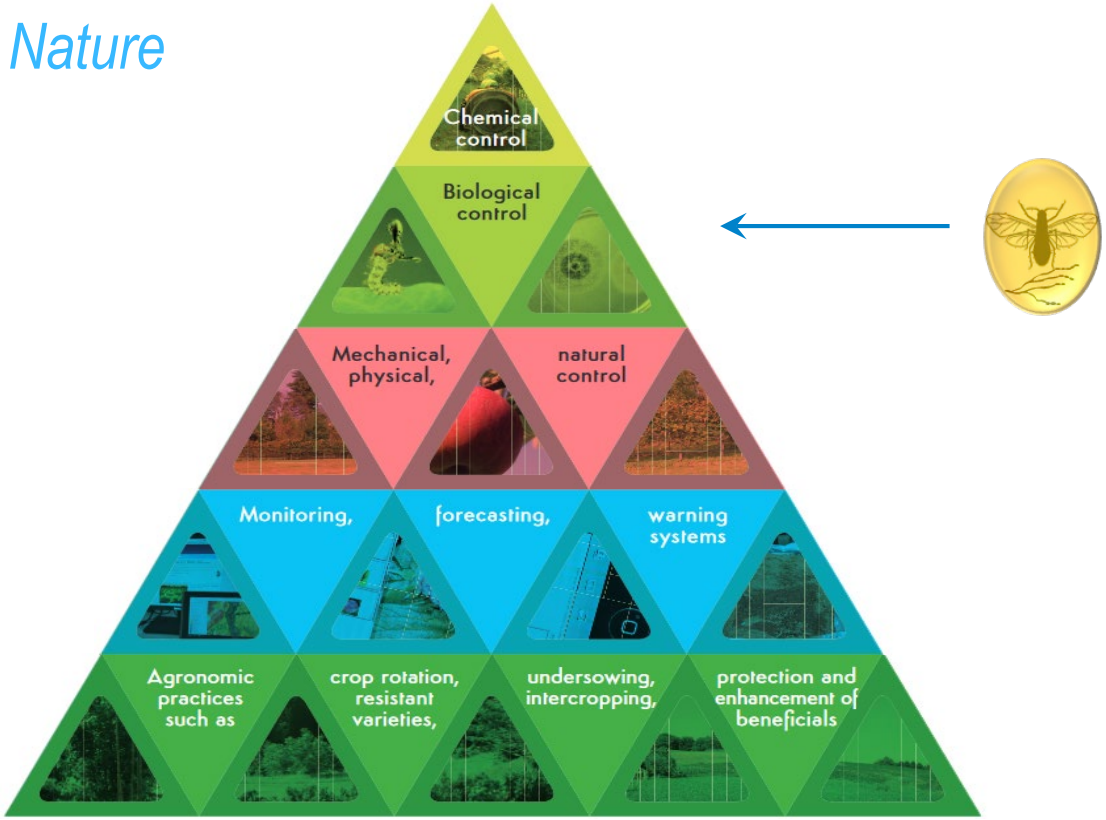
Sustainable Use Directive – IPM

IPM – Working with Nature

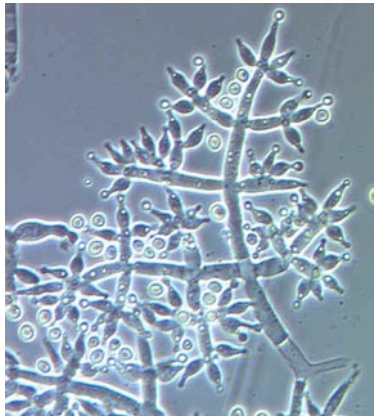
IOBC
OILB

Pesticide
Action
Network
Europe

IBMA
INTERNATIONAL BIOCONTROL
MANUFACTURERS ASSOCIATION

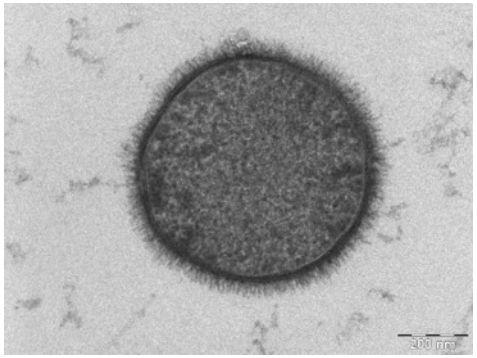


Biopesticides:



- Plant protection products based on:
  - Living microbes.
  - Natural products: e.g. plant extracts (botanicals), insect sex pheromones.

