AHDB

Arable review 2022–23

Contents

Produced for you by AHDB ahdb.org.uk

Foreword

Welcome to AHDB's arable research review for 2022–23.

A large portion of your Cereal & Oilseed levy supports AHDB in bringing independent research and evidence to areas of utmost importance within the industry.

From soil health and nutrient management to integrated pest management and variety selection, the goal of our extensive research programme is to inform on-farm decision-making without bias.

This publication serves as an overview of the work commissioned by AHDB to achieve this. Not every project is summarised, but all active projects are listed on pages 22–23.

To deliver the output from these projects to our levy payers, AHDB works in partnership with a wide range of organisations. One of many examples is our work with the resistance action groups. These groups produce guidance on pesticide resistance issues. Hosted by AHDB, this information can be used to help protect crops and the long-term efficacy of herbicides, insecticides, and fungicides.

- **ahdb.org.uk/wrag** (Weed Resistance Action Group)
- **ahdb.org.uk/irag** (Insecticide Resistance Action Group)
- **ahdb.org.uk/frag** (Fungicide Resistance Action Group)

Such partnerships often have no direct cash cost to AHDB. Another example is the net-zero partnership with BBSRC (91140082, **ahdb.org.uk/net-zero-partnership**). This partnership is comprised of 10 short projects (final project reports 640–1 to 640–10) to support the transition to more sustainable farming systems. Most of these are highlighted in this review. In this collaboration, BBSRC provided the funding and AHDB provided the near-market research expertise.

This edition also includes a flavour of trials in the AHDB Farm Excellence programme, which helps brings research to life at Strategic Cereal Farms and Monitor Farms across the country.

As research delivers results throughout the year, we have created web pages to capture the key developments as they happen. Visit **ahdb.org.uk/arable-review**

Finally, if you would like more information on our full range of activity, visit the AHDB website:

- **ahdb.org.uk/knowledge-library** (publications and research reports)
- **ahdb.org.uk/farm-excellence** (Monitor Farm and Strategic Cereal Farm meetings and results)
- **ahdb.org.uk/agronomy-focus** (information on our monthly Agronomy Focus e-newsletter)
- **ahdb.org.uk/arable-focus** (our arable journal, which also features agronomy research)

Ana Reynolds
Head of Engagement
Cereals & Oilseeds

Meet the team

Visit the AHDB website to learn more about and contact Arable Review's contributors. ahdb.org.uk/meet-the-team

Integrated pest management (IPM)

Integrated pest management (IPM) is a coordinated and planned strategy for the prevention, detection and control of pests, weeds and diseases. AHDB aims to promote a greater understanding of non-chemical control options, the sustainable use of plant protection products and potential management trade-offs.

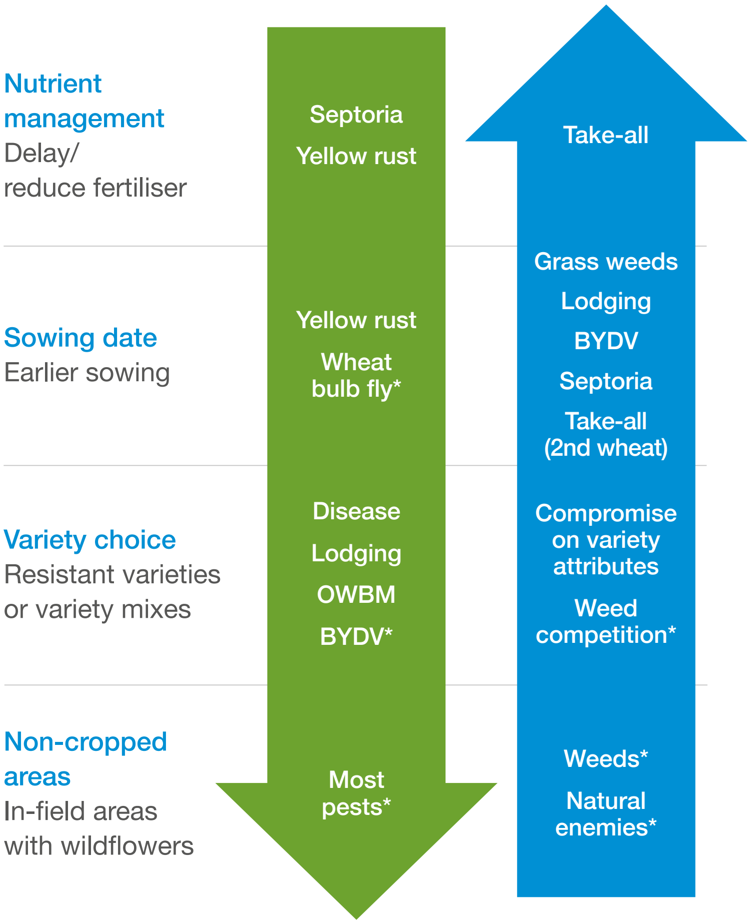
IPM trade-offs

In 2021, AHDB commissioned a review (AHDB Research Review 98) to look at the evidence behind IPM and enable its uptake in UK arable rotations. The review, which covered cereals (wheat and barley), oilseeds and potatoes, considered 80 of the most significant crop pests (invertebrate pests, diseases and weeds) and non-chemical approaches to other issues, specifically lodging.

The review identified and considered 40 IPM control strategies. In total, 642 situations were identified where IPM strategies could have a role. These were scored (on a 1–5 scale) for the effectiveness of control, the economic importance of the pest, and aspects related to the practicality of implementation. IPM methods with increased scope for further adoption were also identified.

The implementation of some strategies to tackle one issue can have undesirable consequences that exacerbate other issues. The review also considered such trade-offs by exploring the advantages and disadvantages associated with management actions. An example of the pros and cons associated with some actions is shown in Figure 1.

In 2022, a second part of the review was published that covered IPM in non-broadacre crops, including rye, triticale, linseed, peas, beans and fodder crops.



Source: AHDB Research Review 98: Enabling the uptake of integrated pest management (IPM) in UK arable rotations (a review of the evidence)

Figure 1. An indication of the disbenefits (green arrow) and benefits (blue arrow) associated with management choices in winter wheat

*More research is needed to strengthen evidence

The latest on IPM

IPM is at the heart of many projects featured in Arable Review. For the latest IPM findings from our research programme, visit **ahdb.org.uk/ipm**

Varieties

The Recommended Lists for cereals and oilseeds (RL) provides independent information on the performance of varieties. Paul Gosling explains how RL data helps inform the selection of the most appropriate varieties for each farming situation.

The role of IPM

Varieties are the foundation of integrated pest management (IPM). The requirement for robust crop genetics is increasing as the pesticide toolbox reduces and the demand for lower-input varieties increases.

The RL is supporting this transition. For example, the relative importance of disease resistance has increased. When assessing varieties, this allows the inclusion of some varieties with improved pest and disease resistance, even when their yield is not the highest. Recent examples (added to the RL 2022/23) include the winter wheat variety Mayflower and the winter barley variety LG Dazzle.

The ability to adapt to changes in the pathogen population is an increasingly important feature of the RL. Disease rating calculations (on a 1–9 scale, where 1 is highly susceptible and 9 is resistant) are usually based on disease data taken over several (three or five) years. The ratings are revised annually to help account for changes in pathogen populations.

Following concerns about the breaking of septoria tritici resistance in the 2020/21 growing season, the RL 2022/23 winter wheat disease ratings were issued early and in two forms. The first was based on the standard three-year (2019–21) data set. The second used a one-year (2021) data set to help reveal the 2020/21 season's impact. Critically, it helped to highlight the varieties most likely to benefit from closer monitoring.

New recommendations for winter wheat in the RL 2022/23 include varieties with an alternative genetic basis of resistance to septoria tritici, which should make useful contributions to the continued management of this important foliar disease.

