NIAB
Landmark
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Reviewing innovation in agritech

A robotic harvesting arm fitted with a soft-robotic gripper designed for picking blackberries without damaging them. Photo courtesy of Clockhouse Farm, Dr Marcello Calisti (University of Lincoln), Fabio Taddei Della Torre (University of Trento, Italy), Dr Phil Johnson (CTP programme), and Dr Charles Whitfield (Niab).

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NIAB

Events 2025

FIND US AT KEY INDUSTRY EVENTS

Cereals THE ARABLE EVENT

Wednesday 11 & Thursday 12 June
LINCOLNSHIRE

Groundswell

Wednesday 2 & Thursday 3 July
HERTFORDSHIRE

Fruit Focus

Wednesday 9 July
KENT

British POTATO

Wednesday 19 & Thursday 20 November
YORKSHIRE

NIAB SUMMER EVENTS

Booking will be available in late Spring 2025

SAXMUNDHAM OPEN DAY • Thursday 22 May
SOILS AND ROTATIONS – SUFFOLK

EAST OPEN DAY • Tuesday 3 June
VARIETIES AND AGRONOMY – CAMBRIDGESHIRE

SOUTH OPEN DAY • Tuesday 17 June
VARIETIES AND AGRONOMY – HAMPSHIRE

TMAF MORLEY INNOVATION DAY • Thursday 19 June
VARIETIES AND AGRONOMY – NORFOLK

STAR OPEN DAY • Tuesday 24 June
SOILS, CULTIVATIONS AND ROTATIONS – SUFFOLK

CROFT ARABLE EVENT • Thursday 26 June
VARIETIES AND AGRONOMY – CO DURHAM

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Mario Caccamo, Chief Executive, Niab • mario.caccamo@niab.com

Today's innovations to feed tomorrow's world

In March 2023, almost two years ago, the Genetic Technology (Precision Breeding) Bill was granted royal assent, becoming an Act of Parliament. This important legislation provides the framework for a faster and more streamlined process to regulate the products of new precision breeding techniques, such as CRISPR gene editing.

As I wrote then: "this is the first time in decades of a new law in the UK that seeks to enable - rather than restrict – the use of advanced technologies for agriculture." However, parliamentary approval of the secondary legislation needed to implement the Act's provisions is still lacking. As it stands, the Precision Breeding Act remains an empty shell that serves no functional purpose.

I therefore welcome the announcement by Secretary of State for Environment, Food and Rural Affairs Steve Reed MP who, in his speech at the 2025 Oxford Farming Conference this January, finally confirmed that the secondary legislation needed to implement the Precision Breeding Act will be introduced to Parliament by the end of March 2025.

We know that investors and developers are queuing up to bring forward exciting precision-bred innovations which will support more sustainable and productive farming systems. They need reassurance that these statutory instruments are not only in place but also that they are proportionate and enabling.

Among other applications precision breeding can fast-track new crops to provide alternative sources of vitamin D, reduce the use of nitrogen fertilisers, and also deliver new, more durable sources of disease resistance in plants and animals. Introducing these innovations today, before the secondary legislation is in place, would still result in their classification as GMOs by regulators.

Niab Chief Executive Mari Caccamo is a Director and Council Member of the Oxford Farming Conference

The Secretary of State's commitment to domestic food production was reassuring. He said: "Farms need to be successful, profitable businesses. The prize is long-term food security, resilient farm businesses, healthy ecosystems, beautiful countryside, and nutritious food on our plates."

Meeting these targets is within reach but, as Professor Ian Marshall from Queen's University (Belfast) put it in his presentation to the Conference, we need to adapt and reposition agriculture in an agri-enabled bioeconomy.

We will also need to build resilience to prepare for the challenges ahead.

In January, the UK Weed Resistance Action Group reported the first case of resistance to glyphosate in Italian ryegrass. This was identified by ADAS following rigorous investigation, involving re-sampling and re-testing.

Grass weeds significantly threaten production but, over many decades, a combination of measures such as soil cultivation and crop rotation has achieved effective management. The application of non-selective herbicides, like

Niab Chief Executive Professor Mario Caccamo originally joined Niab as the Head of Crop Bioinformatics in 2015, became NIAB EMR's Managing Director in 2017 and was appointed Chief Executive in 2021. A computer scientist by training, Mario has over 25 years' experience in life science research and big data, including specific projects to apply the latest DNA sequencing technologies and bioinformatics methods to advance scientific understanding of crop genetics and the interaction of agricultural crops with their environment. He is currently a Director of the Oxford Farming Conference.

glyphosate, controlling weeds before planting complements this.

Scientists have long recognised the threat of weeds developing glyphosate resistance, and multiple confirmed cases have occurred in annual ryegrass species, including Italian ryegrass, in other countries over the past 30 years. That is why this first detection of confirmed resistance to glyphosate in Italian rye-grass in the UK is not unexpected and, in time, other cases are likely to emerge.

This report does not change the strategies that UK farms currently use to ensure effective grass weed management, but it does stress the need to build resilience to address expected challenges and to be prepared for the unknown ones.

New genetics technology, the opportunity to modernise our farming systems and the effective use of the vast datasets that are available to us will all play a central role in the future of agriculture. It highlights the importance of enabling all the scientific solutions available to us, by implementing timely, proportionate regulation to incentivise the investment needed to develop them. This is a lesson we should have learned from our recent experience with the Covid pandemic!

In this *Landmark* issue we report on the recent publication of the AHDB Cereals and Oilseeds Recommended Lists. With 41 new varieties of wheat, barley, oats and OSR the Lists offer something for all. Credit must, once again, go to our plant breeding industry, which has demonstrated its resilience after yet another difficult year for combinable crops.

In November last year Niab attended the inaugural meeting of the All-Party Parliamentary Group on Science and Technology in Agriculture, reconvened after the 2025 General Election. This Group is now chaired by former science minister George Freeman MP with the remit "to provide a forum for parliamentarians and stakeholders to debate and highlight the value of science and technology in agriculture."

In my speech at this event I highlighted the critical role that proportionate and enabling regulations play in driving the investment needed to support innovation and build R&D capabilities, combining public funds with industry contributions.

I argued for prioritising enhanced access to innovative farming technologies to improve productivity, achieve environmental targets, draw inward investment, and ensure the practical application of plant science. We need to enable the innovations available today to ensure we can continue to feed future generations sustainably!

The first case of resistance to glyphosate in Italian ryegrass has been confirmed

Secretary of State for Environment, Food and Rural Affairs Steve Reed MP spoke at OFC 2025 on the secondary legislation on the Precision Breeding Act

Clare Leaman • clare.leaman@niab.com

New cereal varieties for 2025

After yet another difficult year for crops a raft of new varieties have been added to the AHDB Recommended Lists for 2025/26, announced in early December 2024. The fact that these new varieties have all come through testing in a series of tricky years will hopefully mean that they have had plenty of opportunity to prove their resilience as it seems the tricky years are set to continue.

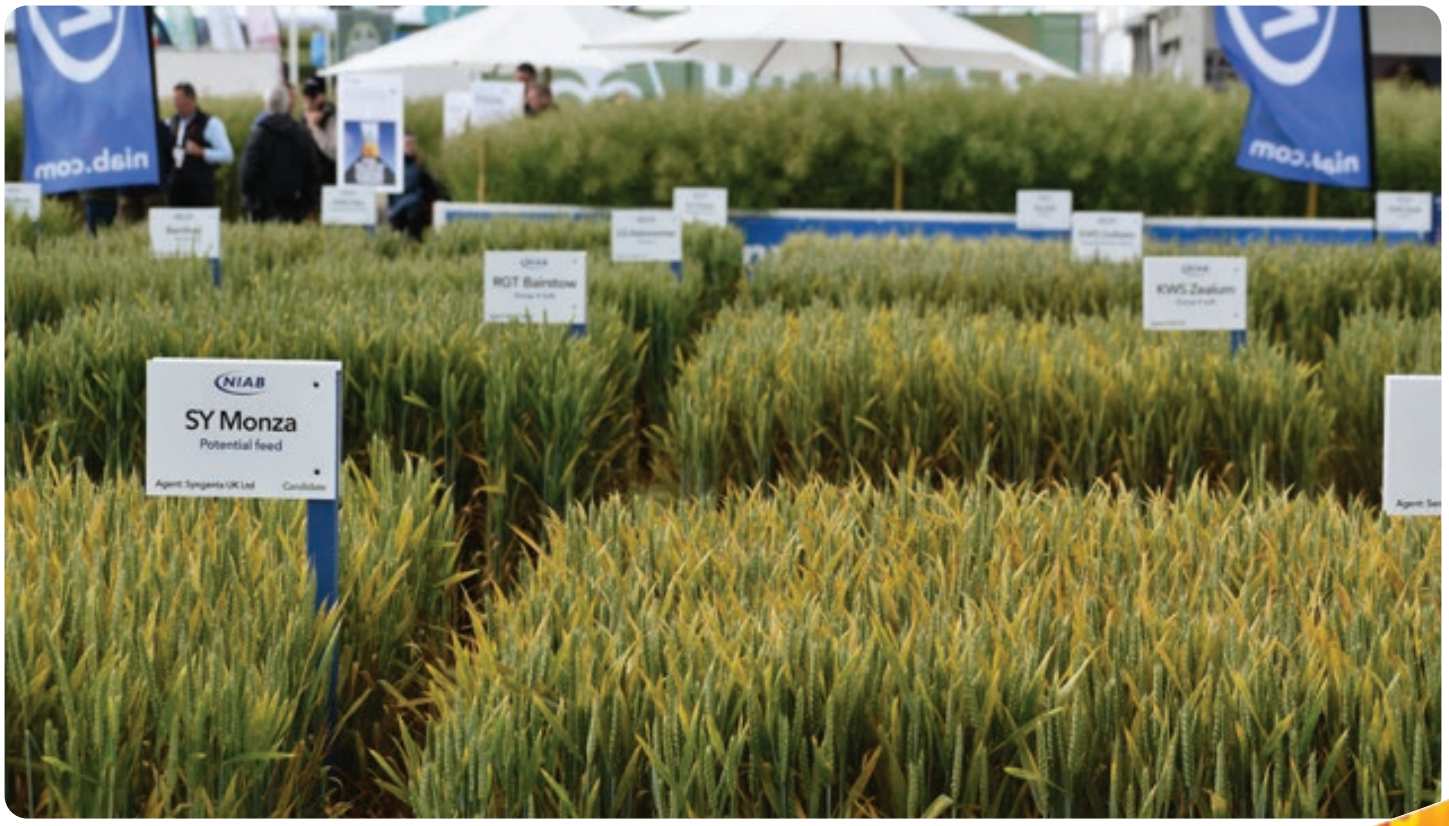
Clare Leaman has worked in variety evaluation at Niab for over 30 years. For the majority of this time Clare has worked with combinable crops, with a focus on cereals. Much of Clare's work revolves around knowledge transfer within the industry both through the Niab membership as well as to a much wider audience. Translating data and trial information into a digestible format for the growers and agronomists to use on the front line is a high priority. Clare is widely regarded as a key source of independent cereal variety advice to growers.

Wheat

The AHDB 2025/26 Recommended List sees new winter wheat additions across all end use groups, although it is the Group 2 section that gains half the new entrants and it will be interesting to see if they all manage to achieve market share in an already busy group.

After many years waiting for a new UK Flour Miller's Group 1 breadmaking variety we have a second in as many years. **KWS Vibe** (KWS) joins the List with a treated yield sitting between KWS Zyatt and Skyfall, but also with a vastly improved untreated yield, demonstrating the improvement it offers in terms of risk management. It has no specific weakness in its disease profile with good yellow rust resistance, moderate brown rust resistance as well as the best in group Septoria rating of 6.6. This is backed up by Pch1 eyespot resistance as well as good fusarium resistance and it is also stiff strawed. As is normal, it has been added to the RL with provisional Group 1 status and this is due to be confirmed in early Spring 25. KWS Vibe has a good set of grain quality and baking data behind it so, hopefully, the ongoing large-scale testing will not cause it any issues. Although at first glance growers may be slightly disappointed that neither KWS Vibe nor SY Cheer offer a step change in treated yield, the benefits they bring agronomically should not be underestimated.

UKFM Group 2 has been a popular hunting ground for growers in the last few years with KWS Extase, and more recently KWS Palladium, taking sizable market shares. With these varieties it has often been good disease profiles and lower risk that has been the attraction rather than a top line yield or quality.



KWS Arnie breaks this mould slightly, with a treated yield up with best feed varieties as well as a very respectable untreated yield. It offers relatively good resistance to both yellow rust and Septoria and has a high specific weight. While it sits in Group 2, KWS Arnie is at the lower end quality wise and it is most likely to be grown as a top yielding feed, particularly on heavier land where it has yielded very well.