- Regulatory authorization.
- Formulated, packaged etc.



- Sprays, drenches, granules.
- Use as IPM tools.

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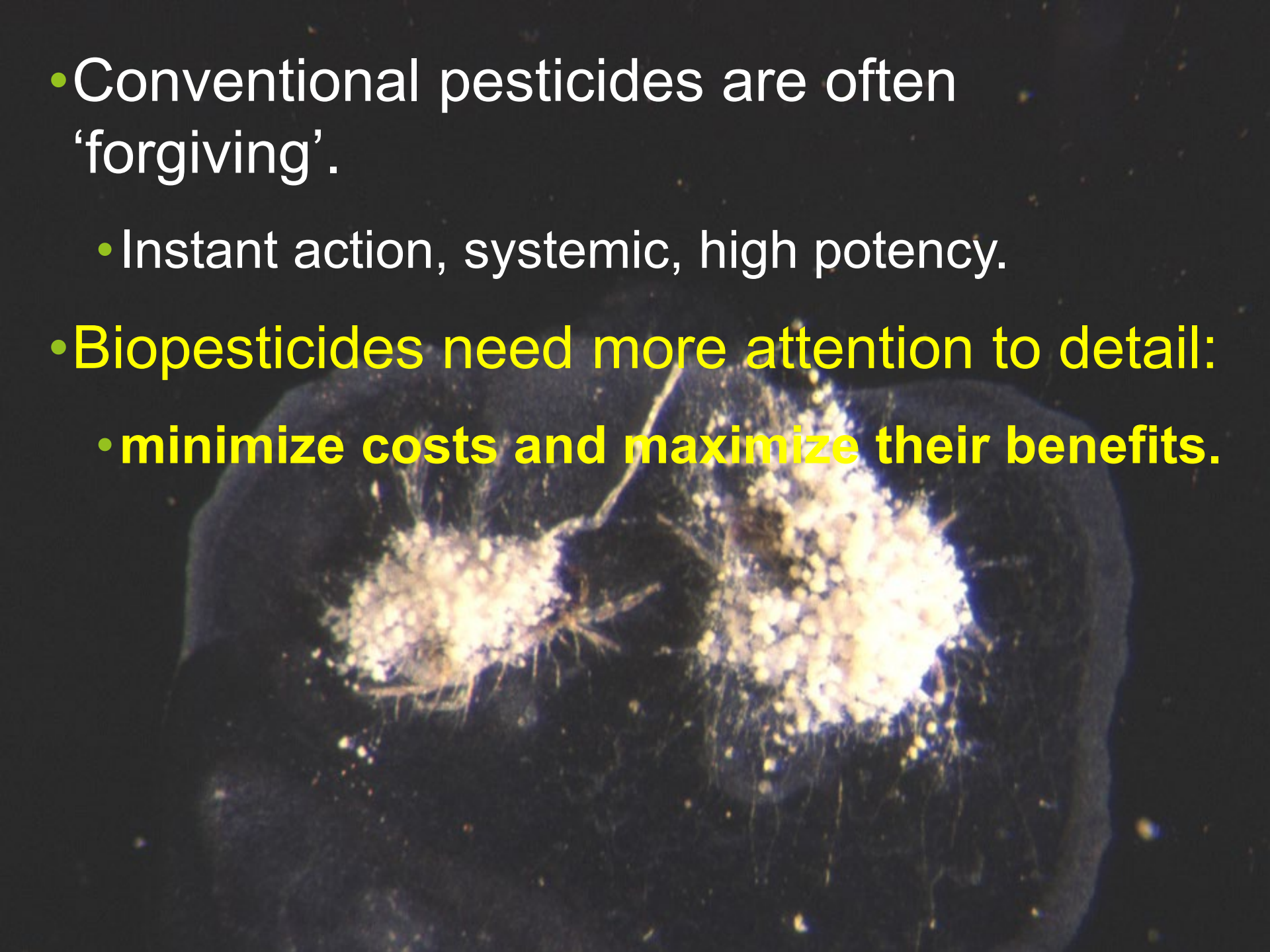
Biopesticides: pros and cons