The RL team also works with AHDB Research and Knowledge Exchange teams to identify where variety selection can help in the management of hard-to-control problems, and how to add value to RL data to guide management choices. Recent examples of this include the creation of the variety blend tool for winter wheat and the wheat yellow rust watch list.

New variety traits

The RL 2022/23 featured a record number of variety types and traits, introducing new traits for barley, an improved choice of spring and winter milling wheat varieties, as well as new options for brewing and distilling.

Specialist and described categories are being used more frequently to help fast-track varieties with new quality or resistance (to pest or disease) traits. The approach allows varieties to be added to a list even when yields lag behind other varieties. Such categories allow the data to be published, so farmers can see if the new trait or market option is worth any potential yield penalty.

Recent examples of this approach include the addition of BYDV-resistant winter wheat and BYDV-tolerant winter barley. The RL 2022/23 also included a described null-lox barley variety. This lacks the genes to produce lipoxygenase and dimethyl sulphate, both of which can affect beer quality.

Better access to RL data

While the paper RL booklet remains available, there are now ways to access and interrogate RL information digitally through the RL app and variety selection tools.

The variety selection tools allow the user to make comparisons based on their unique situation. Agronomic merit, for example, is a non-yield-based metric that captures the genetic potential for disease and lodging, rating components into a single score. Each component is weighted, and these weightings can be adjusted by users to reflect the specific challenges on the farm.

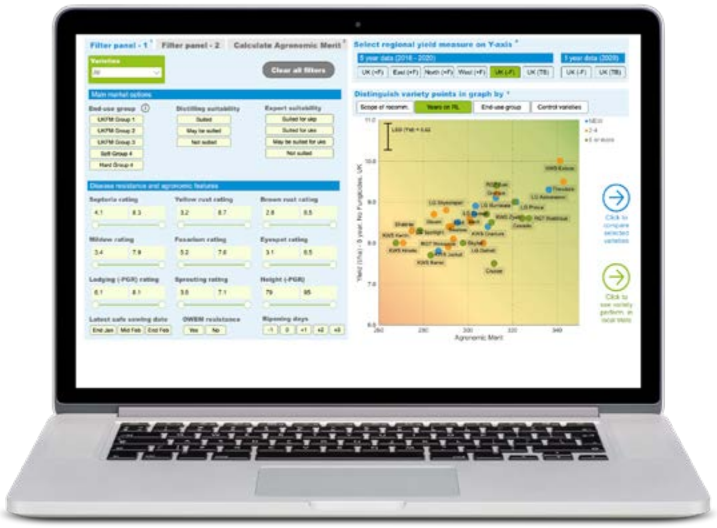


Figure 2. An illustration of the variety selection tool for wheat

The tools' graphical displays allow the user to plot varieties in numerous ways. For example, to show agronomic merit scores against treated yields, untreated yields or fungicide treatment benefits.

Harvest results

The three RL crop committees and RL board use the results from the RL trials to decide on the inclusion of each variety for the next edition (RL 2023/24 will be available online at the end of November 2022).

As people make varietal choices throughout the year, the Harvest Results service makes trial data quickly available on the AHDB website (shortly after harvest). AHDB also provides opportunities to see varieties and talk with RL team members at summer events across the UK.

About the RL

The RL programme is a collaboration between AHDB, the trade associations of the flour milling (UK Flour Millers) and malting industries (MAGB), and crop breeders (represented by BSPB). By working closely with flour millers and maltsters, RL varieties align with specification requirements and the needs of their customers. Critically, it helps farmers to target crop premiums.

ahdb.org.uk/rl

Genetics research

AHDB supports pre-breeding research activity to deliver novel and improved traits to the varieties of the future. Dhan Bhandari outlines research that aims to enhance the genetic power of UK cereals and oilseed rape.

Flour quality

A major determinant of processing quality is the quantity and properties of gluten proteins in wheat grain. A PhD project (21130058) has conducted field trials, over three years in three different environments, to study grain quality in wheat populations with Malacca (average grain protein content) and Hereward (high grain protein content, high stability) in their parentage.

Grain quality tests include protein composition analysis and measurement of metabolites that affect baking quality, such as sucrose, maltose and raffinose. The work has identified indicators associated with protein content and a section of DNA (QTL) associated with bread texture.

Nitrogen is required for the synthesis of grain proteins, such as gluten. Bread-making wheats need a relatively high protein content (typically 13%). As a result, the requirement for nitrogen applied to wheat may be above the optimum for yield – by up to 50 kg N/ha.

With an increasing focus on production sustainability and the cost of fertiliser, the requirement for milling wheat varieties with improved nitrogen efficiency has also increased. At the heart of the challenge for this project is the need to unravel the genetic control of this.

Identifying grain quality indicators and understanding the underpinning genetic mechanism(s) are valuable to the plant-breeding industry, as it helps them develop varieties with increased quality stability.

Critically, AHDB's investment also delivers skills to the industry – a primary aim of the PhD studentship programme. In this case, the project will deliver a scientist with a strong understanding of genetic mapping, agronomy, and grain testing techniques.

Controlling male fertility in wheat

Crossing two varieties increases the yield of the resultant offspring (hybrid vigour). However, hybrid production is a technically challenging breeding process due to the need to ensure effective pollination and avoid self-fertilisation.

A BBSRC LINK project (21130024), led by the University of Nottingham, is developing systems to control and improve fertility in cereal crops. To date, the study has further characterised key conserved genes in barley and wheat that are critical for pollen development, pollen dehiscence (release) and carbon-sink mobilisation. The work has generated plant lines with altered fertility. They have analysed the fertility switch, which is based on high temperature, to better understand the genetic mechanism.

Genetic Improvement Networks (GINs)

AHDB supports the activity of the Defra-funded Genetic Improvement Networks (GINs), which include wheat and oilseed rape. The GINs aim to generate pre-breeding material that carries novel, profitable and sustainable traits. Collaborative research is at the heart of the networks, to ensure efforts are placed on key traits and the material produced (genetic and knowledge) is accessible to breeders.

ahdb.org.uk/gins

Diseases

The pathogen population never stands still. Catherine Harries explains how AHDB's long-term investment helps monitor changes in both varietal resistance and fungicide efficacy.

Varietal resistance

For over half a century, a project has monitored the cereal pathogen population to look for evidence of significant changes. The United Kingdom Cereal Pathogen Virulence Survey (UKCPVS, 21120034) focuses on yellow and brown rust populations, as well as barley powdery mildew populations.

UKCPVS

The project conducts many tests, including screens of the five most relevant yellow rust isolates on all winter wheat varieties on the Recommended Lists (RL) and other standard varieties. The screens are conducted on young plants in the laboratory and mature (adult) plants in field trials.

A relatively high-profile activity of the survey is the confirmation of new races and detailing how they affect specific varieties (Figure 3).

The team also provides information on the type and frequency of virulence (ability to cause disease) genes in pathogen populations. These details help breeders identify and prioritise resistance genes to move through breeding programmes.

Jointly funded by AHDB and APHA, the collaborative approach promoted by UKCPVS helps varieties keep pace with major changes in pathogen populations. For example, most winter wheat varieties on the RL have strong resistance (8–9) to yellow rust. New entrants to the list help counter the resistance erosion in established varieties (Table 1).