KWS Equipe (KWS) comes from the same breeding programme as KWS Extase, and is comparable, offering very similar but slightly improved attributes. **KWS Newbie** (KWS) has a good treated yield but its untreated yield is slightly down on most in this group, likely due to its lower septoria rating. It has good grain quality and limited data suggests it has performed particularly well in the North. **LG Shergar** (Limagrain) has good yield, specific weight and disease characteristics, and its very short stiff straw may be useful for exposed or fertile sites. Finally in this group we have **RGT Goldfinch** (RAGT), a quality variety offering resistance to both Barley Yellow Dwarf Virus and Orange Wheat Blossom Midge, which has the potential to help manage risk. Whilst in BYDV free situations its treated yields are down this gap is likely to be less under virus pressure. Its excellent resistance to both yellow and brown rust coupled with a good level of Septoria resistance results in a much smaller gap in untreated yield. It is, however, weak-strawed and will require a well-timed straw management regime.

UKFM Group 3 sees two new entrants consolidating the yield step change first offered by Bamford last year. **KWS Solitaire** (KWS) is very high yielding, both treated and untreated, with good resistance to yellow rust as well as the best Septoria rating in this group and resistance to OWBM. It is, however, weak strawed and will require good straw management. **KWS Flute** (KWS) has slightly stiffer straw and a good treated yield, but its untreated yield is lower with a less comprehensive disease profile, although it does still offer resistance to OWBM.

RGT Hexton (RAGT) joins the UKFM Group 4 soft feeds with a high treated yield just 1% behind that of LG Redwald, although its untreated yield is at the more moderate end. It has relatively good resistance to both yellow rust and Septoria, good straw characters and a good specific weight.

Finally, we have the Group 4 hard feed variety **KWS Scope** (KWS). KWS Scope joins the RL with the highest treated yield, 1% above Champion and KWS Solitaire. It has relatively good resistance to both yellow rust and Septoria, stiff straw and a high specific weight. It has been particularly high yielding in the West.

This year we also have four new spring wheat varieties. **STRU102574k021511 (STR Pace)** (Agrovista) is a new Group 1 variety offering a good yield and specific weight. **KWS Bezique** (KWS) is a new high yielding Group 2 with OWBM resistance and a good specific weight. There are also two new feed varieties, **WPB Fraser** (Limagrain) and **Ophelia** (Elsoms). Both offer high yields and solid disease profiles with Ophelia also offering a good specific weight.

Barley

The AHDB 2025/26 Winter Barley Recommended List saw a huge influx of new varieties with 14 added. **KWS Valencis** (KWS), **Russo** (Agrii) and **NOS Olena** (Senova) all join LG Caravelle and LG Capitol at the top of the two-row feed group on a treated yield of 106%. KWS Valencis and NOS Olena have both shown some lodging, but

this should not be an issue with good straw management. Russo has an East recommendation as it has yielded particularly well in this region.

A couple of percent below this group we find **KWS Heraclis** (KWS), **Kitty** (Senova), **Rosemary** (Elsoms Ackermann) and **SU Arion** (Saaten Union). KWS Heraclis and Rosemary have a North recommendation where they have performed well, and SU Arion is recommended for both North and East. Rosemary has shown some lodging and will require good straw management. Kitty is a UK recommendation and has the benefit of stiff straw and an excellent specific weight, often highly valued by growers. Kitty has the added benefit of resistance to Barley Yellow Mosaic Virus strain 2 as well as BaYMV strain 1, with Valerie the only other Recommended List variety currently offering this trait.

Also new to the two-row feed group are **Organa** (Senova) and **LG Carpenter** (Limagrain). Both these varieties bring BYDV tolerance into this group for the first time, offering more choice to growers with only a small treated yield penalty at worst. Both varieties have a high untreated yield but have shown some lodging. LG Carpenter, in particular, will require careful straw management although it does have a slightly improved specific weight.

In the six-row group there are three new hybrids. **Inys** (KWS) is the first hybrid barley from KWS and comes in at the top of the RL for treated yield. It also offers a good untreated yield and stiff straw. Up with Inys is **SY Quantock** (Syngenta) which also offers a good untreated yield and strong agronomic profile. The third hybrid is **SY Kestrel** (Syngenta) and is a slightly different offering. SY Kestrel brings BYDV resistance to the List as well as tolerance to wheat dwarf virus and is particularly high yielding in the West.

Finally, we have two conventional six-row varieties that both offer BYDV tolerance. **Integral** (Secobra) has a competitive yield both treated and untreated as well as stiff straw, whilst **Sixy** (Elsoms Ackermann) has a high treated yield and stiff straw but a disappointing untreated yield and a lower specific weight.

For those growers in higher risk situations the opportunities to mitigate against BYDV are continually improving with ever diminishing downsides.

The AHDB Spring Barley Recommended List has four new varieties undergoing brewing and malt distilling tests as well as one new feed variety. **SY Arrow** (Syngenta) is a high yielding variety with a good level of resistance to both Rhynchosporium and Net Blotch. **Firecracker** (Agrii) offers high yields both treated and untreated. **Ptarmigan** (Agrii) is also high yielding with a high specific weight and is slightly earlier to mature whilst **KWS Enduris** (KWS) offers a combination of good yields and straw characters. **NOS Gambit** (Senova) was considered as a malting variety last year but fell short. This year it has been successfully re-entered as a feed variety rewarding its high yields, both treated and untreated.

Oats

There are no new winter oats to consider but there is an interesting new spring oat. **Caledon** (Saaten Union) joins the top of the List, offering a 4% treated yield increase on the next best variety as well as the top untreated yield. With a good set of agronomic and grain quality data Caledon looks set to be of interest to growers and millers alike.

NIAB TRAINING COURSES

CROP INSPECTOR TRAINING

Available for cereals, pulses, herbage and oilseed crops

Niab has trained many generations of crop inspectors and seed analysts from across the UK agricultural industry. More than 300 crop inspectors are trained each year, regardless of prior experience, who go on to officially check the various levels of certified seed that are sold in the UK.

Niab offers courses for cereals, pulses, herbage and oilseed crops and regularly train international candidates in all botanical characteristic recognition, enabling them to work towards licences in their own countries.

Courses are run in two parts:

- Part I – online training and exam. Candidates have access to online tutor support throughout the course.
- Part II – practical training and exam. Held at Niab in Cambridge, looking at live material in small groups with a tutor and demonstrator. Final examination held in the plots.

The intensive training is provided by experts in that specific crop type, offering instruction on variety identification, aided by experienced official crop inspectors. The course is designed to provide the appropriate training for candidates sitting their examination for an APHA Crop Inspector's Licence. Training covers crop botany, classification and identification relating to the licence, plus the theory and practice of crop inspection. Features of the course include:

- detailed instructions of crop inspection techniques;
- comprehensive literature;
- identification of major crop species and minor species.

To qualify for a full licence, candidates must pass the Part I and II examinations in the same calendar year.

It is a requirement under the Seeds Marketing Regulations 2011 that a person applying for a crop inspector's licence has "completed an appropriate training course relating to the inspection of seed crops of that species and category".

BOOK NOW

For further information, course prices and dates, and to book places email cert.training@niab.com or scan the QR code

News from NIAB

New nestboxes for Niab

Niab will be giving more birds a safe home this year thanks to the delivery of some new bird nestboxes – built and painted by local schoolchildren. The nestboxes, donated by schoolchildren from Bar Hill Primary School, will provide homes for nature at Niab's recently renovated Park Farm offices and laboratories in Histon, just outside Cambridge.

The expansion of Niab's bird nestbox numbers has come at the perfect time. The current boxes sited at Park Farm have all been successfully occupied over the past two years by Blue and Great Tits. It is hoped that more boxes will also lead to House Sparrows, a bird of the highest conservation concern, nesting once again at Niab.

The materials for the boxes were initially provided by Bar Hill Parish Council, as they were running a competition for the best decorated nestbox at the local primary school. With several boxes looking for new homes, one of the schoolchildren, Megan, thought Niab would be a good place for them: "When I visited my Mum, who works for Niab, I was really lucky to see some baby Blue Tits in a nestbox. After we had finished our improving the environment project at school, I asked if Niab could take some of the nestboxes we had painted. I'm excited to see which birds have a family in my nestbox, but I would really like to see Blue Tits nesting in it."

Kevin Middleton, Niab Communications Officer, monitors Niab's existing nestboxes and said: "We're grateful to Bar Hill Primary School for donating these new nestboxes to Niab, which means we can increase the homes available for birds around our offices. We'll keep an eye on these nestboxes and will let the schoolchildren know when birds start showing interest in their boxes. It's always exciting to lift the lid on a nestbox to see what's inside – whether that's several gleaming eggs or big gaping mouths of tiny chicks.

"In addition to our traditional nestboxes for smaller birds, we also have three bigger nestboxes situated around our trial grounds between Cambridge and Histon. These were all occupied in 2024 resulting in four Kestrel and seven Barn Owls chicks fledging. We'll continue helping these birds make their homes on Niab grounds and hope for a successful breeding season in 2025."

All nestbox monitoring is carried out under license by trained individuals.

Raising the profile of UK agri-science in Parliament

In late January the All-Party Parliamentary Group on Science & Technology in Agriculture (APPGSTA) hosted an 'Agri-Science Week in Parliament' exhibit in the Palace of Westminster.

The multi-partner exhibit, staffed by scientists from Niab, the John Innes Centre, Rothamsted Research, the Roslin Institute and the University of Lincoln, showcased UK taxpayer-funded research and innovation taking place across a range of sectors and technologies, including digital agriculture, robotics, advanced crop and livestock breeding, vertical farming and AI.

The initiative provided a unique opportunity to engage with MPs, Peers and their staff, explaining why agricultural science and technology are so important to all our futures, particularly to a new intake of MPs who may not immediately think of farming innovation as important to them or their constituents.

APPGSTA chair George Freeman MP and vice-chair Charlie Dewhurst MP were joined by Agriculture Minister Daniel Zeichner MP (pictured) at the exhibit's opening ceremony and the launch of a new innovation agenda for UK agriculture from the Group.

Flora O'Brien • flora.obrien@niab.com

GROWING GREEN

Business sustainability training programme launches

Led by Niab, a new sustainability training programme is launching in Kent and Medway for horticultural growers. Following a successful pilot, Growing Green is designed to inspire and train growers to implement innovation that not only reduces their carbon footprint, but helps create new value and revenues from their production.

Dr Flora O'Brien is a specialist in root and soil biology. Her research focuses on aspects of root and soil biology in horticultural crop production. Her areas of interest include soil health and carbon sequestration, and root-rhizosphere interactions. Flora is leading Growing Green, a new sustainability training programme for horticultural growers.

Navigating the carbon landscape

Improving sustainability is a high priority for many horticultural growers, particularly as their customers set stringent environmental standards through their assurance schemes. While there is widespread awareness and willingness to reduce their carbon footprint, knowing which measures to invest resources in can be challenging. With many ways to measure your environmental sustainability, identifying which changes will have the biggest impact, on both emissions and bottom line, can be difficult to navigate.

Step in Growing Kent & Medway's sustainability training programme, Growing Green. Successfully piloted in 2022, and previously funded by the UK Government's Community Renewal Fund, the training programme trialled an innovative approach to incentivising the move to net zero for SMEs in the horticulture, food and drinks sector. Following its positive feedback and results, Growing Green is being rolled out in 2025, with improved features.

The programme is tailored specifically for the sector. It focuses on upskilling and improving the knowledge of the participants, so they can confidently implement strategic improvements to their business. Networking with similar businesses to share ideas and learn from each other is another important element.

Businesses participating in Growing Green in 2025 can apply for a grant of up to £7,000, receive accredited training and get a professional membership.

Creating value from waste

Innovation within the sector has highlighted exciting opportunities to create new products and markets while lowering emissions, cutting waste, and reducing costs. Horticultural crop by-products have the potential

Growing Green helped Roughway Farm work with a local engineer to develop a new de-husking process for cobnuts

to contribute to a biobased circular economy. High-value compounds from crop residues, such as polyphenols from grape waste and essential oils in hops, can be upcycled and used in industries like cosmetics and pharmaceuticals.

Roughway Farm, a fruit farm run by the Cannon family in Kent, was supported by the pilot in 2022. Kent Cobnuts are one of their speciality crops, however, their existing de-husking process led to damaged fresh nuts, which reduced their market value and storage potential, leading to food waste.

Through Growing Green, they worked with a local engineer to innovate a new de-husking process. It removes the leafy outer husk, separating the husks and nuts with minimal damage to the fruit. The team have found an opportunity to valorise the waste husk material, creating a new revenue stream. They are also able to offer a dehusking service to other local growers.

The new system also means they can process the produce closer to harvest, dry them more quickly and store them at ambient temperatures, rather than the normal cold stores. This further reduces their carbon emissions and cuts their energy costs.

Tom Cannon, Roughway Farms said: "The [Growing Green] programme has been helpful in giving us business tips, like developing waste streams. There are many areas in our business where we can reduce our carbon emissions. It has helped us think about how we de-carbonise but also grow the business, and you want to do both."

Reducing inputs and protecting soils

SC Berry Ltd is a mixed farming business in Faversham, Kent, that includes hops, vineyards, apples and pears, and cereal crops. They were looking to expand their regenerative horticulture approach and so joined Growing Green in 2022.