- Safe to people and environment.
- MRL exempt.
- Low harvest interval.
- Spray, drench etc.
- Can work well in IPM – reduce dependency on conventionals.

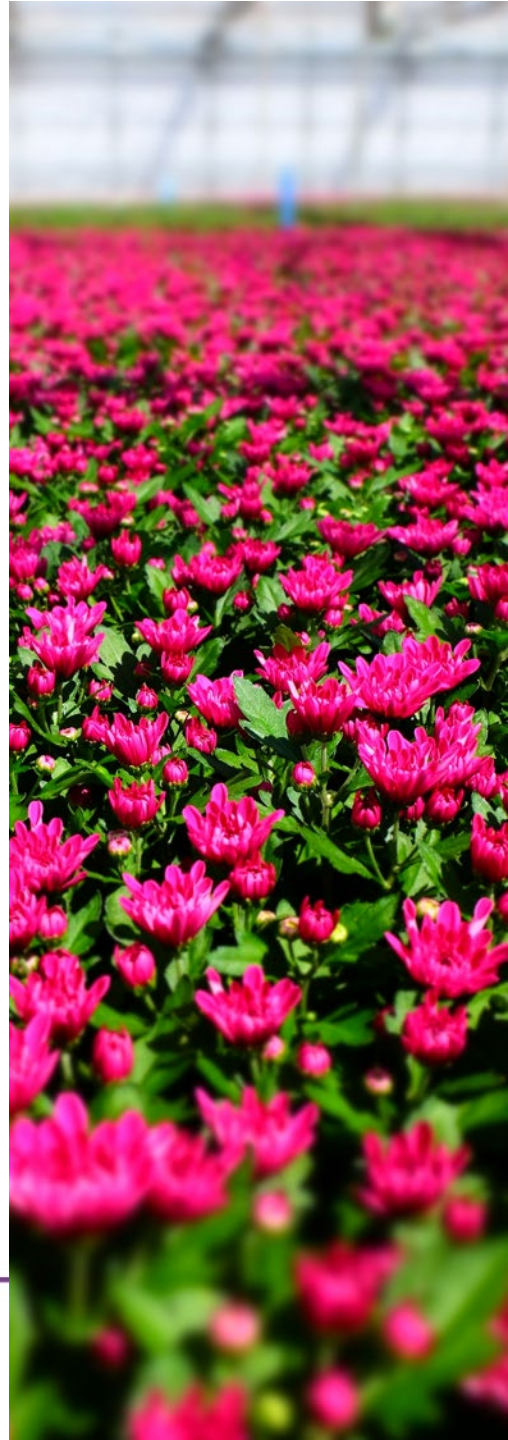
- Slower acting.
- Many have contact action – so not systemic.
- Lower persistence.
- Lower efficacy.
- Environmental conditions.



- Conventional pesticides are often ‘forgiving’.
  - Instant action, systemic, high potency.
- Biopesticides need more attention to detail:
  - **minimize costs and maximize their benefits.**

The AMBER challenge

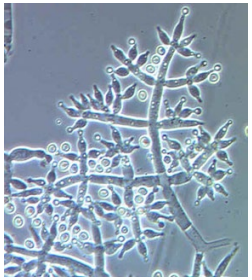
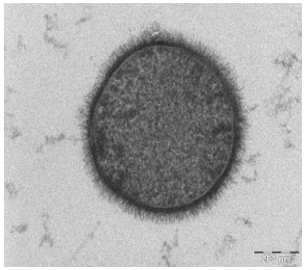
- Capture the benefits of biopesticides and mitigate for their downsides.
- Do this by changing grower practice (as this is in our control).
- Need generic tools & practices:
  - Different crop types.
  - Different P & D.
  - Different biopesticides.
- IPM compatible; look to the future.
- This is not easy.