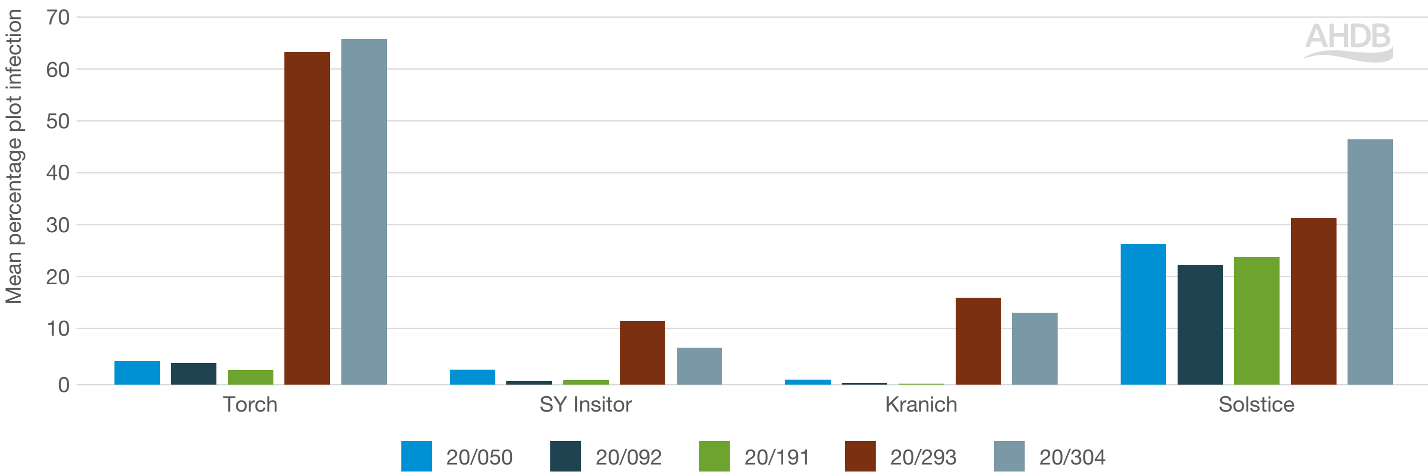


Figure 3. The amount of wheat yellow rust observed depends on the variety and the pathogen isolate present (coloured bars). Data based on a subset of varieties from 2021 adult plant UKCPVS trials

Table 1. How variety disease resistance ratings to yellow rust changed over time (2014–23) for a selection of winter wheat varieties. These are Recommended List ratings: 9 = very high resistance to disease, whereas 1 = low resistance

Variety	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Gleam					7	6.9	6.7	5	5
KWS Barrel			8	8	8.2	8.5	8.5	6.9	6.2
KWS Firefly						8.7	8.6	6.6	6.1
KWS Kerrin				6.7	6.8	7	6.6	4.1	3.6
KWS Zyatt				7.0	7.2	7.5	7.3	5	4
KWS Spotlight						8.2	8.1	5.6	4.6
RGT Gravity					8.3	8.4	8.2	6.5	5.8
Skyfall	6.2	5.9	6.2	6.1	5.7	5.4	5.2	3.2	3.2
SY Insitor							6.7	5.3	4.9

Note: A change in the disease rating calculation method contributed to a relatively large drop in ratings between 2020/21 and 2021/22.

Barley brown rust

Crop immune responses to pathogen infection have been pulled apart by researchers in a net-zero partnership project (see page 23). Their findings could help revolutionise the way disease is detected. The research team investigated the ubiquitin pathway, which is involved in the immune response in several plant species.

When two plant stress hormones were applied to spring barley varieties, the researchers observed a general ubiquitin-mediated immune activation in all varieties infected by the brown rust pathogen. The result confirms that this pathway is present in spring barley.

The research team also believes it may be possible to use protein markers to detect and quantify early pathogen infection. In theory, it is possible to detect infection long before visible symptoms appear in crops, helping to facilitate protectant fungicide use. Rapid detection would also help speed up plant breeding programmes.

Read an article on this work and access the final report (PR640–08) at **ahdb.org.uk/net-zero-partnership**

Monitoring contaminants

AHDB is highly valued for its independent work on monitoring agrochemical residues and contaminants. Conducted since the mid-1980s in the UK, the results provide customer confidence and quantitative reference points for industry data (obtained with rapid-screening tests). They also inform the authorities in setting maximum/guidance levels of contaminants and help the supply chain prepare for new legislation.

Data is collected from representative commercial samples of UK-grown and imported wheat, barley and oats and co-products (wheatfeed and oatfeed).

In the latest phase of the project (21130040), Fera conducts annual surveys of pathogen-produced mycotoxins, such as DON, ZON, T2/HT2, OTA and ergot alkaloids, and other contaminants such as pesticides and heavy metals.

Based on harvest 2021 results, no samples exceeded the maximum levels (ML) for the main mycotoxin for grain intended for food (DON). However, there was an exceedance for the storage mycotoxin OTA in one food oat sample.

In milling wheat, total ergot alkaloid levels were higher than in the previous five years. For all the other mycotoxins, in most cases, results were lower than the five-year rolling average. Chlorpropham was detected in one milling wheat sample. Over 400 pesticides and seven metals (including four regulated metals) were analysed, with no maximum residue level (MRL) exceedances detected.

Figure 4. A wheat ear infected with fusarium showing head blight symptoms. Infection is associated with the production of mycotoxins in grain

Fungicide performance

Covering wheat, barley and oilseed rape, AHDB fungicide performance work (21120013) uses high-disease pressure trials to reveal the performance of fungicide products against specific diseases. Information from the trials, which assess disease levels and yield, provides a foundation for commercial fungicide programmes. The commercial programmes are based on mixtures of active ingredients and products. However, the project includes tests of single active ingredients even though this may not be the appropriate way to use them in a commercial situation.

Figure 5. Cereal plots at a fungicide performance trial site in Herefordshire

Did you know?

The fungicide performance trials started almost 30 years ago. The wheat trial series started in 1994, followed by the barley and oilseed rape trials in 2002 and 2006, respectively.

Dose-response curves

Each product/active ingredient is tested at four doses to allow response curves to be generated. For cereals, the doses are quarter, half, full and double the recommended label rate. The inclusion of the double rate is to improve the ‘fitting’ of the dose-response curve. For oilseed rape, doses are quarter, half, three quarters and full. In this crop, doses above the full rate are not used due to potential growth regulatory effects.

Each December, AHDB updates the dose response charts on the AHDB website (**ahdb.org.uk/fungicide-performance**). This article includes the main messages from the December 2021 data release.

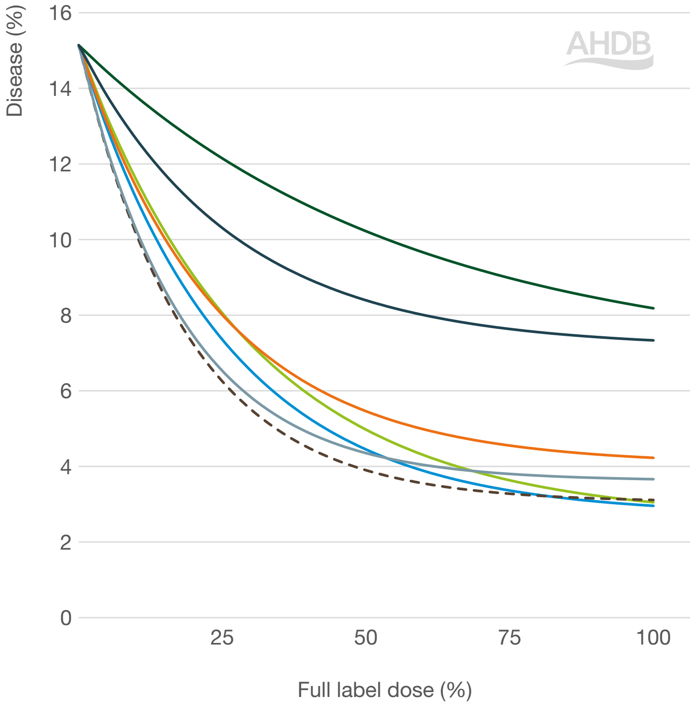


Figure 6. An illustration of fungicide dose response curves

Fungicide performance results

Table 2. Products that featured in the 2021 fungicide performance presentation for wheat and barley

Product	Active(s)	Mode of action
Arizona*	folpet	Multi-site
Proline	prothioconazole	DMI**
Myresa	mefentrifluconazole (revysol)	DMI**
Imtrex	fluxapyroxad	SDHI
Elatus Plus	benzovindiflupyr (solatenol)	SDHI
Comet	pyraclostrobin	QoI***
Peqtiga	fenpicoxamid	QiI
Ascra Xpro	bixafen + fluopyram + prothioconazole	SDHI + SDHI + DMI**
Elatus Era	benzovindiflupyr + prothioconazole	SDHI + DMI**
Revystar XE	mefentrifluconazole + fluxapyroxad	DMI** + SDHI
Univoq	fenpicoxamid + prothioconazole	QiI + DMI**
Siltra [barley only]	bixafen + prothioconazole	SDHI + DMI**
Kayak [barley only]	cyprodinil	Anilinone-pyrimidine

*Arizona tested at full dose only. Folpet authorised for use in several products. **Azoles. ***Strobilurins.