Following support from the specialist team and a grant from Growing Green, they purchased a subsoiler with a precision fertiliser applicator for use on their hops and vines. Their goal was to reduce their fertiliser use and remove compaction on their soils by using a low-disturbance subsoiler. By subsoiling on rotation, they aimed to improve their soil structure and its ability to hold nutrients, further reducing the need for fertiliser use.

Tom Cannon has used Growing Green for advice on reducing carbon emissions

Their fertiliser cost savings were estimated at £4,000 per year, with an annual carbon saving estimated at 9,518 CO_2eq.

Another mixed farm, EH Holdstock and Son, based near Canterbury, used their Growing Green grant to move from an overhead irrigation system to a trickle irrigation system in their orchards. Their action plan estimated this would save around 58% of water use, and reduce their diesel use by 71% due to reduced evaporation and water run-off, and shorter running hours. Support from the team also enabled them to introduce dosemeters, so their fruit trees could be fed while irrigated.

Grow your business greener

Applications for Growing Green are now open again to horticultural or plant-based food and drink businesses based in Kent and Medway. There will be four groups throughout 2025, and places are limited. Further information about the programme and more details about how to apply can be found at growingkentandmedway.com/growing-green.

Growing Green is a training programme delivered by Growing Kent & Medway, an enterprise cluster funded by UKRI's Strength in Places fund, and led by Niab.

In 2022, 33 horticultural and plant-based food and drink businesses took part in the pilot scheme. It provided training, co-developed decarbonisation action plans and issued grants to 24 of the businesses to the value of £180,000.

As well as driving down carbon emissions, the independent report that evaluated the programme anticipates the pilot will deliver over 20 new jobs and £3 million in GVA (gross value added) in Kent and Medway by 2028.

The pilot was led by Growing Kent & Medway and delivered by Niab, Low Carbon Kent, Locate in Kent, Produced in Kent, University of Kent, the Kent Foundation and APS Produce Limited.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New oilseeds and pulse varieties for 2025

Colin Peters is NIAB's break crop specialist, providing specialist technical and scientific knowledge on the evaluation, selection and management of crop varieties, focusing on break crops including oilseed rape, linseed, pulses, sugar beet and other minor crops.

Pulses

We start with the pulses and the Processors and Growers Research Organisation has a good selection of new varieties added to the 2025 Descriptive Lists. There is one new winter bean variety, four new spring bean varieties and nine new peas; one Marrowfat, one Green and seven Yellow. This year virus resistance information for combining pea varieties has been introduced for the first time.

The sites for the harvest 2024 trials were similar to previous years, working with the same growers and growing areas to achieve a good geographic spread and a range of soil types. The Descriptive Lists are based on a five-year data set from 2020 through to 2024.

Winter beans

Vespa and Vincent still head the DL from a yield perspective, but with three years of data, **Miro** (Senova) has been added to the List with a 101% yield. It has a good early maturity score of 7, significantly better than all the varieties above it on the List, although it has a very low downy mildew score of 3 and care will be needed with fungicide inputs. Miro has good mid-range protein level at 26.2% and matches Vespa with the highest score of 7 for chocolate spot resistance.

Spring beans

There are four new varieties: **Notilus** (Senova), **LG Eagle** (Limagrain), **Ketu** and **Loki** (NPZ, formerly LSPB). Notilus and LG Eagle head the List as newcomers with a yield score of 110%, although they are somewhat later maturing than the majority. Ketu is slightly lower yielding at 107% with early maturity, and is also an LVC (low vicine and low convicine) variety; a digestibility trait that makes a variety more suitable for certain animal diets. Loki completes the set with a yield of 103% and has the best rust resistance of all the newcomers with a score of 6 which still means that careful attention needs to be given when growing. All four of these newcomers show some susceptibility to downy mildew, with Notilus and LG Eagle scoring only 3.

Still on the List is Maris Bead, which first appeared in 1964. It only has three years of data but the beauty of the Descriptive List means that the older varieties do not need to be trialled every year as long as they keep three years of data rolling within the five years.

Peas

There is one new Green pea on the List this year. **Pangea** (NPZ) is the highest yielding in its group with a standing ability at harvest score of 6. It has a downy mildew score of 6, which is at the lower end for the group, but is rated Highly Resistant for powdery mildew; the only two other Green peas rated HR are Reacher and LG Aviator.

Midori (NPZ) enters the Marrowfat List as the highest yielder in its group with a yield of 103%, although it is later maturing with a score of 4. It has a good standing ability at harvest score of 7 but a 4 for downy mildew shows some susceptibility.

There has been a lot of investment in bringing new Yellow peas to the UK and seven new varieties are added to this group for 2025 – **KWS Bram** (KWS), **Marler** (Cope Seeds & Grain), **NOS Blondie** (Elsoms Seeds), **Captur** (Agrovista), **Bellair** (IARA), **LG Corvet** (Limagrain) and **Bonham** (Senova).

KWS Bram is tied at the top with Concerto for yield at 118%, Marler and NOS Blondie are close behind at 116% and Captur and Bellair at 115%. LG Corvet, with a yield of 111%, does have the highest rating on the List for downy mildew at 8. NOS Blondie and Bellair have downy mildew scores of 5, which show they are somewhat susceptible. Bellair, together with another newcomer Marler, has a HR score for powdery mildew. Generally, in this class of peas the higher yielding varieties have lower proteins. KWS Bram, Marler and NOS Blondie all have proteins in the 21% range but Captur and Bonham buck the trend with a 22.6% with LG Corvet at 22.2%. All these new varieties have similar maturity and

standing characteristics.

This year the List includes breeders' claims on virus resistance. In each of the following cases the breeder has noted resistance to the following viruses: KWS Bram – BYMV (Bean Yellow Mosaic Virus), Bellair – PSbMV (Pea Seed-Bourne Mosaic) and Reacher – PSbMV and PEMV (Pea Enation Mosaic Virus).

Spring linseed

There are four new varieties on the AHDB 2025 Descriptive List: **Baroness** (Elsoms Seeds), **Nimbus** (JTSD), **Paddington** (Elsoms Seeds) and **Genie** (JTSD). Baroness and Nimbus are brown seeded varieties with yields of 102% and 98% respectively. Paddington is a yellow seeded variety yielding as is Genie which yields 83%.

Winter oilseed rape

The 2023/24 season was a difficult one for winter oilseed rape, both commercially and within trials, with many trials abandoned mainly due to establishment problems with flea beetle and soil moisture. Pigeon grazing, clubroot and flooding also caused problems. A trial needs to be fairly uniform to be relevant even when multiple replicates are used, so issues such as pigeon damage are very problematic.

Ten fungicide-treated trials survived through to harvest in 2024 with the average yield of the control varieties at 4.92 t/ha, close to the four-year average of 5.05 t/ha, but results were somewhat variable compared to the norm. The lowest yielding trial this year was in Midlothian (control average 3.58 t/ha) and the highest yielding were two trials in Cambridgeshire where the controls yielded 6.08 t/ha (these were netted for the winter).

Yields on the Recommended List are reported as a gross output; seed yield adjusted for oil content. The values are represented as a percentage of the control varieties, which for 2024 were Turing, Aspire, Aurelia, Ambassador and PT303.

Eight new varieties were added to the AHDB 2025/26 Recommended List, but there were a number of good varieties that failed to make the List but growers should be aware of. The first are

the hybrids; **Cognac** (DSV), **LE21/456** (Limagrain) and **Churchill** (DSV) are all solid varieties with gross outputs of 103% and above with Turnip Yellows Virus resistance. Cognac has good pod shatter resistance, with Churchill and Cognac showing very good stem canker resistance with scores of 8, as does **Paparazzi** (RAGT), another hybrid. Paparazzi also has very good gross output at 102% but lacks the genetic TUYV and pod shatter resistance.

Hallmark (Elsoms Seeds) is a good yielding conventional that, at 98%, outyielded the control variety Aspire and **Cromat** (NPZ) at 97%, a hybrid with clubroot and TuYV resistance. All of these varieties have been through the whole Variety List and Recommended List trials process and are good varieties in their own right but did not make the final Recommended List.

Moving on to the new varieties that did make the AHDB 2025/26 Recommended List for planting this coming autumn and there is a good mix from several different breeders. **LG Adapt**, **LG Avenger** and **Magelan**, all from Limagrain, are still completing the Variety List registration process system and will be fully on the RL by the end of January 2025, unless there are any representations relating to their registration.

The top four yield spots are taken by **Maverick** (NPZ), **LG Adapt**, **Hinsta** (KWS) and **Magelan**. LG Adapt performs well across the whole UK, the other three are suggested more for the south. They all yield very well, ranging from 106-109% of the controls which is not significantly different, and all have TuYV resistance. Unlike the other three in this group, Maverick does not have pod shatter resistance but does have an excellent stem canker resistance score of 9 which comes from the addition of the RlmS genetic resistance. Maverick, LG Adapt and Hinsta all have good light leaf spot resistance scores of 7, Magelan slightly lower with a 6. The physical characteristics, plant height, standing ability and flowering/maturity dates are all similar although the oil content of LG Adapt and Magelan are slightly higher.

One for the north, **LG Avenger** at 106% has good light leaf spot resistance (7), less so for stem canker with a score of 5 but does have both TuYV and pod shatter resistance.

There is one new conventional variety on the List with **Powerhouse** from Elsoms, which thus far in trials has yielded higher when grown in the north (102%). It does not have TuYV resistance but does have a good light leaf spot score of 7.

There are two new clubroot varieties on the RL: **Crusoe** (NPZ) and **Cromputer** (DSV). Both have UK recommendations and Crusoe yields very well for a specialist variety at 103% in the south. Both have TuYV resistance, Crusoe has a good stem canker resistance score of 7 whereas Cromputer is slightly less at 5 but with a higher oil content. Although it is tempting to use these varieties on a "just in case" basis, all of them use a very small genetic resistance pool and if used too widely, that may break. Ideally, use them where you know or suspect there is a problem.

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Cover crop use in the UK and the US

The International Soil Tillage Research Organisation (ISTRO) held its 22nd conference in Virginia, USA in September 2024. Its theme was *Living Roots, Living Soil*, focusing on regenerative agriculture, soil health, cover crops, residue systems and sustainable crop production as a whole. Over the five days of the conference 198 scientific abstracts were presented by 512 authors and co-authors registered from 35 countries around the world.

Dr Nathan Morris is Niab's farming systems and soils specialist, actively involved in knowledge exchange and farmer training activities. His particular interests and expertise include developing farming systems to improve soil structure and stability whist maintaining crop productivity.

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I was fortunate to attend the conference and the first thing I was reminded on arrival was the vastness of the state of Virginia and the many varied climates that support the growing of crops from broadacre crops of corn, soyabean through to specialist fresh vegetables, cotton and even tobacco. The state of Virginia stretches from the Chesapeake Bay to the Appalachian Mountains, with a long Atlantic coastline with over 3.1 million hectares farmed. The top three products (by farm cash receipts) in Virginia are broilers, cattle and turkeys. Crops such as soyabeans and corn are only sixth and seventh on the list respectively. Agricultural exports make an important contribution and are valued at more than $5 billion in 2022.

Cover crops in Virginia

As with all farming systems across the globe, the challenge to produce wholesome food, at low cost and with care to reduce the impact on the environment is ever present. Support through the Virginia Agricultural Best Management Practices Cost-Share Program (VACS) allows growers access to financial and technical support to grow cover crops that fit with a farm's rotation and allows for reductions in nonpoint source pollution by slowing runoff and absorbing excess nitrogen that otherwise would leach into the water (Figure 1).

Figure 1. A soil profile demonstration, with cover crops, at the ISTRO Conference in Virginia

Together farmers, agronomists and scientists at universities (through the extension network) have worked together to setup the Northeast Cover Crops Council (https://northeastcovercrops.com/). This brings together a suite of data on cover crop species, growth characteristics and weather data to develop tools for farmers to aid their decision support making when choosing the species of cover crops for particular situations and rotational choices.

In addition to the selector tool there is a cover crop nitrogen calculator (https://covercrop-ncalc.org/) that aids farmers with decision support regarding cover crop residue persistence, as well as the amount and timing of nitrogen availability, something that has always been a challenge to quantify specifically in the UK agricultural industry. Perhaps, one day, an industry-led tool could become something that the UK farming industry aspires too!

The Cover Crop N Calculator provides a user-friendly approach to estimate decay of cover crop residues and release of N for offsetting N fertiliser inputs. The data used in the model was generated from controlled laboratory experiments and on-farm cover crop decomposition studies across diverse environments were used in the model's development. Depending on residue placement, the calculator uses soil moisture and soil temperature (for incorporated residues) or residue water potential and air temperature (for surface residues) to adjust decomposition rates.

Long-term studies supporting the science

As with many system changes on farm, whether it be adapting the rotation, integration of cover crops, cultivation regime or revisions in nutrient supply to the crop these are all complexities that need to be considered within an integrated system. One change within the system often has subsequent effects on other parts of the system.