Industry benefits

Help to get the best out of the biopesticide tool kit



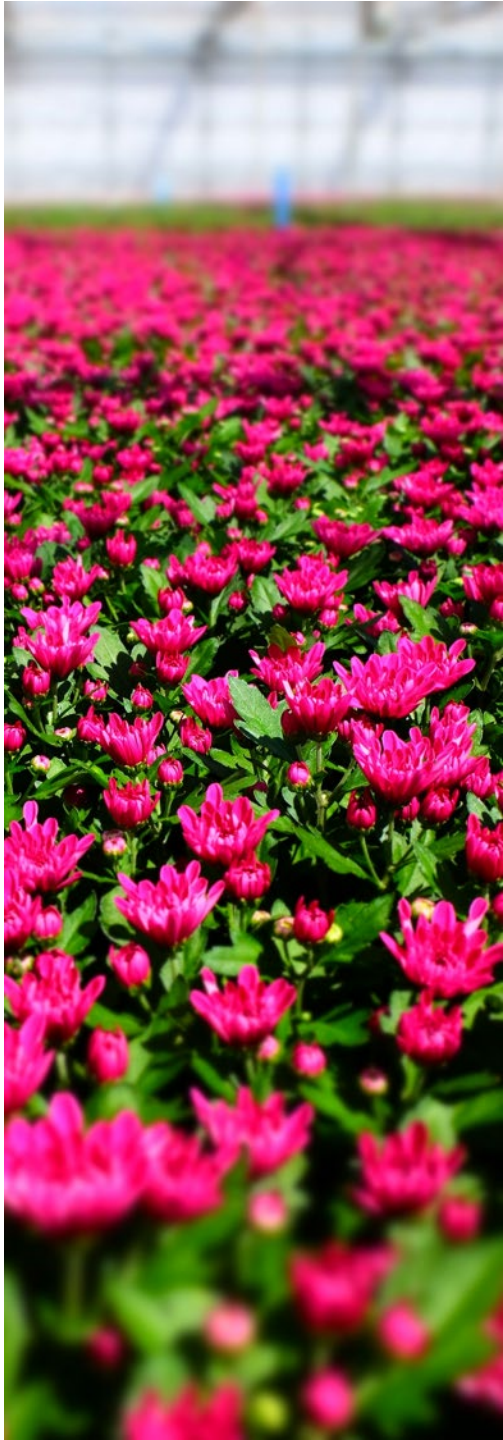
Help growers to improve spray application, with recommendations on water volume, best way to deliver required dose

Improve information on timing and frequency of microbials

Develop some core principles that growers can use to optimise the use of biopesticides in IPM

Biopesticide ‘benchmarking’

- Observed how growers used microbial biopesticides as part of IPM, following product guidelines.
  - Aphids, pepper.
  - WFT, chrysanthemum.
  - Whitefly, poinsettia.
  - Powdery mildew, cucumber.
  - Botrytis, cyclamen.
  - Root rots, Choisya & Dianthus.
- Identify issues that were likely to affect biopesticide performance.