Fungicide performance: barley summary

All diseases: control was always better in protectant situations.

Ramularia: mefentrifluconazole added efficacy.

Rhynchosporium and net blotch: prothioconazole and fluxapyroxad were both effective.

The SDHIs fluopyram and bixafen added useful activity, particularly on net blotch.

Fungicide performance: wheat summary

Septoria tritici: Univoq and Revystar XE showed the highest level of activity.

Yellow rust: Elatus Era was particularly effective, but all mixtures performed well.

Brown rust: mefentrifluconazole and SDHIs tested were highly active, while fenpicoxamid and prothioconazole added useful activity.

Fungicide performance: oilseed rape summary

For details of products and active ingredients in the trials, visit **ahdb.org.uk/fungicide-performance**

Phoma stem canker: controlled by azoles, SDHIs and strobilurins. The average yield response was 0.3 t/ha, with little benefit from applying more than 50% of the full label rate (two-spray programme). There were some differences in canker control between products, but these translated to small yield differences (0.1–0.2 t/ha), especially when the disease index was less than 30.

Light leaf spot: Azoles and non-azoles provided similar levels of disease control and yield. Some light leaf spot isolates have a decreased sensitivity to azoles (in laboratory tests), although field performance was not affected.

It is important to make use of different modes of action for resistance management.

Fungicide resistance

As the fungicide performance project tests products prior to registration, it allows data to be released when products reach the market. A recent example is fenpicoxamid. As a quinone inside inhibitor (QiI), it is a relatively new mode of action for cereal disease management. It offers good potential to maximise efficacy and manage resistance in a carefully constructed spray programme.

In theory, any pathogen can develop resistance to fungicides, but septoria tritici in winter wheat has a proven track record of working its way around chemistry. It is one of the reasons why AHDB invests in strategic monitoring of the pathogen that causes the disease (21120018a).

The fungicide performance team supplies septoria pathogen isolates from various UK locations – before and after fungicides are applied.

Figure 7. Septoria tritici on wheat

In the laboratory, these samples are used to screen their sensitivities against key fungicides – azoles and SDHIs, as well as new modes of action that are in line to enter the UK market. By comparing the results with a baseline sensitivity for each fungicide, it is possible to track the development of resistance.

The 2022 project report included baseline results from fenpicoxamid, which showed strong inhibition of septoria growth at very low concentrations of the active ingredient. Although this is good news, it is important to note that the Fungicide Resistance Action Group (**ahdb.org.uk/frag**) classifies the resistance risk in septoria for this mode of action as moderate/high.

As always, it is important to use the lowest active ingredient dose possible to obtain the required control of the primary disease risk – with each component of the mix giving comparable levels of control. The lowest dose possible is tricky to gauge, as it involves complex interactions with many factors, such as variety, sowing date, location and weather. Mixtures and alternate use of fungicides with different modes of action, from different fungicide groups, are often the most effective and reduce the likelihood that fungicide resistance will develop in pathogens.

Figure 8. Peach-potato aphids on oilseed rape (left) and grain aphids on wheat (right)

Pests

History is peppered with cases of insecticide resistance and withdrawn chemistry, so integrated pest management (IPM) must do more heavy lifting. Crop protection scientists, Siobhan Hillman and Kristina Grenz, outline research that aims to identify the weak underbelly of key crop pests.

Insecticide resistance

As part of our insecticide resistance monitoring project (2150015), Rothamsted Research exposes live insect samples to insecticide compounds at various screening doses to test for resistance. Where known, the team also quantifies the presence of genetic resistance mechanisms. The winter 2022 edition of Arable Focus features an article on the research, with the main messages outlined below:

- **Peach-potato aphids**
  - Most are associated with strong pyrethroid resistance
  - Resistance to pirimicarb (conferred by MACE) remains present
  - No high or extreme esterase-based resistance (associated with resistance to organophosphate compounds) detected
  - For other compounds, no evidence of resistance that may compromise control – although a subtle susceptibility shift to neonicotinoids in one sample from oilseed rape was detected
- **Grain aphid** – Pyrethroid resistance is present, but control failures are unlikely to occur if resistance management guidance is followed. This includes applying products at full recommended label rates with good aphid contact
- **Bird cherry-oat aphid** – No evidence of either resistance or reduced sensitivity to pyrethroids in the UK
- **Cabbage stem flea beetle** – The frequency of pyrethroid-resistant beetles continues to rise

The Insecticide Resistance Action Group (**ahdb.org.uk/irag**) considers the results from the resistance screening work and issues updates to its management guidance each year. IRAG is also set to consider the results of another project (21120163) that uses innovative approaches to test resistance management strategies. The main aim of the work is to check whether current guidance applies equally to all major pest groups. A change to resistance management guidance will only occur when the evidence to make change is compelling.

Novel monitoring and control

It is particularly difficult to monitor and control pests that are active at night. A net-zero partnership project (see page 23) has developed a prototype tool that automatically detects nocturnal pests. Although developed for vine weevil beetle, the tool can be adapted for other pest species, including cabbage stem flea beetle. Such a 'smart' automated monitoring tool has the potential to issue an alert when a pest threshold is breached. This will facilitate control, including the use of emerging biological control options that need to be targeted carefully.

A PhD studentship project (21510042) at Harper Adams University is assessing biopesticides as control options for cabbage stem flea beetle. The work screened a range of biopesticides – entomopathogenic fungi, nematodes, bacteria, fatty acids and botanical biopesticides – in controlled laboratory bioassays. This identified two species of nematode – *Steinernema feltiae* (Nemasys, BASF) and *Heterorhabditis bacteriophora* (Nemasys H, BASF) – able to kill up to 100% of beetles. Other products with potential include the entomopathogenic fungi *Beauveria bassiana* (Botanigard WP) and fatty acids (FLiPPER and one coded product), resulting in 56%, 85% and 65% beetle mortality. As part of the project, trials will determine the potential control offered by such biopesticides under field conditions. It will also suggest ways to improve product formations and methods.

Figure 9. Cabbage stem flea beetle under the microscope captured as part of the PhD exploring novel (biopesticide) approaches to control the pest

As biopesticides often have a high target-specificity, compared to many conventional chemical products, a wider range of products may be needed to protect crops against multiple pest threats. A net-zero partnership project (see page 23) focused on the principles of tank-mixing biopesticides, using pairwise combinations of four commercial biopesticides targeting two horticultural pests. Results indicate that tank-mixing is unlikely to compromise pest control efficacy, laying the grounds for further research in this area.

A project (21120185) that uses commercial oilseed rape crops to investigate the power of non-chemical control of cabbage stem flea beetle has entered its final year. To date, the team has tested numerous approaches – including companion cropping, stubble lengths, organic amendments, seed rates, sowing dates, trap crops and winter defoliation – with several showing promise. This cropping year (2022–23), the trials will focus on combined control measures.