In this way, it is important that agricultural research has the ability to look at systems over the long-term, something that Niab is fortunate to be involved in delivering research to farmers, agronomists and the wider industry. New Farming Systems (NFS) is a key project that Niab facilitates, with the support of the Morley Agricultural Foundation (TMAF) and the JC Mann Trust, that started in 2007 at Morley, Norfolk. One element of this work has been studying the inclusion of repeated use of cover cropping across the rotation and the effects of reduced intensity of cultivation in combination with cover cropping. Over a period of 12 years the energy input ratio can be calculated with more efficient systems returning a lower ratio. When looking across systems and across time the shallow non-inversion tillage with the use of cover crops shows a reduction in energy consumption compared to the plough-only control (Figure 2).

Work led by Syngenta UK, with industry partners Niab and Game & Wildlife Conservation Trust, seeks to develop an understanding of a broadacre cropping system based on Conservation Agriculture (CA) principles so that when moving towards a more sustainable cropping system allows for the quantification in key indicators. The study is run across two farms at Loddington, Leicestershire (heavy land site) and Lenham, Kent (light land site). The trial consists of a four crop rotation with three cultivation approaches shifting to lower disturbance (and the inclusion of cover crops). A huge quantity of data is collected, interrogating field operations, soil health and organic matter, greenhouse gas emissions, farmland and soil biodiversity, yield, profitability and agronomic characteristics.

Results from the first five-year phase of the project are encouraging, showing improvements with more profitability in a lower disturbance system and which also brings positive benefits to soil health and the wider environment, along with increasing work rate by 50% (Figure 3).

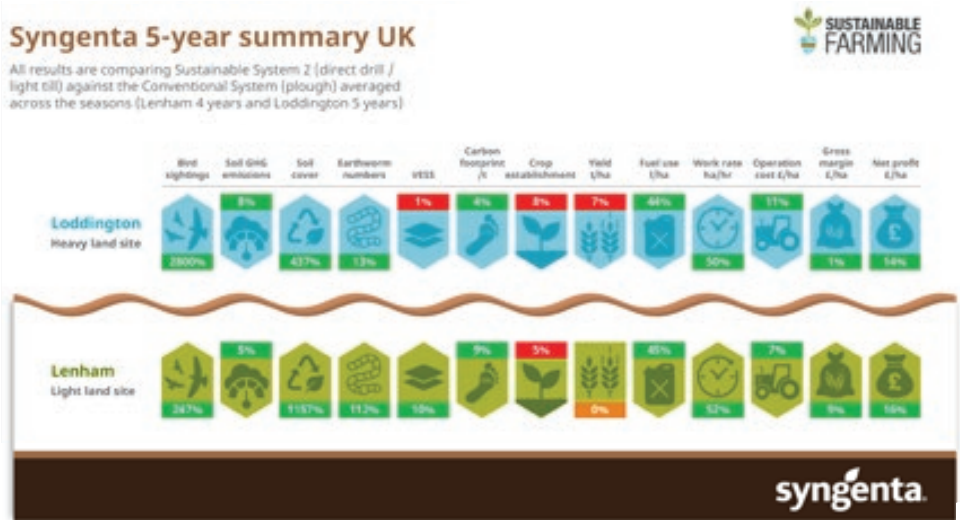
Dr Nathan Morris attended the ISTRO Conference through the support of the Barsby Future Farming Award, an internal Niab staff travel award, and generous support for travel through the RJ Harrison Trust.

Figure 2. Energy input ratio (GJ t-1) for each treatment relative to the conventional plough (control). Calculations computed by Dr Doug Warner at the University of Hertfordshire

Year	Crop	Plough (control)	Deep-NI	Shallow-NI	Plough+CC	Deep-NI+CC	Shallow-NI+CC
2008	WW	1	1.04	0.97			
2009	SOSR	1	1.21	1.05	1.11	1.53	1.05
2010	WW	1	1.07	1.01	1.04	1.09	1.05
2011	SBN	1	1.84	1.74	1.14	1.70	1.78
2012	WW	1	0.97	0.90	1.05	1.02	0.92
2013	SBRLY	1	1.05	1.02	1.19	1.25	1.19
2014	WOSR	1	0.89	0.81	1.15	0.99	0.88
2015	WW	1	0.96	0.92	1.01	1.00	0.92
2016	SOAT	1	0.96	0.92	1.07	1.02	0.96
2017	WW	1	0.97	1.00	1.06	1.01	0.98
2018	WB	1	0.98	0.93	1.06	1.02	0.96
2019	WOSR	1	0.87	0.88	1.04	0.90	0.89
2020	WW	1	0.92	0.98	1.03	0.94	0.94
Mean WW2010-		1	0.99	0.98	1.07	1.06	1.01
Mean WW2015-		1	0.95	0.97	1.03	0.98	0.94

Treatment (green cell = decrease, orange cell = increase)

Figure 3. A summary of the first five years of a Syngenta study on broadacre cropping systems based on conservation agriculture principles



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Moving into and on from the SFI 2024 Expanded Offer

Overview

In the Autumn 2024 edition of Landmark, the focus was on the large increase in options that had recently been published for the Sustainable Farming Incentive (SFI) in England, which is the pillar of the wider Environmental Land Management Scheme (ELMS), that aims to allow farm businesses to access payments which help compensate for the loss of payments under the Basic Payments Scheme (BPS) which is being phased out.

Under the BPS, farms declared areas that were farmed and were then paid a calculated sum per hectare for farming the land declared. With SFI, farms are able to apply to undertake a range of qualifying agricultural and environmental management options that each receive payments that are made quarterly (rather than annually in the past) to the business.

The broad aim of all the options available is to steer farming practices towards having less impact on the wider environment and in some cases, creating better and more diverse land uses for the benefit of biodiversity. All this is also aimed at continuing to support 'sustainable' food production. In a nutshell, what is behind the slogan 'public money for public good'.

This structure was setup in the wake of Brexit and the need to support agricultural production and the farmed environment outside of the EU Common Agricultural Policy (CAP). After some years of thinking and piloting, SFI was initially launched, with limited options, in 2023, with an expansion of the options in 2024. The aim being to have an increased availability of alternatives as BPS funding is gradually withdrawn. The much sharper drop in BPS payments from 2025 than would have been expected, announced as part of the infamous October 2024 Budget, means farming businesses which need or would like public funds to buffer themselves financially against the loss of BPS now need to focus on SFI and other ELMS policies that may be relevant to them.

Phil Humphrey has worked as a field agronomist and farm adviser, working mostly with combinable crops, maize and grassland. He now supports Niab Agronomy and Farming Systems teams, with input into a range of projects, including FFRF.

Will Vaughan-France is Niab's regional agronomist covering the south west and is also the membership services development lead. He is based in Somerset with his own farm and has experience in a range of technical and commercial organisations.

Greg Crawford studied agricultural business management at Newcastle University. He went on to work for various agribusinesses working across arable, beef and horticulture before joining Niab in 2022 as the farm business resilience consultant. Greg's role is visiting participants of FFRF to complete the farm business review and report that forms the initial stage of the FFRF support, before signposting to specialist technical advice.

How can farming businesses best incorporate ELMS and particularly SFI?

When a carrot is dangled, there are often several ways it can be looked at, and ELMS and SFI are no different.

Choice 1 – Make no use of them.

If the business does not need to incorporate any of the options on offer for financial profitability, there is no

reason to do so. Businesses which have not historically had much or any support via BPS, or have already restructured their enterprises to be able to not need it, may already be in a position to 'say no'.

There is nothing wrong with this, and indeed, many might view people in such a position with a degree of envy. Alternatively, such businesses can choose to apply for some options that particularly suit them, with the peace of mind that they are not relying on them, just saying 'yes' to what is offered.

Choice 2 – Fully embrace as many of the options available as possible, gearing the business activities around them.

Since support payments were initially 'de-coupled' back in the early 1990s, this sort of option has been taken up by some businesses. Particularly where land is wholly owned and the owners have little interest in farming themselves.

It can also suit farms that are difficult to generate a profit from by food production alone but have a lot to offer in terms of biodiversity when managed at a whole farm level or even as part of a wider landscape level project.

Again, there is nothing wrong with this approach if it suits. Indeed, within reason, such businesses help the industry more generally reach some of the government policy aims around such things as increasing biodiversity, capturing and storing carbon, improving flood management provision and recreational uses in rural areas.

Choice 3 – Incorporate some of the options on offer for financial reasons, whilst maintaining the core food production activities of the business. This is where the majority of farm businesses probably sit, whether by choice or financial necessity.

If you are in 'Choice 1' – feel free to read on, but only if you wish to.

If you are in 'Choice 2', you have probably already enrolled in some of the agri-environment schemes that have been available for many years. You may currently be frustrated being trapped in such as scheme, when you'd rather transfer to the more recent offers.

If you are prepared to stick with environmental land management as a higher business priority than food production, then please do so. The nation will likely need a mixture of food production focused and environmental services focused businesses to best achieve government policy goals related to more sustainable environment management and security of food supply.

If you are in 'Choice 3', the rest of this article will hopefully help steer your thinking in a useful way.

Exactly how you look at things will partly depend on where you are at the moment regarding agreements signed up to or not and their associated management. It is also important to appreciate additional restrictions that tenant farmers may have with being able to sign up for agri-environment schemes. To provide some practical examples, it is probably best to assume that at least some of the business is already in an agri-environmental scheme.

Under the initial SFI 2023 scheme, boundary management (hedges and hedgerow trees), and some companion crop or cover crop options were popular choices. 'No insecticide' was also surprisingly popular.

Quite sensibly, many people went for options that either did not impact their current land management, or that they could incorporate into their established rotation.

The nice thing about both SFI that is available now and the improved Countryside Stewardship Higher Tier (CSHT) scheme that should be up and running by this coming summer, is that businesses can join them on a monthly rolling basis, and payments are made quarterly. It is also Defra's aim for different agreements to be able to run alongside each other in a better way than has been the case sometimes to date.

This is important to bear in mind, as it is understandable that faced with a sudden drop in income, signing up for things in a hurry to help plug the gap is tempting. However, as with many things, not panicking, but taking time to understand things in more detail could be the better course of action. This is not the same as putting off any decision-making until another day.

Going forward, there are three different levels that farm businesses can incorporate funded agri-environment schemes, outlined in Figure 1.

Potentially all schemes will also allow access periodically to capital grants to

Figure 1. Agri-environment schemes for England

Scheme	Comments
Sustainable Farming Incentive (SFI)	Open to nearly all types of landowners/managers of eligible land. Agreements lasting 3-5 years, depending on options chosen. Current method of expanding options is via new agreements, so possible to have several separate agreements. New applications accepted monthly, payments quarterly.
Improved Countryside Stewardship Higher Tier (CSHT	Currently, businesses already in a Countryside Stewardship Scheme (HLS, CSHT etc.) are being invited to apply at different times through 2025. After this, likely to be a competitive scheme based on a combination of Defra priorities and quality of plans presented when applying. New applications accepted monthly, payments quarterly. Agreements likely to be for at least 5-10 years. Grants to support creation of plans are available now.
Landscape Recovery (when next available)	Mainly looking at supporting land management for specified environmental and ecological gains at a landscape level, so most appropriate for larger landowners or groups of farm businesses. Local organisation and more detailed engagement with authorities, interested parties and supporting organisations required. Agreements likely to be for at least 20 years.

either support purchase of equipment, or costs involved in building or maintaining infrastructure to support habitat management.

It can be seen in Figure 1 that there is a hierarchy of commitment. This can be viewed as a trade-off between security of income and freedom of commercial practice.

Careful consideration needs to be given as to which scheme (if any) will best suit business plans for at least the medium term if not longer term (Figure 2). Although comparisons of possible income and costs can be made, it is important to put alongside any such comparisons some sort of contingency for risk. Budgets for commercial income and costs will often become less robust and accurate relatively quickly (within five years).

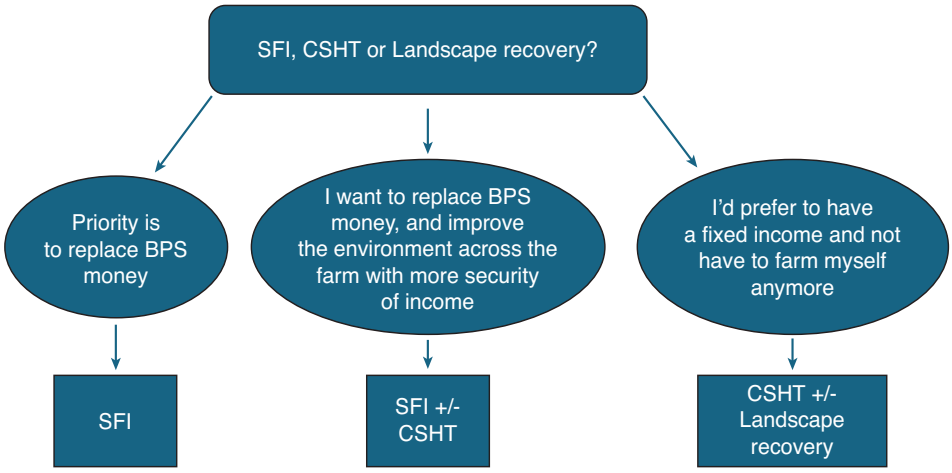
This means that businesses should take a different view of SFI agreement commitments, where well considered budgets of scheme option income v full commercial freedom can be made and judged on their merits, compared to longer term agreements, for both overall net income and practical impacts.