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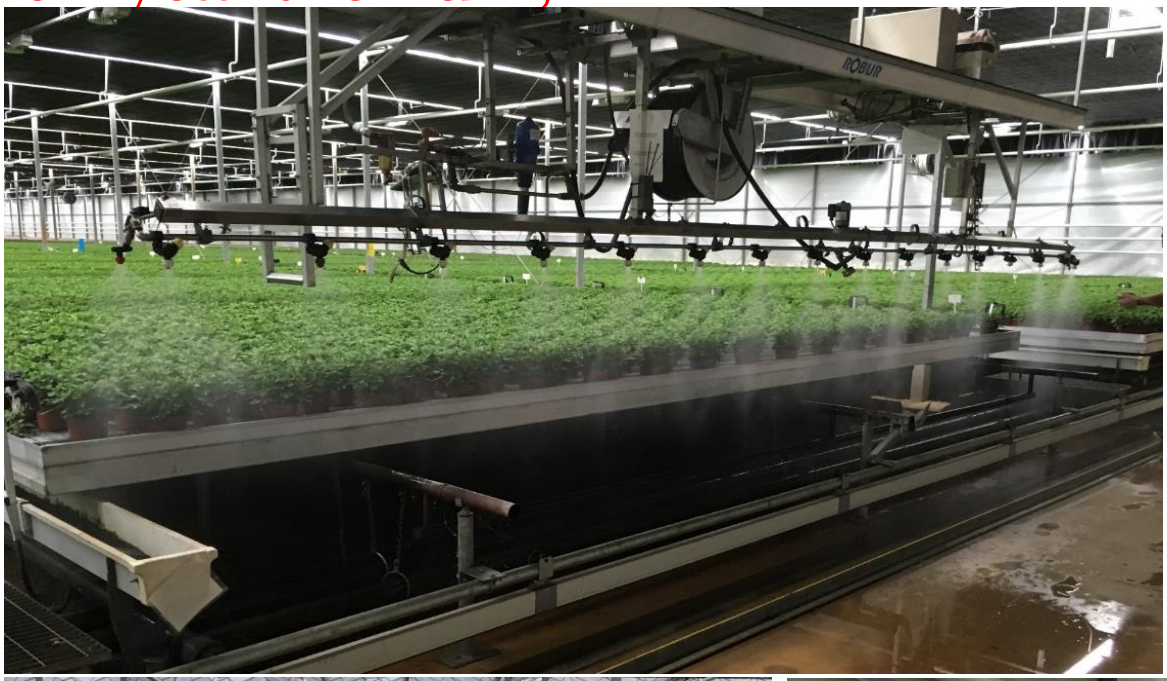
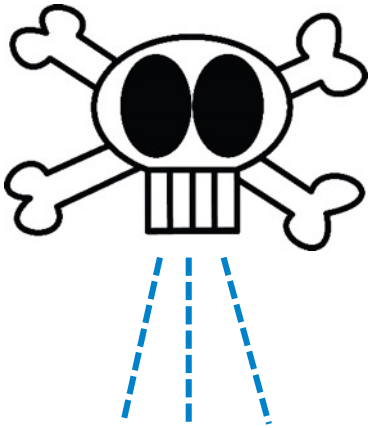
Beauveria; western flower thrips; chrysanthemum;



Effective application

(contact acting)

Right dose



Right place & time

Avoid waste

Biology of pest, disease & M.o.A. biopesticide

Environment; other IPM tools

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Working in 4 areas

Spray application: relationship between water volume and % of spray retained on crop.

Biofungicide performance: new knowledge on biofungicide persistence to improve timing of application.

Bioinsecticide performance: new knowledge on how pest population growth rates influence biopesticide application strategy.

Knowledge exchange: explain the science, get core message out.

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1) Improving spray application (Silsoe)

- How does water volume affect % of spray retained on leaves?
- Most efficient way to deliver required dose to target.