Aphid-spray decision support

Various aphid species, particularly the bird cherry-oat aphid and grain aphid, transmit Barley yellow dwarf virus (BYDV) to cereal crops. Integrated pest management (IPM) is increasingly required for the sustainable control of aphids. From aphid monitoring approaches to the production of decision support tools, an ADAS-led project (21120077a) aims to strengthen support for aphid-spray decisions. To date, key messages include:

- Physically inspecting plants is time-consuming and can miss areas of aphid infestation
- Trap data – whether from national suction traps (managed by Rothamsted Research) or in-field traps – provides a good indication of regional and local aphid pressures
- In-field yellow water traps caught 2–3 times more aphids than yellow sticky traps
- A prototype spray decision support tool – called ACroBAT – shows the potential to reduce the number of autumn aphid sprays

The ADAS Crop BYDV Assessment Tool (ACroBAT) considers many more parameters than the AHDB BYDV (T-Sum) temperature tool. In autumn 2021 (by early December), five BYDV-inoculated barley trials resulted in three and eleven autumn spray recommendations with ACroBAT and T-Sum respectively. Although the initial results are promising, a complete analysis (including 2022 harvest data) is needed to determine ACroBAT's full potential.

Wheat bulb fly survey

At present, chemical control of wheat bulb fly is limited to seed treatments that are only effective in certain situations. The AHDB autumn wheat bulb fly survey (2112003) indicates potential pest pressures and when to consider a targeted treatment. Based on an economic damage threshold to wheat, the soil egg-count data (30 sites) has predicted a relatively low risk from this pest for the last decade. However, it is important not to let complacency set in. Even in low-risk years, some sites buck the trend. Survey and management information can be accessed from **ahdb.org.uk/wbf**

Slug management

Earlier this year, it became illegal to use metaldehyde products, so many will look to alternative forms of slug management. As usual, the successful use of alternatives requires a deeper understanding of pest biology. This is true whether the option is another (relatively expensive) plant protection product or a non-chemical intervention. To prepare for a potential slug onslaught, visit our integrated slug management pages. These explain how slug management options work, and the use of monitoring and damage-risk thresholds. Each solution only provides partial control, so a combination of tactics may be required to keep on top of populations. For more information visit **ahdb.org.uk/slugs**

Strategic Cereal Farm East: Flower strips for pests and beneficials

Many factors affect the abundance and impact of invertebrate crop pests and their natural enemies, including soil type, crop variety and physiology, agronomy, weather and the surrounding landscape.

In May 2020, Strategic Cereal Farm East established a trial to investigate how changes to management affect insect populations on three sandy clay loam fields:

- Field 1: No flowering areas (control)
- Field 2: Flowering field margins
- Field 3: Flowering field margins and in-field flower strips

Plant species composition

Despite poor weather in winter 2020, flower and grass margins established well – at a cost of £714.91/ha.

Numerous plant species (15–21) were recorded in all field margins. Common knapweed, wild carrot, oxeye daisy, ribwort plantain, common sorrel and musk mallow were the most frequently occurring. There was no evidence of species from floral margins in the main crop.

In terms of plant species composition, strips within each field were more similar compared with other fields. This reflects the soil conditions, species selected and date of drilling.

Figure 10. Pollen beetles on a yellow flower in a field margin

Assessing insect biodiversity

Solitary bee nests, pitfall traps and water traps were placed along each field strip and at intervals in the field in autumn, winter and spring.

The rich species diversity provided floral resources before and during summer assessments. It also provided overwintering habitat, as evidenced by the autumn and spring assessments. No two fields were alike in their composition of invertebrate pests and beneficials in the 2020/21 assessments.

Slugs were present in all the fields, close to the field margin and in the field centre – with a slight trend for higher numbers in the middle of the field.

Aphid predators and hymenopteran wasps were more prevalent in the field with both flowering margins and in-field strips. There was a clear trend for wasps to be present close to the margin edge in winter and spring, with an uplift in numbers observed in July 100 m from the margin edge. However, the number of aphids and parasitised aphids (aphid mummies) was very low in 2021. Aphids were well below treatment thresholds in all fields monitored.

Although larger studies have shown that the number of beneficials reduces further into the field, no clear evidence of the impact of distance into the crop on pests or beneficial numbers was observed.

Adding to the dataset

Assessments will continue until the end of the project (harvest 2023). Longer-term assessments are required, as it can take insect populations several seasons to build up following the establishment of floral margins.

Pest and beneficial assessments are also being carried out in an AHDB-sponsored Innovative Farmers Field Lab on flowering margins (91580001) and in cover crop trials at Strategic Cereal Farms in Scotland and the south of England, with results due out later in 2022.

Figure 11. A single-species field margin *(Phacelia)* provides benefits for nature, but a multi-species mix may deliver more

Figure 12. A nest for solitary bees at Strategic Cereal Farm East

Figure 13. A yellow water trap

Nutrients

As part of AHDB's commitment to the Nutrient Management Guide (RB209), we invest in research so recommendations keep pace with modern production systems. Amanda Bennett reviews the latest developments.

Managing costly nitrogen fertilisers

One impact of the energy crisis is the drastically reduced production of nitrogen, pushing up fertiliser prices significantly. To help farmers, AHDB commissioned a rapid review of nitrogen management in cereals and grassland (Research Review 97). By autumn 2021, AHDB had updated guidance on how to adjust nitrogen rates in cereals and quantified the potential impact on grain output. The situation in Ukraine further inflated the prices of cereals, gas and oil. By spring 2022, AHDB released more detailed guidance, which included:

- How to calculate nitrogen prices
- Which crops, fields and nitrogen splits to prioritise
- The influence of expected yield
- Management of organic materials
- How to achieve milling and malting specification
- Precision nitrogen use
- Management of other nutrients
- Longer-term implications

A key output from this ADAS-led project was a nitrogen fertiliser rate adjustment calculator, which allows the economic optimum to be established for specific cereal and oilseed crops.

RB209 guidance was also extended to account for grain prices up to £300/tonne, rapeseed prices up to £700/tonne and nitrogen fertiliser prices up to £863/tonne.

The revised tables (RB209, Section 4) show, for example, that reducing fertiliser applications by 60 kg N/ha (the new economic optimum) would likely reduce yield by 0.5 t/ha in wheat or barley and by 0.2 t/ha in oilseed rape.

In oats, smaller reductions in nitrogen resulted in a relatively large yield reduction. Although oat yields may be slightly reduced by a modest reduction in nitrogen, it is unlikely to have detrimental effects on specific weight or screenings.

The revised tables for oats, which will feature in the 2023 RB209 edition, are available online: **ahdb.org.uk/nitrogen-for-oats**

Nutrients in winter and spring oats

Nitrogen management in winter and spring oats is under investigation in long-term trials (21140039), which also draws upon a wider pool of UK data. Interim findings from the ADAS-led work suggest that the RB209 nitrogen rates may be too low, especially for spring oats. The balance between yield and quality in oats is particularly fine.

Higher nitrogen rates are associated with increases in yield, kernel content and hullability, but lower specific weights and thousand-grain weight. The response also depends on the variety. A lack of sulphur may affect oat yield most on light soil sites. The project concludes later this year.

Nitrogen in milling wheat

Although non-milling wheat dominates the UK crop area, the milling crop area increased from 34% in 2016 to 41% in 2020. With increased attention on milling wheat market specifications, this project (21140040) aims to inform nitrogen and sulphur fertiliser management guidelines.

The work included nitrogen rate and timing trials (2019–21), and nitrogen and sulphur interaction experiments across six sites. The assessment of treatment effects included dough rheology and baking performance tests. A final report is due later in 2022.

Nitrogen in spring barley

Although traditionally grown on light land, spring barley production has expanded onto soils with a heavier texture. Such land is likely to require a different nutrient management strategy. Nutrient management recommendations also need to keep pace with the requirements of modern varieties.