When considering longer term agreements, to some extent, the net income from the scheme needs to be looked at as more of a fixed, but secure income, over a period that may be difficult to judge accurately for either comparative commercial income or a businesses' outlook/vision.

Even when planning an SFI application, do also take into consideration:

a) How things will be if you decide to add additional plans to the original;
b) How things could look if you pulled out after say three or six years?

Figure 2. Decision tree on best suited agri-environment scheme for farm businesses



CASE STUDY

An example story of a 300 hectare farm that used to have £60,000 from BPS

The family had accepted the hit until 2024, when they thought £30,000 was too much to not have (50% of the original 'full' BPS). They had followed cross-compliance rules, but not previously been in any agri-environment schemes. They have plenty of hedges and so decided to put 7,000 metres into all three of the hedgerow management options for SFI 2024, and a further 7,000 metres for management of one side of the hedge.

Codes CHRW1, 2 and 3, at £10/ 100m, £26/ 100m and £10/ 100m = 70 x £46 = £3,220, and 70 x £5 + £13 = £1,260, thus getting some much-deserved income for doing what they already were, but just in a slightly more planned way. As most of the field boundaries have good hedges, they also decide to improve the hedge – crop buffering by making sure they had an average width of 6m (code CAHL4, £515/ha). The total area was calculated to be 12 ha = £6,180.

About 6 ha of this would need some additional grass seed to be sown. Cost of seed and establishment was costed in at £50/ha, so £300. There would be some mowing, costed in at £20/ha over 6 ha annually (£120/yr), and very likely some spot spraying of weeds, so a total of £200/year was budgeted for maintenance.

They also decided to put a few awkward field corners into tussocky grass habitat. A small amount of seed along with natural regeneration, sorted this at very little cost – code CAHL3, 10 ha at £590/ha = £5,900.

They did not really want to commit to anything more, but because they were already doing a lot of the things asked for in the three management plan options, they put these in as well:

- Soil management plan, code CSAM1, £6/ha + £97 = £1,897;
- IPM plan, code CIPM1, £1,129;
- Nutrient management plan, code CNUM1, £652.

These earn another £3,678.

Doing most of the work themselves but needing to pay for soil sample analysis and a BASIS qualified adviser to help with the IPM plan. They budget on using the £4,000 (split over three years) they qualify for the management of their SFI plan to cover most, if not all of these costs.

So, a total (mostly net) income of nearly £20,000 a year, with an estimated lost cropping area of 16 ha. The lost cropping area is bringing in an income of around £9,000 in SFI, so would therefore need to be producing a margin of over £500/ha to fully compensate for not entering it into SFI. Given the nature of most of this land, this is not likely to be the case.

The 2025 decrease in BPS payments

Once they realised that they will only be getting £7,200 worth of BPS in 2025 (76% cut of £30,000 maximum that can be claimed), they think about what else they could do by taking out a second SFI plan.

With some help from a business adviser able to offer them free advice via the Future Farming Resilience Fund (FFRF), they have discussed their business objectives and considered which additional options they should apply for. Luckily (for the length of this article), their business objectives were mainly to be able to retain the income they used to have from BPS before the scaled reductions started in 2021, whilst minimising any changes to their current rotation, based on cereals, with oilseed rape and beans as break crops.

Attracted by the £593/ha payment, for legume fallow, code CNUM3, the farm were thinking they could put 50 ha into that instead of a break crop, get £29,650 and that would do. The FFRF-Niab adviser looked at the gross margins they tended to get from their break crops. Sometimes they were higher than £600/ha and sometimes lower. The farm said the variation was mainly down to yields, with some crops being unduly affected by either pest damage or overwinter weather. The adviser then considered what they might spend on operating costs and compared this to the costs involved in growing a legume fallow. Once seed and establishment costs, together with the cost of mowing twice a year were taken into account, the main difference was some of the cost of crop combining. Costs for the legume fallow were higher if it was not kept in the same fields for three years. The consultant also advised that soil structure benefits would be noticeably better if this option was kept static.

The farm also had a couple of fields they knew were more difficult to farm than most others, and they did not think legumes would thrive in them. The consultant therefore suggested 30 ha could be a three-year static legume fallow, and 20 ha could be wild bird food (code CAHL2, £853/ha), which would earn £17,060. The farm were concerned about the seed costs for this option as well as it not bringing in the same income. The consultant pointed out that the seed mix need not be overly expensive, maybe £50-80/ha. They also said that keeping it on the same, sub-optimal land, would mean they could judge what re-seeding was needed each year, and could probably benefit from some species self-seeding, enabling considerable savings on annual seed costs. This land also happened to be in an area of the farm that already attracted small farmland bird species.

The consultant thought that because growing and operation costs would be lower than continuing to grow cash crops on the land, that budgeting on an income of £700/ha would be fair in this case, giving a total budgeted income of £14,000 per year.

After initial seed costs and annual mowing costs, the consultant suggested a net income of £500/ha for the legume fallow, giving a net income of £15,000 per year. The other advantages of keeping the wild bird food and legume fallow options static would be that any unforeseen weed or volunteer crop seeds would be restricted to a particular area, rather than ending up as an additional whole farm problem. The legume fallow should grow a 'super 1st wheat' after being down for three years, giving a bit of a bonus boost to crop margins.

After some thought, the farm decided to go with this, but were still wondering how to bring in a bit more income from SFI. Having looked around the farm and also studied some maps together, the consultant suggested to the farm that they could consider the following:

- 500 metres next to the main watercourse through the farm could have a 12 m buffer established, as it was one of the few field boundaries without a buffer already – 0.6 ha, code BFS1, £707/ha = £424. Although there would be some establishment costs and operating costs (mainly mowing and spot treating pernicious weeds), the farm should be able to budget on an average annual income of nearly £400/ha. The land used often flooded, so the farm could take a pragmatic view of crop income lost;
- 20 metre grass buffers around in-field trees BFS4, £553/ha (2 ha) = 1,106, again with an estimated net annual margin of £1,000;
- As they already applied fertiliser at a variable rate, the consultant thought they should collect £27/ha for this on the remaining cropped land. Precision fertiliser application, code PRF1 £27/ha, 230 ha = £ 6,210.

This gave the farm business a total additional (mainly net) income for the 2nd SFI agreement of around £36,500.

Looking beyond 2025-2027

Looking further ahead, the farm is aware that by 2027, they will not be getting any BPS money. The consultant left them with some thoughts as to what they might consider in a 3rd SFI agreement. Some land is suitable for no-till, and the farm were also considering the need to introduce some spring crops into their rotation to get better overall control of grassweeds. The consultant therefore suggested a conservative amount of each could generate the additional income wanted.

Having spring crops allows for some income from overwinter stubbles. The farm were attracted by the higher payment of £129/ha for

the multi-species overwinter cover option. However, the consultant pointed out some of the downsides of sowing and nurturing a cover crop. Costs might be around £50/ha with additional risk of problems related to weed control and soil moisture around crop sowing time, which could easily be more than the £20/ha net difference between this option and the lower paying basic overwinter stubble. The consultant advised to go for the basic option, code AHW6, £58/ha on 40 ha:

- 40 ha x £58 = £2,320, with no additional costs to be budgeted for;
- 40 ha no-till establishment (a static option, so needs to be on the same land for three years), code SOH1, £73/ha = £2,920.

With both of these options, the risk of reduced crop margins, mainly due to the possibility of lower yields, also needs to be considered.

If the farm did not wish to go down a no-till or spring crop route, they could consider other options for a 3rd SFI agreement, such as:

- No insecticide on a proportion of crops (late sown, or spring sown cereals) – code CIPM4, £45/ha;
- Some companion cropping (in winter oilseed rape) – code CIPM3, £55/ha;
- Cost of seed, establishment and other management of the companion crops would need to be considered though.

These options would also enable the farm to progress its IPM plan objectives. The farm does have 20 ha of grassland, which is managed in a moderately intensive way. Allowing part of it to go to seed each year to provide overwinter seed for birds (code CIGL2, £515/ha).

The wild bird food and field corner options are 'limited area options', which the farm cannot have more than 25% of its eligible area into. This would be a maximum of 75 ha. Currently they have 30 ha in these options, so they could consider this option on say 10 ha of the grassland and still have room to introduce some more limited area options in the future. For example, some areas of the more intensively managed alternatives to cash crops, such as the pollen and nectar type habitat creation options. Or maybe even some of the endorsed options that should be available by 2026?

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Reviewing innovation in agritech

There are many brilliant articles written towards the end of the calendar year either reviewing the agritech landscape or forecasting a move to the sunlit future. In this article I am outlining some of the macroscopic trends, the issues facing the sector and hopefully making the reader think a little about what is coming, why and when. I am limited myself to data, AI, genetics and robotics and will hopefully look at satellites, drones, chemical and biological treatments and vertical farming, at a later date.

The aim of the article is promote the conversations and to raise awareness of some neglected issues. It is based on opinion and I very much hope to be proven wrong on many of the issues I raise.

As Director of Commercialisation, Dr Michael Gifford develops revenue streams based on the research and intellectual property being developed within Niab. He manages much of the SME engagement, is active in developing spin-out opportunities and led the development of Niab's agritech incubator and consultancy Barn4. He is a serial entrepreneur and angel investor with C-suite experience across a range of sectors including law, engineering, agrochemicals, medical systems, software and infrastructure technology. Michael's focus at Niab is working with fast-growing tech-firms, where he uses strong strategic and commercial instincts backed up by a solid technical background.

Data and AI

One of the areas of technology getting the most attention across all sectors is data, and specifically the use of AI to analyse and act on the data. Agritech is no different except that it comes from an historically low base with regards adoption of digital technologies when compared with most other industries.

There are both start-ups and established companies looking at making data gathered from growers and other sources work harder to improve all aspects of agriculture. The quality and quantity of data that can be captured, stored and analysed has never been higher and can, in theory, lead to greater insights.

To date, the common refrain from growers is "I already have as much data as I can possibly want but nobody is using it to inform my actions". Critical to the success of the next generation of data-enabled technology is that costs are controlled; the insights are actionable; and the impacts significant.

It must be the case in the future that AI plays a large part in providing the insights and maybe in some cases it can even control the subsequent actions. This technology has huge potential but is not risk free. Most of us do not understand Bayesian statistics at a level that we know how to spot an AI algorithm moving out of its comfort zone. To summarise the enormous subject of data and AI, the potential impact is huge, but the developers and users need to be aware that every system has its limits and in this instance they might not be obvious.

The application where AI could make a significant difference to farms it is combining historic data, agronomic principles and the application of the rapidly changing rulebooks that farmers have to follow in order to optimise the decision-making on which fields to put to what use to take the most advantage of incentive schemes whilst still profitably producing food. If it can also fill in the paperwork it would surely be a winner.

Genetics

Much has been made of the UK's Genetic Technology (Precision Breeding) Act. This piece of legislation is designed to pave the way for the application of novel technologies such as gene-editing into food production.

In theory, the technology allows for very precise changes to an organism's genome that can introduce or enhance specific traits without introducing additional genetic material which may have negative impacts on other aspects of the organism. In practice, this is a very difficult trick to pull off in the genetically complex crops that form the bulk of the world's food. There are several organisations in the UK that are using these techniques, the leading one being Niab which runs high-efficiency platforms supplying transformed plants to other research institutions.

The technical challenges are numerous including traits being mediated by multiple parts of the genome; some plant species being extremely difficult to grow from a culture with a small numbers of cell; and the ability of genetically complex plant species to counteract the changes through expression on other parts of their genome.

Arguably it is the political and social challenges that are most likely to delay the adoption of gene editing into the food chain. The new legislation is currently only applicable to England so the benefits will not be available to all UK growers. In addition, as the Labour Government looks to re-negotiate its trade position with the EU, the secondary legislation required to enable all the proposed changes may become a part of the discussions. At present this secondary legislation is scheduled to be introduced to Parliament by the end of March. This is a positive step that will support England leading in the adoption of new genetic technologies.

Robotics

The development of robotics to support growers continues to grab both the industry and the popular imagination. The widespread adoption of robotics in crop management has yet to take place.

The obvious use cases are in the high-value, labour-intensive crops such as soft fruit and asparagus. These present specific technical challenges around handling and assessment of characteristics such as ripeness. There are several issues that the technology developers are facing, not least being the adaptability of the humans that they are replacing. People are able to pick, prune, sort and pack multiple different crops without having to have their hands and feet changed or to require a completely different sensor pack. To carry out all of these tasks, a robot would been very complex and hence expensive. If they cannot carry out all or most of the tasks then multiple robots (or robots + humans) are needed.

The factors above then lead to questions around the pricing and business model, and the level of trust that a grower has to have in the equipment if they are to rely on it and not have the labour force ready to step in if the robot develops a fault or requires replacement parts. For a start-up to have the financial backing, customer trust and a sufficiently robust technical support network is difficult. It is anticipated that some of the earliest autonomous systems will be based on the existing products of the major equipment manufacturers who already have advantages in each of the three areas outlined above.