AHDB

Puddling on leaves leading to run off

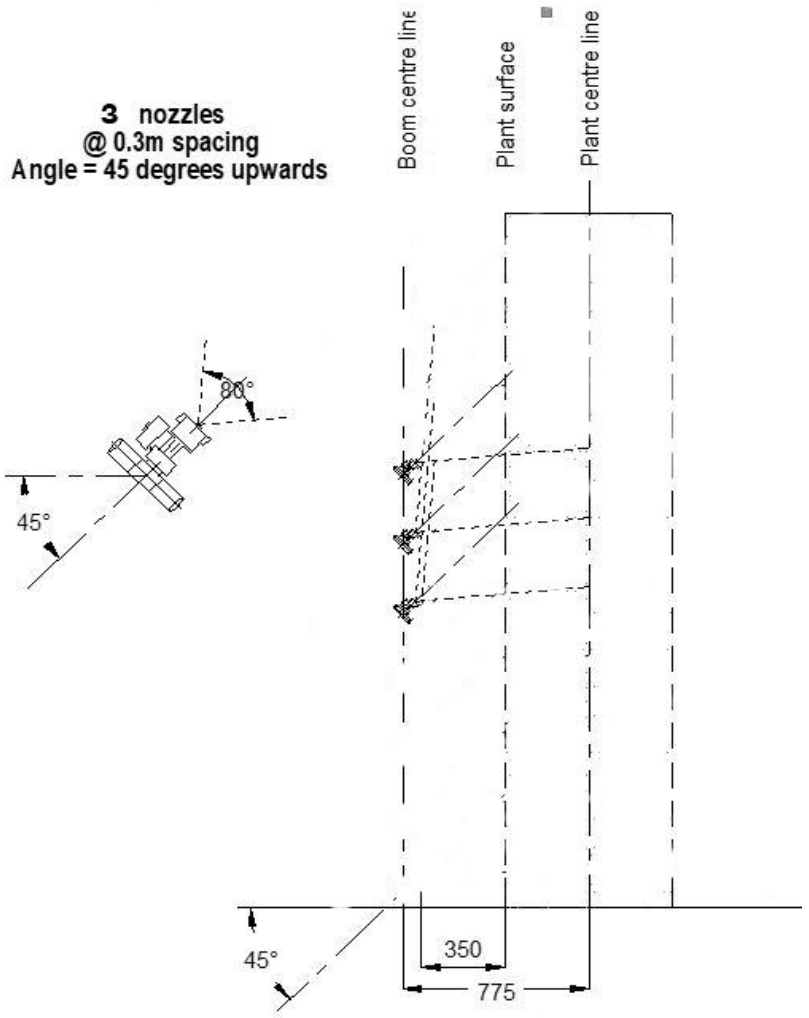
Optimal water vol. = 500 L / ha. Label rate = 1000 L / ha.

1028l/ha

685l/ha

Application to a vertical crop

- Small area of crop available – only space for two treatments
- Some bespoke spraying kit needed – based on existing available equipment at Warwick…
- …taking account of previous HDC study



Application to a vertical crop

- Relationship between quantity deposited and volume applied appears to be less clear-cut for vertical crops than for horizontal ones
  - Is this due to much greater variability in the data?
- Very high volumes applied to the crop are likely to be less efficient
- Normalised data suggests no significant difference over a wide range of volumes – maybe up to around 1,200 L/ha (applied to the crop)

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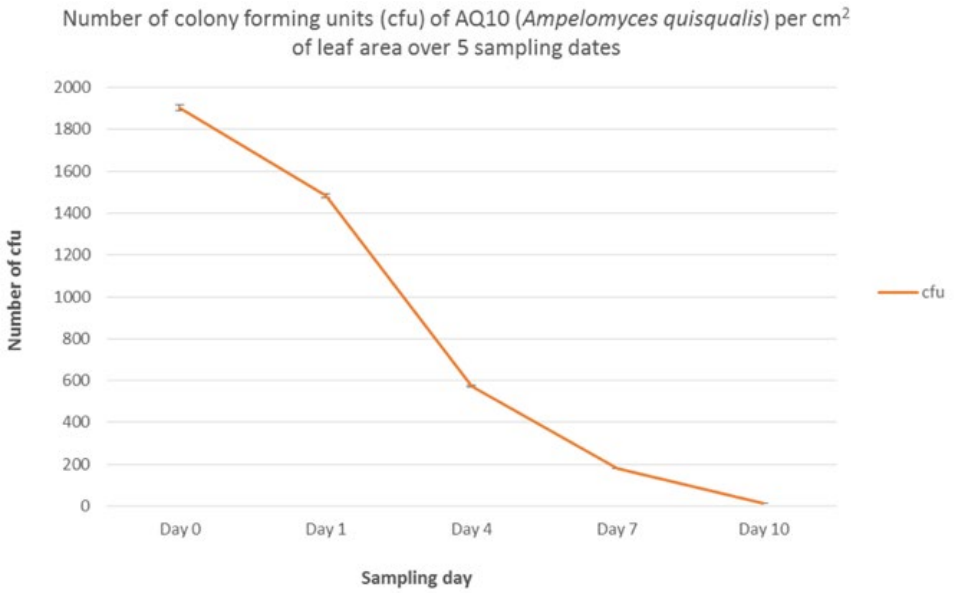
(2) Informed timing of biofungicide application (ADAS)