AHDB nutrient trials on high-yielding spring barley varieties (Concerto, Laureate, Planet and KSW Irina) led to changes to the 2022 edition of RB209. The findings were detailed in an article in the autumn 2021 edition of Arable Focus magazine: **ahdb.org.uk/arable-focus**

Updating RB209

AHDB nutrient management research generates recommendations for updating RB209. Such information is reviewed by independent consultants and the UK Partnership for Crop Nutrition – the body responsible for revising RB209. If the evidence for change is robust, RB209 is updated accordingly. Changes to RB209, in response to these projects, either occurred in the 2022 edition or will occur in the 2023 edition.

In-field soil phosphate test kit

A net-zero partnership project (see page 23) developed a prototype kit to measure available soil phosphate in the field. Currently, recommending optimal quantities of phosphorus fertilisers to apply to soils involves taking a bulked soil sample, sending it off to specialist laboratories for analysis and waiting several days for the results. This project developed an in-field rapid test kit. Feedback from researchers and advisors will enable modifications and improvement of the procedure, kit design and user instructions. It will also provide evidence of the interest and usability of the field kit prior to subsequent activities to make the kit available to end-users.

Figure 14. What to pack for a potential P holiday – this case holds the components of the prototype rapid soil phosphate kit

Strategic Cereal Farm Scotland: Fine-tuning crop nutrition

A major challenge for crop management is to make sure that a plant has the right nutrients available when it needs them. The time a nutrient application is made is as important as the amount applied.

Over two cropping seasons, a replicated tramline trial at Strategic Cereal Farm Scotland has compared a tailored nutrition approach against farm standard agronomy. The first year of the trial (harvest 2021) investigated adjusting nutrition based on crop assessments, in response to laboratory and in-field testing, to optimise sampling procedures.

Established approaches, such as leaf chlorophyll (SPAD) readings, along with the more novel measurement of sugar content (Brix units), were used to assess the crop nutrient and health status in the field of winter wheat (Skyscraper).

Farmbench was used to interpret the results from the trial. In terms of nitrogen-use efficiency (yield per cost of nutrient input), the standard agronomy tramline performed substantially better. However, when compared to crop protection costs only, the tailored agronomy tramline had the most yield-to-cost benefit. For overall input costs, the yield-to-cost benefit was comparable along each tramline.

For harvest 2022, the trial was adapted to better reflect farm practice. An additional tramline treatment was added to include a tailored nutrition approach, with the use of biological and fungicide treatment if deemed necessary. Results are due out later in 2022.

Figure 15. David Aglen, Farm Manager at Balbirnie Home Farms, was appointed as the first host farmer for our Strategic Cereal Farm project in Scotland in March 2020

Soils

To optimise the production of food and the delivery of 'environmental goods', soils need to be in good condition. Amanda Bennett and Alice Sin provide an update on projects that will help farmers optimise the physical, chemical and biological condition of soils.

How to assess soil health

Soil physics, chemistry and biology play essential roles in maintaining productive agricultural and horticultural systems. Funded by AHDB and BBRO, the five-year Soil Biology and Soil Health Partnership (91140002) aims to help farmers improve and maintain crop productivity through a better understanding of soil biology and soil health.

Soil health components are numerous and interlinked. To avoid burial in soil complexity, the researchers have focused on physical, chemical and biological indicators that are relatively easy to measure (in the field or the laboratory). These include:

- Topsoil pH
- Soil organic matter (SOM) content
- Extractable nutrients (phosphorus – P, potassium – K, and magnesium – Mg)
- Potentially mineralisable nitrogen (PMN)
- Respiration (CO_2) burst
- Visual evaluation of soil structure (VESS)
- Earthworms

These indicators have been added to a soil health 'scorecard', which has been extensively tested in the project – in long-term trials and commercial sites (see page 20).

The scorecard flags if indicator scores fall outside of, close to, or within established threshold values for UK soils and climatic regions. If it is the former result, the indicator requires immediate investigation.

Figure 16. These soil layers (1 and 2) were scored using a visual evaluation of soil structure (VESS) – ploughed treatment

Figure 17. Simple pictorial guidance can be used to conduct a visual examination of soil structure (VESS)

Results from 247 soil health scorecards, completed by farmers, researchers and agronomists, were used for advanced analysis and statistical modelling. This confirmed the importance of looking at several measures of soil health. It is not possible to accurately sum up soil health with a single score. The results also showed the importance of considering rotational land use and soil texture class to support on-farm interpretation of soil health scorecard data.

Several final reports from the work are available on the AHDB website. The final soil health scorecard and guidance will be published in 2022–23.

Soil biodiversity

While earthworms are the main organisms explicitly considered on the soil health scorecard, mesofauna, nematodes and microbial communities were also assessed in the long-term trials by the Soil Biology and Soil Health Partnership. This explored the use of molecular (DNA) techniques to provide data on biological indicators of soil health. This research area is rapidly expanding and, one day, it may be possible to define management threshold values for all biological groups.

Molecular techniques were also used in an AHDB and AgriFood Charities Partnership PhD studentship (21140024). This work investigated the impact of cover cropping and nitrogen (in various forms) on the diversity and abundance of arbuscular mycorrhizal fungi (AMF). AMF communities may benefit crops in several ways, including increased nutrient uptake, pest and pathogen resistance, drought tolerance and increased yields.

Critically, this work also considered the impact on crop yield and quality. In collaboration with Fera's Big Soil Community, the PhD also examined how AM fungal populations responded to biotic and abiotic factors, such as organic matter and fungicides.

Results from replicated field trials suggested that multiple iterations of cover crops can increase the extent to which plants are colonised by AM fungi, but single iterations had no measurable impact. The addition of a commercial AM fungal inoculum had little impact on the AM fungal community, crop growth, or yield in field conditions. This further suggests that multiple iterations of soil amendments are required to cause measurable, long-term shifts in AM fungal diversity and other soil benefits.

Rotational results

Most crop research focuses on the yield and quality of specific crops. Very few studies tackle cultivation strategies, rotation length and composition. Led by AHDB Potatoes, a five-year study (91140001) on whole rotation productivity and sustainability concluded in 2021. The diverse Rotations Research Partnership covered a lot of ground. AHDB is reviewing the findings and updating its guidance. However, some key messages are highlighted below.

Tools and technologies

Mis-matched wheelings and over-inflated tractor tyres increase soil damage. The project adapted a model (Terranimo UK) for use in UK farming situations. Through the selection of soil types, tractor types, harvester types, tyres and tyre pressure, the model illustrates the potential effect of loading on soil properties and compaction. The results can inform a farm's machinery policies to help minimise the long-term negative effects on soil and maximise crop productivity.

A way to measure soil organic matter (SOM) in the field was also developed. The method uses a handheld FTIR (Fourier transform infrared) spectroscopy instrument. The team established relationships between SOM quality, soil aggregate stability and resilience. In the laboratory, FTIR also accurately predicted soil organic carbon (SOC) in addition to bulk density. The technology can be used to provide baseline SOM and SOC data and a way to assess the impact of management changes. The project also advanced understanding of the relationships between soil properties and grain and straw yields.

Figure 18. A demonstration of the impact of poor tyre choice on the soil

Cover crops and organic amendments

Almost 100 commercial field experiments were conducted during the partnership. Although most of these had potatoes as the main test crop, other crops were included such as spring and winter cereals.

The use of cover crops was shown to increase total potato yield by around 3.0 t/ha (statistically significant) in 32 experiments. Although the use of an organic amendment was associated with increased yields this was not statistically significant.

Potatoes were more responsive to cover crops and organic amendments compared with other root vegetables and cereals. However, the project included a three-year series of large-scale, fully replicated experiments in Scotland that showed the benefits of cover crops on the yield and quality of spring barley. Improved performance was most stark when a large brassica component was included in the cover crops mix.