Overview

There is a lot to be excited about in agritech at the moment, but as the area is maturing some of the first wave of companies will start to hit the realities of having to sell their product and not just the dream. I anticipate that this will lead to a number of corporate collapses and increasing consolidation. Neither of these should be considered negative to the sector and instead should simply be used as opportunities and case-studies to reinforce good practice in other companies.

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Managing and controlling cabbage stem flea beetle

Colin Peters – see page 13.

Research by Niab and its partners over the past few years has improved and widened our understanding of the lifecycle, control and management of cabbage stem flea beetle, a major pest of oilseed rape in the UK. This knowledge, together with the work showing how cultivations straight after harvest reduce adult flea beetle numbers in the soil, is now being discussed more widely. As is the concept of planting a new oilseed rape crop as far away as possible from the previous crop, a change of strategy that is being accepted as a sensible approach.

There still needs to be better understanding of what is happening when cultivations are carried out. How are csfb pupae/adults populations being reduced, how best should cultivations be carried out and are there any other implications. Niab and its collaborators will put in funding bids for new research as, and when, they are available. On the subject of spatial planting, it is agreed that planting away from the previous crop is advisable and, with today's available satellite technology, this is also an area that can be worked on rapidly if enough oilseed rape growers share their experiences of successful, and unsuccessful, crop establishment.

Niab and AHDB monitored numbers of csfb adults in water traps across the UK during the 2024 autumn oilseed rape establishment season (Figure 1). Water traps are not the most accurate tool, but they have been a useful indicator over recent years. Sites were monitored at seven locations where historically high numbers of adults have been observed through the late summer period.

The results show that csfb adult numbers have been extremely low this season (Figure 2). This will be agreed by many growers who drilled the crop this year and saw little adult activity. Site 3 showed the highest populations but the numbers were still very low compared to previous years. It was a bit concerning that significant numbers of winter stem weevil appeared from mid to late October and it will be interesting

to see how they fair in the absence of csfb. I do remember them in the 1980s when they were very abundant.

Returning to csfb, what does this mean for the coming year? The reasons why numbers are so much lower this year are uncertain. It is likely growers could potentially have an easier year as it is unlikely that the flea beetle population will have the opportunity to replenish from such a small base combined with a lower cropped area in oilseed rape.

The next step would be for growers and agronomists to monitor local populations by taking stem larvae counts. This is very easy to do on farm, in late January through to March, and Niab has put together an instruction video, available on www.niab.com/csfbsmart. If the numbers shown remain low then there will be less pressure on Autumn 25 oilseed rape drilling once other agronomic considerations are taken into account, for example good quality soil-seed contact and soil moisture.

Instruction video

csfbSMART: stem larvae counting made easy

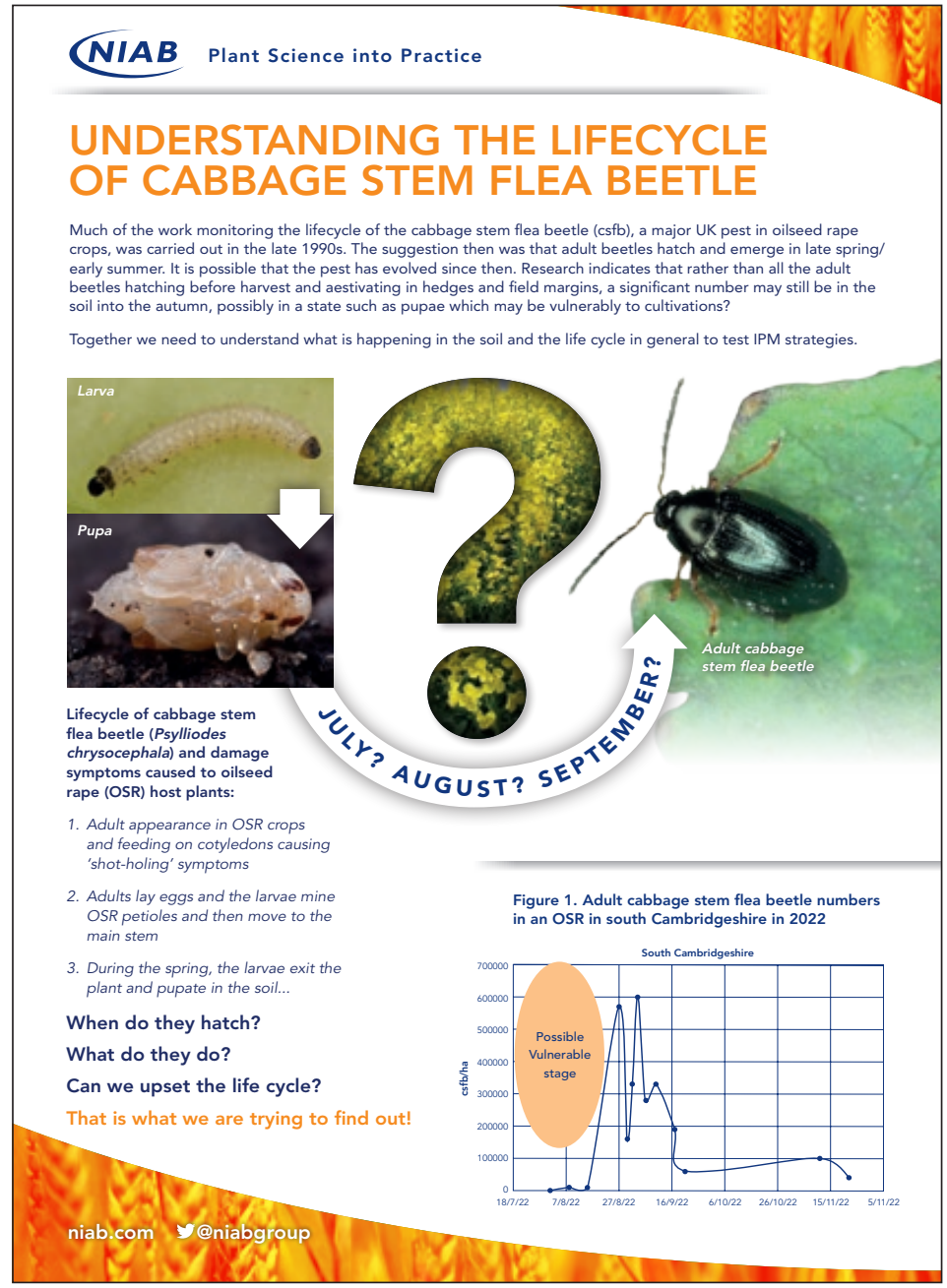


Figure 1. Locations of adult csfb population monitoring – August to November 2024

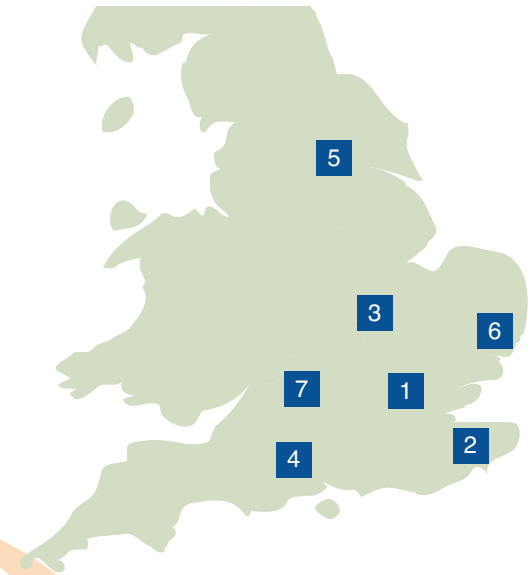
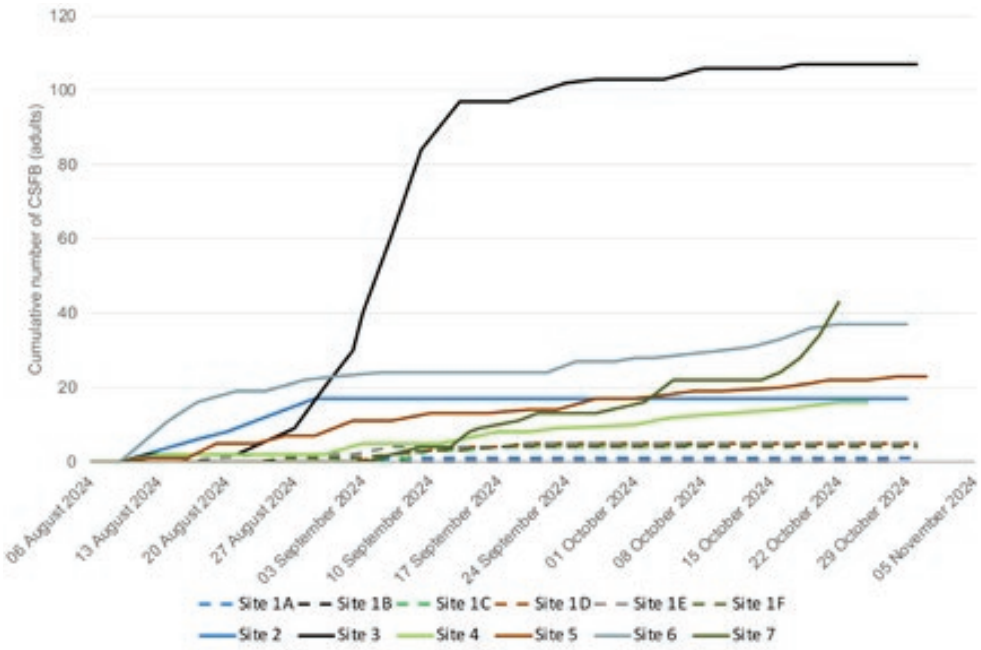


Figure 2. csfb monitoring results from water traps – Autumn 2024



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Niab's WET Centre legacy for soft fruit growers

After eight years of research and demonstration activity (Figure 1), the precision production of soft fruit at Niab's WET Centre drew to a close in 2024. Set up in 2017 following extensive water use efficiency research at East Malling, the WET Centre has successfully led the industry in responsible and efficient use of water whilst showcasing the latest irrigation and tunnel technologies and investigating ways of improving resource use efficiency and productivity.

Early work demonstrated that water savings could achieved by using precision irrigation (PI) tools, a sensor-based, fully automated system that consistently supplies sufficient water to achieve a target run-off volume from bags or containers, and ensures that plant demand is met with supply at different developmental stages and in variable weather.

With commercial strawberry growers typically irrigating substrate-grown crops to 15-20% run-off (Figure 2), the Centre has demonstrated how growers can reduce their total water use each season by up to 33%. This has been achieved by employing PI that relies on some of the most advanced technology, allowing us to reduce the level of run-off to less than 5% of input volume without any significant difference in Class 1 yields or any compromise in fruit quality.

Precision irrigation has also been combined with rainwater harvesting and re-use, to enable the Centre to achieve 90% self-sufficiency in water (Figure 3), even in very dry summers such as 2018. This not only improves local water security, but also reduces the volume of acid needed to acidify rainwater compared to mains water. Its use also reduces water flow from polytunnels, improves humidity control within the tunnels and lowers the risk of soil erosion and compaction.

Research carried out at East Malling between 2011 and 2013 showed that the UK industry average use of water for an everbearer strawberry crop amounted to 82 m^3 per tonne of Class 1 fruit produced. Typically, at the WET Centre, a figure of 43 m^3 has been achieved through PI and at best it has been lowered to 28 m^3. A more recent grower survey in 2023 showed that the most efficient grower had used 60 m^3 for an everbearer crop, demonstrating industry improvement since the Centre was set up.

Figure 1. The Centre has demonstrated precision production to the industry

Scott Raffle is Niab's Senior Knowledge Exchange Manager, raising the profile of the research and commercial activities at Niab East Malling and improving collaboration between researchers and the fruit and wider horticulture industry.

Dr Mark Else is Head of Crop Science and Production Systems at Niab's East Malling site in Kent, whose research focuses on understanding and manipulating crop and environmental interactions to deliver improved resource use efficiency, crop productivity and quality of fresh produce.

Dr Trevor Wignall is operations manager of Niab's WET Centre in East Malling. A plant physiologist he has experience in crop propagation, research, and production environments and facilities. His work at Niab covers resource-use efficiency and the use of telemetry to develop resilient berry production systems in support of the commercial soft fruit sector. Key aims are to increase productivity, resilience and sustainability whilst reducing waste and emissions, and to provide scientific evidence to support the transition towards net zero emissions goals.

Figure 2. Measuring run-off from bags at the WET Centre

Figure 3. Precision irrigation has been combined with rainwater harvesting and re-use to achieve 90% self-sufficiency in water

Figure 4. Measuring photsynthetic activity

All of this progress was achieved with the help of the WET Centre partners who have provided funding and access to the latest available technology. Berry Gardens Growers Ltd, Cocogreen, Delta-T Devices and Netafim have been an integral part of the Centre since its inception along with original partner New Leaf Irrigation, and they were later joined by the AHDB, Yara, Stoller and associate partners HL Hutchinson and Weatherquest, all taking an active role in shaping the work of the Centre. In addition, the rainwater harvesting system and work was funded and supported by Kent County Council.