- Understand the mode of action of the biopesticide …
- …as it relates to the biology of the disease.



- Example: AQ10 - a parasite of powdery mildew.
- It does not persist long in the absence of its host.
- When is the best time to apply it? **The 'Goldilocks' zone**.
- How do you make this happen?

Alert on smart phone: high risk conditions for powdery mildew

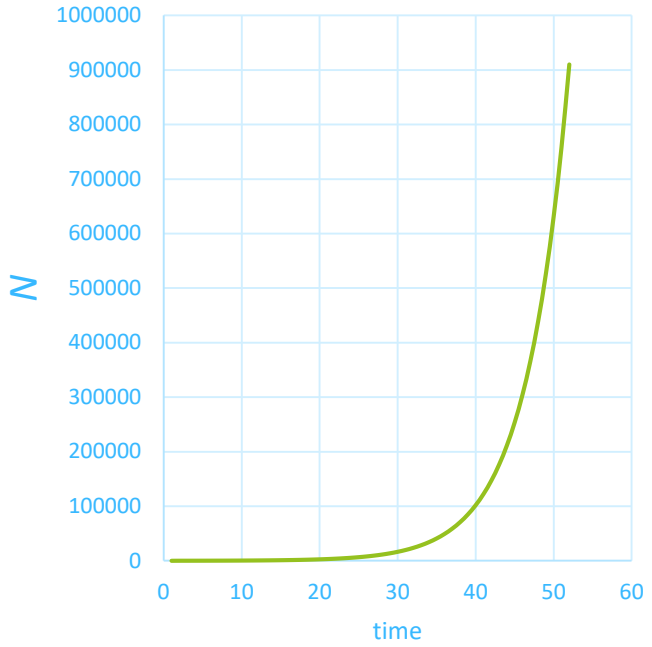
Apply AQ10

Understanding biology of AQ10 – tells you best timing for application

Environmental sensors: Humidity & temp.

(3) Pest growth rate & biopesticide activity.

- Pests show exponential growth.
- BP efficacy affected by speed of kill, pest growth rate & population size.



- How does pest growth rate, speed of kill, crop type etc. determine the best application strategy?
- The Goldilocks zone again.

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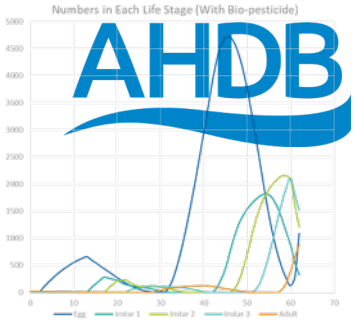
Biopesticides & pest population growth



- BP- pest ‘race’: kill pest before it reproduces.
  - Crop type, temperature, life stage susceptibility.
  - Effects of starting population size.
- Use models to inform best biopesticide strategy for particular pests & crops (when to apply, what product type.)