Figure 19. The soil health scorecard can be used to assess the impact of farm management strategy, such as the use of farmyard manure to optimise organic material content in the soil

Strategic Cereal Farms: cover crops

AHDB Strategic Cereal Farms (East, Scotland and South) are testing the impact of various cover crop mixes on soil health, cover crop development, biodiversity and the following cash crop. The trials also consider the cover crop establishment and destruction methods. Results are due out later in 2022.

Strategic Cereal Farm South: Use of the soil health scorecard to assess no-till impacts

In 2021, Strategic Cereal Farm South took on a new area of land that had been conventionally managed. It provided an opportunity to compare this land with three of the farm's regeneratively managed fields, with a focus on the measurement of soil health, crop rooting and yield.

- Regeneratively managed fields (no-till since 2015): 70 Acres*, Old Park and Rye Furlong
- Conventionally managed field (2016–21): Typhrees

*70 Acres was the only field not sown with a cover crop before direct-drilled spring barley.

Soil structure

Autumn 2021 assessments showed there was some variation in soil structure between the three regeneratively managed fields. However, visual evaluation of soil structure (VESS) assessments highlighted that the conventionally managed Typhrees field had a visibly poorer structure. Distinct layers of consolidation were visible in the soil extracted from Typhrees and little evidence of deeper root growth or bio-pores was observed.

	Field name (Soil texture)			
	70 Acres (Medium stony)	Old Park (Light silt stony)	Rye Furlong (Medium stony)	Typhrees (Medium)
SOM (%)	4.2 (CM)	4 (CM)	3.9 (R)	3.7 (R)
pH	8.2 (R)	7.5 (R)	8 (R)	7.6 (R)
Ext. P (mg/L)	37 (CM)	48 (R)	56 (R)	28 (CM)
Ext. K (mg/L)	125 (CM)	151 (CM)	186 (CM)	97 (R)
Ext. Mg (mg/L)	28 (R)	47 (R)	32 (R)	29 (R)
PMN (mg/kg)	43 (CM)	107 (CM)	46 (CM)	99 (CM)
CO_2-burst (mg/kg)	66 (I)	159 (CM)	71 (I)	148 (CM)
VESS	2 (CM)	1 (CM)	1 (CM)	3 (R)
Earthworms (number/pit)	13 (CM)	12 (CM)	8 (CM)	29 (CM)

Red = Investigate (I); Amber = Review (R); Green = Continue rotational monitoring (CM)

Soil mineral nitrogen

Soil samples were collected from sampling sites in each field in November 2021 and in March 2022.

In November and March, the soil mineral nitrogen (SMN) content was greater in Typhrees than any of the other three fields. Although the difference was less pronounced at the later measurement.

The higher SMN level in Typhrees was accredited to the poor establishment of the cover crop in the field. It was hypothesised that the lack of vegetation in Typhrees meant that less plant-available nitrogen was being taken up, leaving more in the soil. Results are due out later in 2022.

Figure 20. Earthworms in a sample

Net-zero partnership

With a focus on sustainability, the net-zero partnership with BBSRC (see page 23) featured four projects with soil management at their core. These short projects were designed to provide a foundation for further research.

Project 1: Residue management

Minimising soil disturbance and leaving crop residues on the surface after harvest is known to benefit deep-burrowing earthworms. This project investigated another potential benefit – reducing plant pathogen inoculum levels in crop residues.

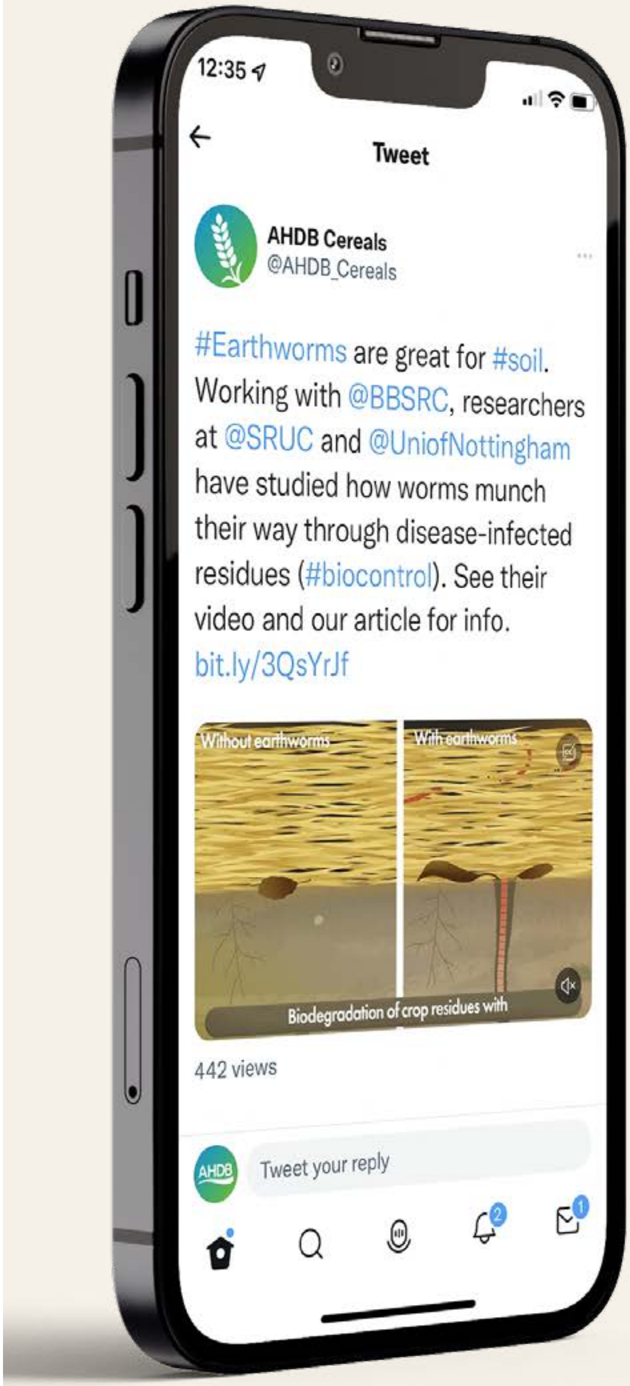


Figure 21. A screenshot from an animated social media post about how earthworms consume plant residues

https://twitter.com/AHDB_Cereals/status/1537740770307985409?s=20&t=PU6GxkWBdMimV10dv7XA9g]

Field and laboratory experiments identified that pathogen-infected materials were an attractive food source for *Lumbricus terrestris* earthworms, which rapidly removed infected materials from the soil surface. However, the work also identified fitness penalties in earthworms associated with the consumption of pathogen inoculum. In addition, the project also asked farmers how they preferred to digest information. This revealed an appetite for simple and visual guidance that links to more detailed information.

Project 2: Chitinous biowaste

Chitin-containing soil amendments have the potential to improve crop vigour, soil moisture retention, uptake of soil nutrients, induce plant defence mechanisms and increase soil suppressiveness against pests and pathogens. This project reviewed the literature on this topic and analysed three chitinous by-products – a shellfish by-product compost, a black soldier fly by-product and spent mushroom compost. It also investigated the legislation related to the application of such soil amendments.

Project 3: Regenerative agriculture

Via events and a questionnaire, farmers in the north of England were asked for their opinions on regenerative agriculture. They identified regenerative agriculture with a set of practices (including no-till, cover cropping, diversified rotations and the integration of livestock into farming systems), and with a broad range of outcomes linked to soil health, carbon sequestration, ecosystem services, crop health and water quality. Before the project, it was hypothesised that the northern climate and its soils were the most likely barrier to uptake of the technique. However, the most common barrier cited was a lack of knowledge, with financial risk and time and labour also frequently mentioned.