A crucial feature of the WET Centre has been the division into a 'commercial area', which mirrors typical commercial practice, and an 'advanced area', which incorporates the latest technologies to more precisely control the polytunnel phytoclimate. Not only have visitors to the site viewed this in action, but our scientists have been able to make direct comparisons of fruit yield and quality between the two areas and report their results to the industry, allowing businesses to make informed decisions over whether to implement such technology on their own sites.

Having highlighted methods of using water more efficiently, attention turned to maximising yield potential from everbearer strawberry plants. Comparisons between the commercial and advanced areas demonstrated significant differences in fruit yield using the everbearer Malling Champion. In 2020, Class 1 yield was found to be 5% higher in the commercial area, perhaps a result of the higher levels of shading in the advanced area, lowering the photosynthetically active radiation (PAR) at the canopy height by 3-7%. It is thought that the increased steelwork associated with the roof vents in the advanced tunnels reduces light levels sufficiently to cause this yield difference, and this effect is probably exacerbated by the relatively large rainwater collection gutters. However, the more flexible venting control resulted in a 1°C reduction in temperature in June and July and up to 7°C in August 2020, and so the improved internal climate control from auto-venting could have significant benefits in terms of cropping potential in hotter years. In addition, since manual venting of tunnels is time-consuming and therefore expensive, auto-venting could also help to lower labour costs.

In each growing season, a strong correlation between light availability (PAR – Figure 4) and Class 1 yields was recorded in everbearer varieties. This was particularly noticeable when comparing seasons 2020 and 2021 – exceptionally high PAR throughout the 2020 season led to 50% higher yields in Malling Champion compared to 2021 when the accumulated PAR over the growing season was much lower. Differences in PAR were also recorded within tunnels, leading to Class 1 yields differing by as much as 12% in rows just two metres

apart within one tunnel bay; this equates to a yield differential of over 11 t/ha.

As a result of higher levels of PAR being recorded in the middle rows of a six-row tunnel bay, Rows 3 and 4 produced the highest Class 1 yields and the outside rows (1 and 6) the lowest. The efficiency of photosynthesis was highest in Row 4 and also higher in the morning than in the afternoon. Row 1 on the eastern side was also found to produce higher yields than Row 6 on the west due, we think, to higher PAR in the morning when photosynthetic efficiency was highest. In an attempt to increase yields in Row 6 to match those in Row 1, additional LED lighting was installed in 2024 and applied every morning between 5 and 9 am during cropping. The effects of this treatment on cropping potential will be determined.

In the final two years the everbearer strawberry Malling Ace was used for demonstration at the Centre. In contrast to Malling Champion, which was planted at a density of eight plants/m in a staggered layout in the coir bag, the density of Malling Ace was reduced to six plants/m, planted in a single line. Commercial grower experience of planting Malling Ace at this lower density had unexpectedly resulted in higher yields per plant. Lower density planting also improves air movement around the plant, reducing humidity, and leading to improved control of powdery mildew, to which Malling Ace is sensitive. In 2024, the plants produced an average of 1 kg per plant, and despite some early symptoms of powdery mildew being identified during weekly crop monitoring, a spray programme relying on products with both preventive and curative properties, ensured that little fruit was lost to the disease.

Other studies have taken place during the lifetime of the Centre to compare strawberry bag colour, tunnel polythene and dripper numbers in strawberry bags. Class 1 yields were found to be 5% higher in white Cocogreen bags compared with black Cocogreen bags. Class 1 strawberry yields were found to be 16% higher under clear polythene compared to yellow polythene, a result that reflected the history of higher yields being achieved under higher light levels. In work with Malling Ace planted at the lower density of six plants/m in a line, bags with seven drippers produced higher yields (15 g more Class 1 fruit per plant) than those with five drippers, but seven drippers used 3.2 litres more water per plant (10.5% increase). However, these results were not statistically significant so should be interpreted with caution.

The Centre has also demonstrated water and fertiliser use in pot-grown raspberry and attracted Innovate UK funding to develop a model that matches nitrogen supply with demand using the raspberry cultivar Malling Bella. This has led to reductions in nitrogen use of 76% compared to a commercial control along with a reduction in water use of 27% as a result of a smaller cane and leaf canopy in the crop (Figure 5).

Although yields from the nitrogen reduced programme were slightly lower than the commercial, the results were not significantly different. It should also be noted that the reduced canopy size led to reductions in cane management and picking costs as the fruit was better presented to pickers.

The WET Centre has led the industry to reducing the average water use per tonne of fruit produced, it has generated benchmark data for realistic net-zero targets, and also delivered benchmarking for comparative performance of other growing environments including glasshouse and total controlled environment agriculture or vertical farming systems. It has also successfully developed more precise growing conditions to maximise yields and fruit quality, and coupled with rainwater harvesting has provided more water security. Identifying how important light is to productivity has led to further Niab research to develop improved propagation systems for maximising yield potential of strawberry.

Figure 5. The N-model (right) reduced nitrogen use by 76%

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Colin Peters – see page 13.

Growing mustard: the Condimentum story

Mustard seed for condiment use has been grown in eastern England, and for Colman's, since 1814, with the families of some growers tracing back their involvement with the company since the 1880s.

It all began in 1814 when flour miller Jeremiah Colman started producing mustard at his water mill in Stoke Holy Cross, near Norwich. He created the classic tangy flavour by mixing double milled white and brown mustard and, by 1965, the firm had moved to a larger factory at Carrow Road in Norwich. The Colman family's pioneering achievements in social welfare are part of Norwich's history; in 1857 a school was opened for employees children and in 1864 the firm employed a nurse to help sick members of staff, a social revolution at the time. The Colman's part of the business was demerged in 1995, becoming part of Unilever UK. In addition to mustard, the Colman's brand is also used with condiments, sauces and other foodstuffs.

Today, mustard seed cropping is concentrated on arable farms in Eastern England, principally in Cambridgeshire, southern Lincolnshire and Norfolk, with a recent expansion into Kent, Hertfordshire and Warwickshire. Two types of mustard seed are grown; white mustard *Sinapsis alba* and brown mustard *Brassica juncea*. The seeds of white mustard contribute the pungency with the brown mustard seed adding the heat.

In the early 2000s, yields of the white mustard variety Gedney had been dropping and the future of the crop looked very uncertain. A lack of investment and an abandonment of the plant breeding and agronomy programme by the parent company, before selling to Unilever, had contributed to falling yields.

With the aim to protecting and reviving the crop, the English Mustard Growers cooperative (www.englishmustardgrowers.co.uk) was formed in 2009 by a group of 11 growers, many of whose families had been growing for the Coleman's brand for generations. The group invested the help of the John Innes Centre, who discovered that there were unintended consequences of sieving the largest seed to sow the following year. White mustard is "self-incompatible", meaning that an individual plant cannot pollinate itself. Instead, it needs to receive pollen from a different family of mustard seed which needed to be grown in the same crop; these pollinator plants were the ones that had been sieved out. Further work with DNA profiling on some old jars of seed samples found in the factory identified the original seed mix and, with the help of the plant breeder Elsoms Seeds, seed stocks were grown on and the variety was reinvigorated.

English Mustard Growers was aware that Colman's existing Carrow Road facility was aging and, with local group Norfolk Mint Growers being in a similar situation, the two organisations joined forces and created Condimentum (www.condimentum.co.uk).

In 2019, the Colman's factory at Carrow Road rolled its last jar of mustard off the production line and its "best before" date was changed for the occasion to "Norwich's Last. By Its Finest!" At the time it looked like production would have to move to Burton-on-Trent and Germany, so a bold plan was hatched. Condimentum built its own state-of-the-art factory in Norwich, one of only three mills in the world capable of milling Double Superfine mustard flour. More recently the mill, which is 60% grower owned, has opened up a wet processing line and is now fully operational, processing all the mustard and mint.

English Mustard Growers has continued to expand and by 2024 there were 36 growers within the group. Elsoms Seeds remains integral to the development of new varieties which are uniquely produced in a "closed loop system". The varieties are owned by the growers and unavailable for sale. In recent years, Guthrie, a variety of white mustard, has proven to be winter tolerant and is now grown as an autumn drilled crop.

Photo: English Mustard Growers

A crop of mustard

This negates many of the soil condition issues experienced with a spring crop establishment but more importantly, misses the main window for pollen beetle damage.

In 2023, Niab began work with Unilever and the mustard and mint growers, assessing how production could be adjusted to reduce its carbon footprint; a great opportunity for Niab to work with this enthusiastic group of growers. Initially, in the mustard crops we have been looking at the potential for nitrogen reduction and replacement products. This has been used on large field-scale plot trials, with all the inputs being applied by the farm's commercial equipment. Four mustard growers took part in the trial in 2024, using the fertiliser inputs Vixeran, Persist N and R Leaf. Drones were deployed on some sites to give a useful visual insight as to how the different treatments looked.

As part of the project, the agronomy company Hutchinsons has used its digital mapping service Omnia as part of a supply chain tool. The trials have been geocoded into Omnia with the results made available to the growers (Figure 1). Detailed yield maps were also created using the commercial combine yield data.

Initially, no crop yield improvement has been recorded. However, useful data for real in-field commercial situations has been secured through the use of these large-scale field trials, including using digital information from commercial farm equipment as well as systems such as Omnia. The aim is to expand the work in 2025, with Unilever's support, and look at nitrogen inputs in both the winter and spring crops as there is a lack of information in this area. Previous yield data will be analysed to position trials onto uniform areas and, over the next few years, study the relationship between yield, gross margin and nitrogen inputs on a range of soil types.

Photo: English Mustard Growers

Mustard crop harvest

Figure 1. Geocoded field scale fertiliser treatment trial using Omnia

Photo: English Mustard Growers

Harvested mustard seed

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The benefits of soil amendments for improved control of apple canker

Almost all apple growers, agronomists and technologists will have listened to presentations at tree fruit events, or read articles in these pages, about the latest research into improving the management and control of apple canker, caused by the pathogen *Neonectria ditissima*. In September 2024, *The Fruit Grower* magazine outlined some of the latest Growing Kent & Medway and other funded research that Niab has been working on to improve novel approaches to managing and controlling the disease. Apple canker is repeatedly cited by growers as the most pressing crop protection problem that they face in apple production today.

The Fruit Grower article highlighted the severity of the problem, explaining why the disease spreads so rapidly and why it has become so difficult to slow the progression of the pathogen through both newly planted and established orchards (Figure 1). The incidence of canker in newly planted trees has increased, particularly in very susceptible varieties like Gala planted in high density fruit wall systems, and it is not uncommon to see 10% of trees dying each year in the first three years after planting an orchard.

The industry has lost numerous authorised control products for canker control in recent years. Several recent and ongoing trials have been assessing alternative conventional fungicides, biocontrol agents, biostimulants and defence elicitors and although some are showing promise, no effective products have yet been adopted by the industry. Perhaps it is time to alter our approach.

Niab's Pest and Pathogen Ecology team at East Malling is increasingly seeking to harness existing ecosystems on fruit farms as an alternative way of gaining natural control of both insect pests and diseases of fruit crops. Partnering with Agrovista and Avalon Fresh in a Growing Kent & Medway funded

Figure 1. Apple canker spreads rapidly and can lead to 10% of trees dying every year after planting

Scott Raffle – see page 29.

Dr Louisa Robinson-Boyer is a research leader in the pest and pathogen ecology team at Niab in East Malling. With over 20 years of experience in the use of plant growth promoting rhizobacteria and arbuscular mycorrhizal fungi for increasing plant health, water and nutrient use efficiency in soft and top fruit, her focus is in development and application of beneficial microbes for sustainable crop production systems. Current research focuses on the applied use of beneficial microbes to combat biotic and abiotic stress and the possible mechanisms responsible for the observed benefits to plants.

Dr Matevz Papp-Rupar is a research leader in the pest and pathogen ecology team at Niab in East Malling with over 10 years' experience in plant pathology. His focus is on the development of sustainable, ecological approaches to control of plant pathogens and improving resource use efficiency in horticulture.

Figure 2. The roots of young Gala trees were treated before planting

Figure 3. Wildflower root colonised by AMF

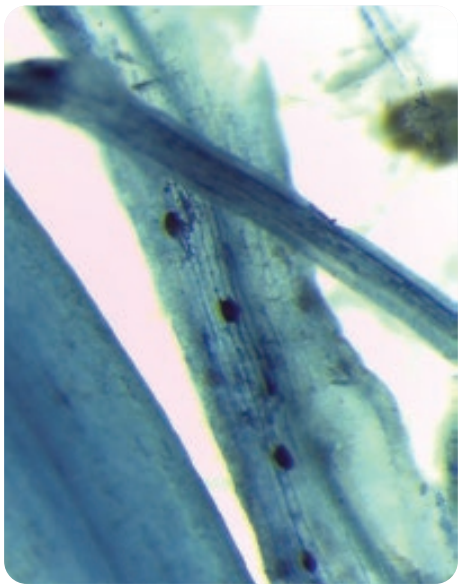

Figure 4. AMF were inoculated on tree roots using a modified root pruner with an attached stocks applicator, developed by Agrovista

project, Niab sought to amend the soil with microbial products to improve both the health of the tree and its resilience to withstand attack from pathogens such as *N. ditissima*.