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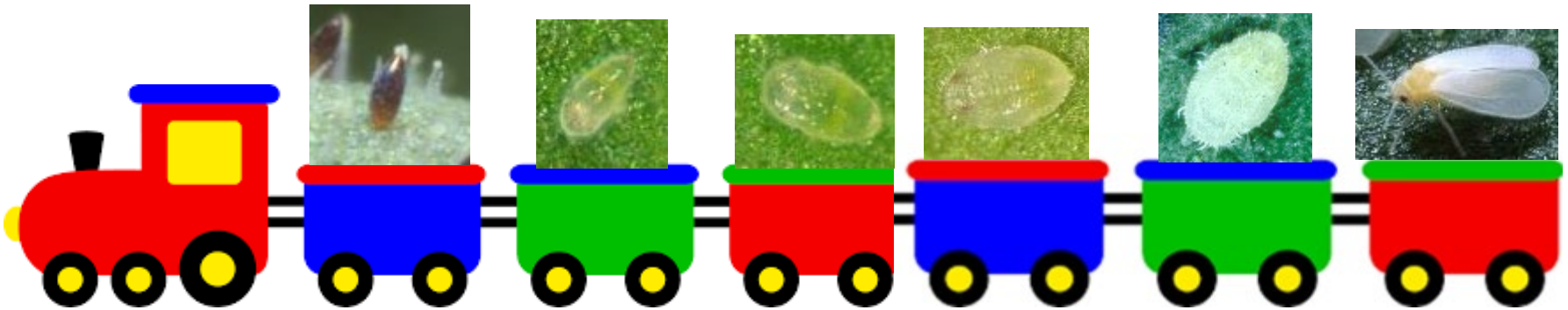
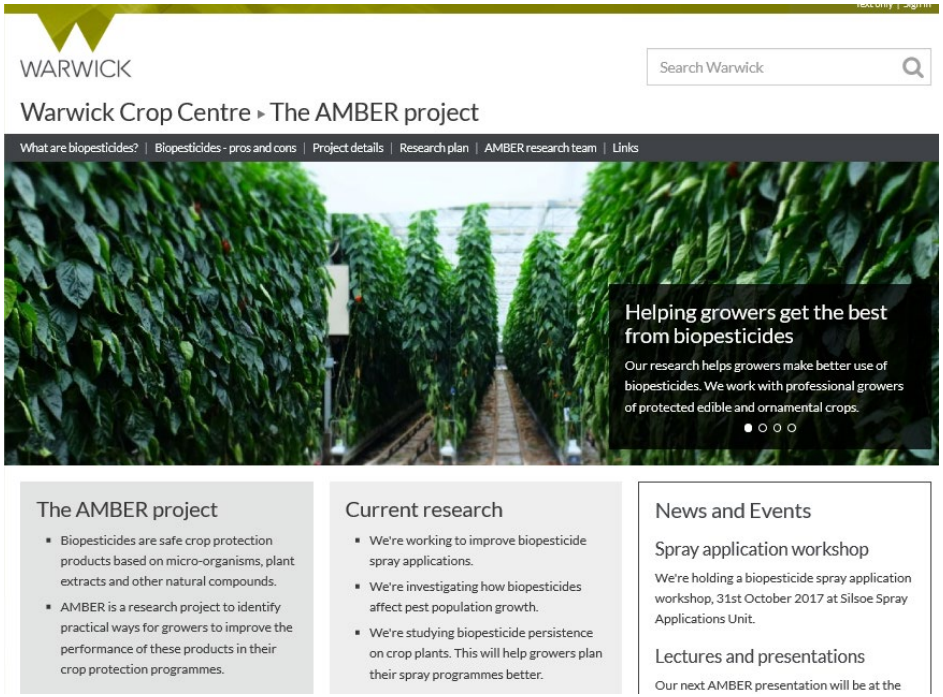
Boxcar model for glasshouse whitefly

- Simulates number of individuals at each life stage (train carriage)
- Tracks the maturation of individuals to next life stage (movement between carriages)
- Calculates numbers of new eggs laid per day
- Individuals lost to natural mortality
- Simulates applications of EPF (frequency & timing) and control efficacy (persistence, mortality & speed of kill



Supporting IPM

Getting better performance from Biopesticides



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- Contact us
- Joe.martin@ahdb.org.uk

Thanks

Questions?

https://warwick.ac.uk/fac/sci/lifesci/wcc/research/biopesticides/amberproject/


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