Project 4: Sustainable oilseed rape

This project held a series of workshops to identify how to optimise input use in UK oilseed rape production. Farmers prioritised management approaches based on their potential benefit and feasibility. The most promising approaches included:

- Utilising alternative nutrient sources, such as manure
- Improving habitats to promote ecosystem services, including pollination and natural pest control
- Making better use of pest management thresholds
- Managing the crop canopy better

To access all our soil information and resources, visit: **ahdb.org.uk/greatsoils**

AHDB-funded research

Topic	Project number	Title	Lead contractor(s)	End date	Funding (total project costs in brackets)
Varieties	21130028	AHDB Recommended Lists for cereals and oilseeds (2021–26)	AHDB, BSPB, MAGB, UK Flour Millers	Autumn 2026	£875,000
Varieties	21130024	Developing systems to control male fertility in wheat for hybrid breeding, enhanced pollen production and increased yield	University of Nottingham	Autumn 2022	£896,624
Varieties	21130071	A model for wheat cultivars and optimisation for climate scenarios – Sim Farm 2030 (PhD)	University of Sussex	Spring 2024	£74,100 (£84,100)
Diseases	21120062	Developing guidance for fungicide resistance management: SDHI case study and generalisations for future mode of actions (PhD)	Rothamsted Research	Autumn 2024	£63,959
Diseases	21120034	United Kingdom Cereal Pathogen Virulence Survey (UKCPVS)	NIAB, John Innes Centre	Spring 2023	£599,965
Diseases	21120068	Yellowhammer: a multi-locus strategy for durable rust resistance in wheat	NIAB	Autumn 2023	£98,002
Diseases	31120140	Integrated forecasting for diseases affecting multiple hosts exemplified by vegetable brassicas and oilseed rape (PhD)	University of Newcastle	Autumn 2022	£71,400 (Jointly funded with AHDB Horticulture)
Diseases	21120013	Fungicide performance in wheat, barley and oilseed rape	ADAS, SAC Commercial, NIAB, Harper Adams University	Spring 2022	£732,234
Diseases	21120018a	Monitoring and understanding fungicide resistance development in cereal pathogens	Rothamsted Research	Spring 2022	£126,381
Diseases	21130040	Monitoring of contaminants in UK cereals used for processing food and animal feed	Fera	Summer 2022	£813,368
Pests	21120219	Varietal resistance to feeding (herbivory) by the cabbage stem flea beetle in oilseed rape	John Innes Centre	Spring 2024	£60,000 (£1,886,025)
Pests	21120064	Genetic basis of winter oilseed rape resistance to the cabbage stem flea beetle (PhD)	John Innes Centre	Autumn 2022	£76,354
Pests	21120185	Reducing the impact of cabbage stem flea beetle in oilseed rape	ADAS, Harper Adams Univeristy	Summer 2023	£300,000
Pests	21120188	Novel approaches to cabbage stem flea beetle control (PhD)	Harper Adams University, Certis UK, AFCP	Summer 2023	£38,790
Pests	21120163	Testing insecticide resistance management strategies (2020–23)	ADAS	Summer 2023	£138,867
Pests	21120186	Improving integrated pest management (IPM) of aphid BYDV vectors (PhD)	Harper Adams University	Winter 2023	£74,100
Pests	21120077a	Management of aphid and BYDV risk in winter cereals	ADAS, Rothamsted Research	Winter 2022	£200,100
Pests	21120214	Testing aphids for BYDV from suction traps	Rothamsted Research	Spring 2022	£3,500
Pests	2150015	Monitoring and managing insecticide resistance in UK pests	Rothamsted Research	Spring 2022	£42,000
Pests	21120184	Autumn survey of wheat bulb fly incidence	ADAS	Autumn 2022	£30,000

Topic	Project number	Title	Lead contractor(s)	End date	Funding (total project costs in brackets)
Nutrients	21140039	Nitrogen and sulphur fertiliser management for yield and quality in winter and spring oats	ADAS	Summer 2022	£120,000 (£616,560)
Nutrients	21140040	Nitrogen and sulphur fertiliser management to achieve grain protein quality targets of high-yielding winter milling wheat	NIAB	Spring 2022	£179,548 (£230,999)
Soils	91140002	Soil Biology and Soil Health Partnership	NIAB	Summer 2022	£858,869 (BBRO co-funding £140,934)
Soils	91140001	Rotations Research Partnership	NIAB CUF	Summer 2022	£1,203,152
Soils	21140024	Fostering populations of arbuscular mycorrhizal fungi (AMF) through cover crop choices and soil management (PhD)	University of Cambridge	Autumn 2021	£45,250
Weeds	21120187	Wheat germplasm for enhanced competition against black-grass (PhD)	University of Leeds	Autumn 2024	£74,100
Various	91580001	Innovative Farmers field labs*	Innovative Farmers	Summer 2022	£177,000 (£1,294,190)
Various	91140082	Net-zero partnership**	Various	Summer 2022	£0 (£500,000)
Various	N/A	Strategic Cereal Farm trials for harvest 2022***	NIAB, SRUC	Autumn 2022	£150,000

Notes

In general, listed projects were active in 2022. For information on projects that completed in 2021 or earlier, visit **ahdb.org.uk/research**

***Innovative Farmers field labs**

AHDB funding is split approximately as follows: AHDB Cereals & Oilseeds 53%, AHDB Horticulture 19%, AHDB Pork 17% and AHDB Potatoes 11%. Typically, the AHDB cost of each field lab is £18,600 (Cash) and £3,775 (in-kind). The five projects supported by AHDB Cereals & Oilseeds are:

- Anaerobic digestate: impact on soil microbiology and nitrogen retention by cover crops (concluded in 2021)
- Defoliation of winter oilseed to manage cabbage stem flea beetle (concluded in 2021)
- No-till with living mulches (ongoing)
- Flowering habitats for pest control (ongoing)
- Impact of sheep grazing on over-winter cover crops (ongoing)

ahdb.org.uk/innovative-farmers-field-labs

****Net-zero partnership**

This partnership with BBSRC supported 10 short projects to support the transition to more sustainable farming systems, including the following of relevance to AHDB Cereals & Oilseeds:

- Field testing the user friendliness of a rapid, low-cost in-field available soil phosphate test kit (PR640–01) (£18,799)
- Optimal grazing management to enhance soil biodiversity and soil carbon in upland grassland (PR640–02) (£49,860)
- Determination of the quantity and homogeneity of UK sources of chitinous biowaste streams for improving soil resilience (PR640–03) (£44,209)
- Developing a prototype smart monitoring tool to detect night-time pests (PR640–04) (£47,220)
- Reducing crop disease risk through residue management (PR640–06) (£44,939)
- Optimising agronomic and biological inputs for more sustainable oilseed production (PR640–07) (£38,687)
- Improving crop immunity by exploitation of the ubiquitin system (PR640–08) (£47,026)
- Identifying and implementing regenerative agriculture practices in challenging environments (PR640–09) (£18,061)
- Assessing the impacts of tank-mixing on biopesticide efficacy (PR640–10) (£47,055)

ahdb.org.uk/net-zero-partnership

*****Strategic Cereal Farm trials**

Trials are procured annually. The trials for harvest 2022 are as follows.

Strategic Cereal Farm East:

- Managed lower inputs (£10,264)
- Reducing nitrate leaching with cover crops (£16,401)
- Flower strips for pests and beneficials (£13,200)
- Calculating marginal land value (£10,820)

Strategic Cereal Farm Scotland:

- Assessing the impact of cover crops ahead of spring barley (£25,214)
- Managed crop nutrition (£12,084)
- Optimising nitrogen application (£12,483)

Strategic Cereal Farm South:

- Cover crops and water quality (£9,357)
- Soil health under different management systems (£9,957)
- Soil health at crop establishment (£12,257)
- Soil health field assessments (£8,250)

ahdb.org.uk/strategic-cereal-farms

Produced for you by:

AHDB
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

T 024 7669 2051
E comms@ahdb.org.uk
W ahdb.org.uk

20024 1023