Arbuscular mycorrhizal fungi (AMF) and the biological control agents Trianum (*Trichoderma harzianum*) and Vintec (*Trichoderma atroviride*) were the chosen soil amendments. AMF is commercially available for use by growers. It has been extensively studied by Niab and is believed to improve soil structure, health and nutrient and water uptake, thereby enhancing tree health, tree growth and resistance to pathogen infection (biotic and abiotic stress). Trianum is currently authorised for use on protected soft fruit crops under permanent protection full enclosure structures to control fungal diseases. Vintec is currently authorised for use on apples to control canker, but as an overall spray application.

Two trials were set up, the first to investigate the use of commercial AMF and Trichoderma based products applied to newly planted Gala orchards to assess their impact on canker development. In the event that AMF amendments were successful, the second trial was set up to assess methods of increasing the populations of AMF in established orchards.

Increasing resilience in newly planted orchards

Four new planting sites were selected by Agrovista and Avalon Fresh on commercial farms that are prone to waterlogging and two further sites were chosen on a farm that is prone to drought. All trial sites, which had previously been cropped with apples, were planted in Spring 2022 with 150-200 trees per site and treated at planting with an AMF product, a Trichoderma based product or a combination of the AMF and one Trichoderma product.

The AMF product chosen was RootGrow, containing six AMF species and supplied by PlantWorks UK, whilst the two Trichoderma based products chosen were Trianum-P supplied by Koppert and Vintec supplied by Certis Belchim. Planting holes were dug and trees positioned in or next to the hole (Figure 2).

The roots of trees treated with a Trichoderma product were dipped in a 10 litre bucket containing a solution of the product for two to three seconds while mixing the solution. Trianum-P was mixed at 0.1 g per tree in 0.1 litre of water (5 g of product in 5 litres of water in the bucket) and Vintec at 0.2 g per tree in 0.1 litre of water (10 g of product in 5 litres of water in the bucket). Inoculated trees were positioned in the planting holes and the remaining inoculum poured directly on the tree roots in the planting holes at around 80-90 ml per tree.

AMF inoculum (RootGrow at 50 g per tree) was sprinkled over the wet roots pre-treated with a Trichoderma product. Where AMF was used alone, the roots were dipped in water before sprinkling the AMF inoculum on them, thus ensuring that the inoculum adhered to the roots.

In 2023 and 2024, at each site Niab, along with industry partners Agrovista and Avalon Fresh, recorded canker incidence, tree mortality and tree growth every six months, and yield was recorded at the end of each season. All of the plots were compared to untreated control sites.

There were no statistically significant differences between AMF and/or Trichoderma amended trees and the unamended control. However, there were some very encouraging trends. Amendment with AMF alone, Trianum alone and AMF + Vintec all showed a reduction in tree mortality, and in the AMF + Vintec treatment by up to 50%. This reduction was most noticeable on the sites with highest tree mortality rates. The AMF treatments also consistently reduced mainstem cankers on all sites, with the AMF and Vintec treated trees displaying greatest reduction, although different products delivered different results depending on the sites. The effect on peripheral and total number of cankers varied depending on the site and the canker load. There were no significant positive or negative effects on fruit yields between treatments although there was a significant difference between sites. All treatments caused a slight reduction in tree growth in the first year after planting although this reduction was not seen in the second year of growth.

Increasing AMF populations in established orchards

The team also assessed methods of increasing mycorrhiza populations (Figure 3) in established orchards. The first involved planting specific wildflower species in the alleys that are known to support the growth of naturally occurring and introduced mycorrhiza, whilst the second inoculated AMF around existing tree roots using a modified root pruner with an attached stocks applicator, developed by Agrovista (Figure 4).

Three mature orchards were chosen by Agrovista and Avalon Fresh, including two Gala and one Egremont Russet. In each orchard, wildflowers were sown in the alleyways (Figure 5), either with or without AMF, and compared to a grass alley control. The wildflower mix contained ten species, eight of which are reported to have associations with AMF. The seeds were sown at a rate of 4 g/m^2 and where added, AMF at 2 g/m^2. In addition, the trees were root pruned either with or without added AMF (10 g/tree) applied continuously with the stocks applicator and compared to an unpruned control.

A soil assessment of the most probable number of AMF was made before the treatments were applied followed by periodic assessments of AMF populations in the grass alleys, wildflower alleys and apple root zones. In addition tree girth, fruit yield and fruit quality were recorded over two seasons.

The wildflower mixes established very well on all of the sites assessed (Figure 6). The baseline assessment of the soils before treatments showed undetectable levels of AMF in any of the trial orchards. However, after two years, there were AMF propagules recorded across all of the treatments. Both wildflowers alone and wildflowers with added AMF increased AMF root colonisation in all orchards. No differences in AMF were detected in the apple root zone but the roots were difficult to analyse and further work is required before conclusions can be drawn on this.

Tree growth was found to be reduced by root pruning whilst root pruning and wildflowers alone both reduced fruit size and diameter. However, the addition of AMF negated any reduction in growth

Figure 5. Wildflower species were sown in the alleys of orchards

Figure 6. The wildflower mixes established very well on all of the sites assessed

and restored fruit size and diameter to that recorded in the untreated control. All of the treatments significantly increased Brix levels in harvested fruit, particularly in the AMF plots.

Conventional canker treatment

In a final work package in this project, an assessment of the efficacy of a range of novel canker treatments was made over two seasons to a Gala orchard at East Malling with very high canker inoculum levels. The treatments included a range of plant protection products, biocontrol agents, biostimulants, resistance elicitors and some other commodity substances. All treatments were applied as sprays to the trees, between three and five times from the end of harvest until 100% leaf fall.

Two products, hydrated lime (Ca OH) and the Bayer product Luna Care, showed promise. Further work is needed to develop a lime product that is both easier and simpler to apply. A similar product is now being tested by Omex. Luna Care is also being further tested with the intention of seeking an EAMU authorisation.

When applied at leaf fall, none of the biocontrol products, biostimulants or defence elicitors offered any level of control, so further work may be required to consider alternative application timing for these.

Impact on the industry

This Growing Kent & Medway funded project has offered some promising results for apple growers and agronomists, highlighting the potential for arbuscular mycorrhizal fungi and Trichoderma species to reduce the rate of infection and spread of canker, although neither of the Trichoderma products used in this project are currently authorised for use on apple roots. The effects were considerable in stressed orchards with high levels of canker. There is also scope to increase the populations of mycorrhiza in established orchards to reduce canker pressure, by incorporating wildflowers which have the added advantage of improving orchard biodiversity to further support pollination and beneficial insects for pest management services.

At the close of the project Alex Radu, technical manager for project partner Agrovista, said: "We've long felt that the interaction between mycorrhizal and Trichoderma fungi could be beneficial in helping fruit trees respond to canker, but haven't had the evidence to prove this until now. The fact that these trials have taken place on several commercial sites will give significant confidence to growers on the credibility of these results."

Nigel Jenner, chief technical officer for partner Avalon Fresh who led the project, said: "The project has yielded successful results, providing valuable insights and practical solutions for fruit growers."

Glasshouse Services

Testing beyond the field

Glasshouse facilities

Our glasshouse facilities at Cambridge and East Malling (Kent) reflect modern commercial services and feature:

- Offer a complete bespoke package from trial design, trial delivery, data collection, analysis, and reporting
- Approximately 6,500 m² of controlled environment glasshouses and specialist plant growing facilities combined across the sites including spore-proof growth rooms, growth chambers, containment and vertical farm unit and vernalisation areas
- Ability to provide small pre field scale trials supporting R&D and proof of concept projects.

Glasshouse capabilities

- Biostimulant trials
- Nutrition and water management
- Seed bulking
- Fertiliser and crop protection products
- Herbicide efficacy trials
- Growing media trials.

Niab glasshouse services include:

- Experimental design
- Impartial assessment
- Phenotyping
- Data handling and analysis
- Genetic resource maintenance
- Specialist plant husbandry
- Additional analytical services available via Niab LabTest

Testimonial:

"We are a young start-up company with no track record in agriculture. When we mention that we are undertaking trials with Niab, we get a positive response from potential customers or partners. Working with Niab helps us to demonstrate that we want to produce robust evidence about our product that stands up to scientific scrutiny."

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Staff profile – Ben Tea

Ben Tea is a technical manager working in Niab's glasshouse complex at Park Farm, Cambridgeshire. Here, he provides agronomy for protected environments, while also working on developing trials for commercial customers. Niab *Landmark* finds out more about what Ben does, his Niab career and why it is so fulfilling.

What are you currently working on?

We grow around 30 different crop species across 18 different areas, a real variety from around the world, including ornamentals, cereals and legumes. My day-to-day role is looking at how to best grow these crops inside the glasshouse and making the best of our facilities.

The second part of my role is around business development; working with commercial customers to develop trials for their products, from growing media, we currently have a lot of peat-free growing media trials, to biostimulants as well as other novel products for the horticultural industry.

Has your role changed?

I've been at Niab for almost eight years and when I joined the ornamentals team our main contract was the Community Plant Variety Office (CPVO). This protects plant variety rights in the EU, but Brexit ended that contract. To keep the team going we sought funding and business from elsewhere with a lot now coming from commercial customers looking for independent trialling. These companies can't rely on in-house testing and saying 'Our product is great'. They need independent trialling to back that up. At Niab we have the facilities and technical expertise to do just that. Our clients can then give their customers the satisfaction that products are thoroughly tested and will do what it says it will on tin.

What are your biggest challenges?

Glasshouses and growth chambers are stressful environments to grow plants in. Yes, you don't have the elements to contend with, but in a protected environment you must tailor the growing media. There can be serious pest and disease pressures – a small outbreak can become a big problem very quickly.

Our best practice is crucial – our processes and agronomy must be spot on, or we will lose plants. And those plants are project work, we can't afford to lose them. Those are real problems that we encounter every day.

How do make your work sustainable?

We run a lot of peat-free growing media trials for our customers and, as a facility, we use a lot of peat-reduced mixes and reduced fertiliser blends ourselves – we're constantly trying to evolve. We only use plastic that can be recycled: black plastic goes back to a recycler, and we use taupe-coloured pots that can be recycled by the kerbside. The aim is to ensure our work has as minimal impact on the environment as possible, including how we dispose of our waste.

What's your career path been at Niab?

I initially joined the ornamentals team at Niab, but before coming here I spent a long time working as a commercial grower. There wasn't really any chance of progression and I wanted to expand my knowledge. Now, working in research, I'm able to work on projects that have a real-world impact, to assist growers improve processes and transfer research into usable skills and knowledge; it's much more fulfilling for me.

How do you see your role evolving?

The industry has a huge gap in its knowledge exchange since the loss of AHDB Horticulture, the research and the expertise we have at Niab places us in a good position to support this, I think we need to develop that even further and provide better support for the grower. Especially the young grower who doesn't get that information from AHDB anymore. That's my goal – to provide back to the industry that gave a lot to me, especially as a young grower.

What's it like working at Niab?

I have a great team around me, a brilliant network from so many different backgrounds. Each person may do a specific job but often have expertise in other areas too. There is always someone you can go to who has the right answer. And it just makes your job a lot easier. Plus, the facilities here are second to none. I could never have dreamed of being able to grow plants in a facility like this.

Having grown up wanting to work on the technical side of agriculture, to now being able to work here, it's fulfilled that childhood ambition. What's not to like?

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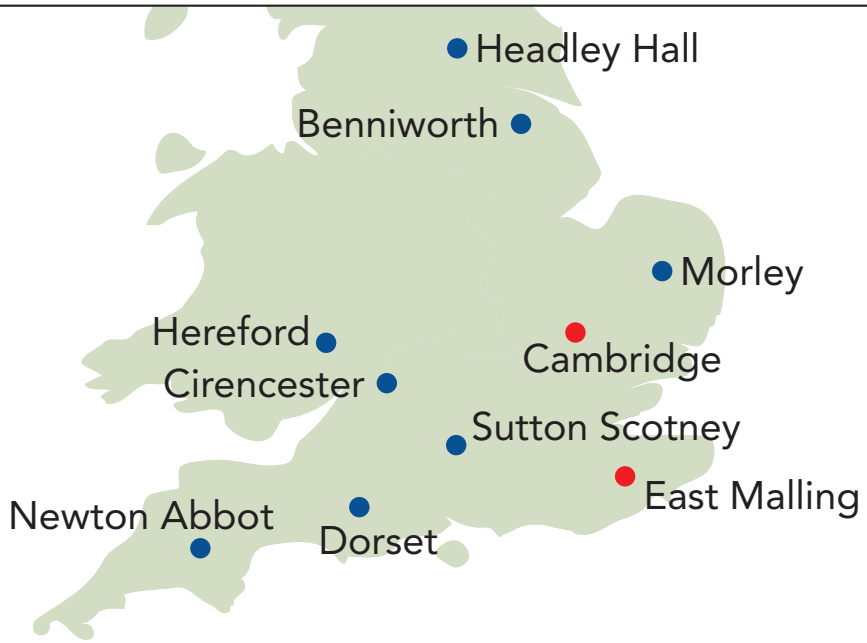

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