NIAB
Issue 58 • Spring 2025

Landmark

The path to becoming an agronomist

In this Issue

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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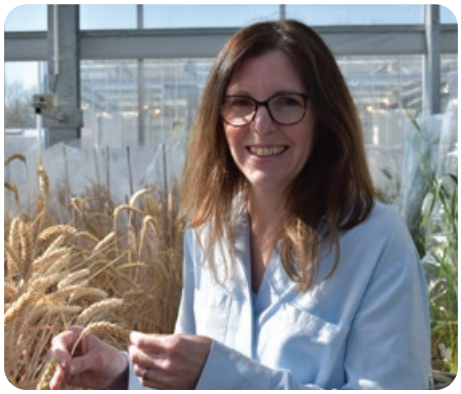
Leadership in plant science

October 2024 marked the fourth anniversary of the Crop Science Centre (CSC), the alliance between the University of Cambridge's Plant Sciences department and Niab. As the current CSC Director I am thrilled to introduce this rather special Niab Landmark issue, focused on female leadership and highlighting the contribution, knowledge, participation and success of women in crop science at every level.

This Landmark's all-female author list is just one opportunity to celebrate our successful partnership, rooted in research and providing results with a real-world impact, and ultimately working towards a food production system that is more equitable, sustainable, and resilient. At the Crop Science Centre we focus on key research areas to achieve this: crop nutrition, photosynthesis enhancement, promoted resilience against environmental stresses, including pests and pathogens, and advanced breeding technologies. Our mission and research goals, inspired by former Niab CEO Professor Tina Barsby and the University's Professor Sir David Baulcombe, continue to hold significant importance. By accelerating the development and implementation of new technologies and accessing the research facilities at Cambridge, we can ensure we will continue to deliver world-class science to create the foundations required to sustainably feed future generations.

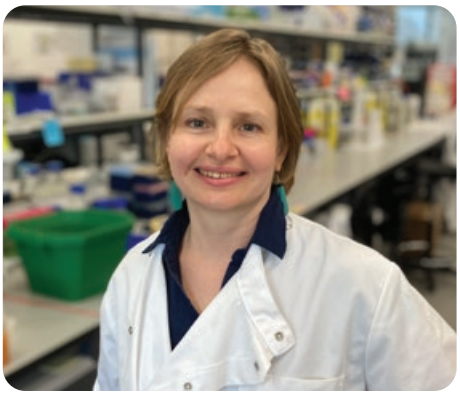
Professor Giles Oldroyd, the CSC's founding director, recently announced his departure to become the next president of the Donald Danforth Plant Science Center in St. Louis. We are excited for Giles as he takes this step in his career; he established and drove the CSC to where we are today and has been an inspirational leader for all of us.



Dr Stéphanie Swarbreck is researching nitrogen responsiveness in wheat

Giles's vision hinged on providing CSC with cutting-edge facilities and expertise in modern genetic technologies. As one example, we are using gene editing to create crops with maximised nutritional benefit from symbiotic relationships with soil microbes. Gene editing reduces the time needed to generate new crop varieties, providing a faster response to, for example environmental challenges and ensuring we can capitalise on opportunities.

We thus applaud the UK Parliament's recent secondary legislation implementing the Genetic Technology (Precision Breeding) Act. England will gain a balanced regulatory structure for gene editing through this. Similarly, there is progress at the EU Council to facilitate the debate and approval of a new legislation to enable new genetic technologies. These examples highlight the scientific community's successes and legislative progress in fostering, not restricting, essential agricultural technologies.



Dr Natasha Yelina is improving legume crops using precision breeding tools

Uta Paszkowski is Acting Director of the Crop Science Centre and Professor of Plant Molecular Genetics at the University of Cambridge. She leads the Cereal Symbiosis Group, investigating the molecular mechanisms underlying formation and functioning of arbuscular mycorrhizal symbioses in rice and maize with a particular focus on plant-fungal communication. Uta received her PhD in Biotechnology at the ETH-Zurich (Switzerland), with postdoc positions at the University Basel (Switzerland) and the Torrey Mesa Research Institute in San Diego (USA). She led a research group at the University of Geneva (Switzerland), followed by an Assistant Professorship position at the University Lausanne (Switzerland) before moving to Cambridge in 2012.

CROP SCIENCE CENTRE

One illustration is Dr. Natasha Yelina's research, which aims to create gene editing tools to enhance legume breeding. Natasha is a Fellow at the CSC with experience in plant meiosis, the cell division that generates gametes in sexual reproduction. Although legumes improve soil nitrogen and would be beneficial in crop rotations, their performance in northern latitudes is subpar. Natasha's work targets this gap by developing new breeding techniques for crops such as soya and common bean.

High-yield cereals like wheat relied on nitrogen fertiliser that is generated using the unsustainable energy-intensive Haber-Bosch process. The focus of Dr Stéphanie Swarbreck, a research scientist at Niab, is on nitrogen responsiveness to select varieties with lower fertiliser requirements. This directly contributes to the objectives of the CSC and is complementary to the research programmes of the Fellows.

Another priority area

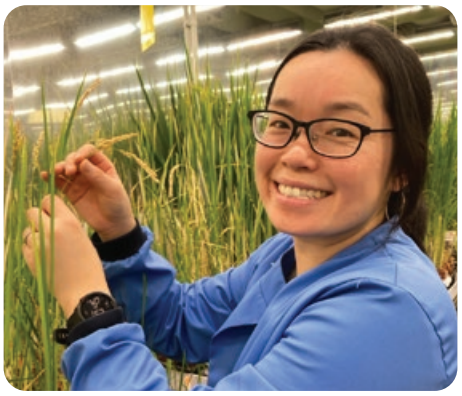
for the CSC is the development of alternative approaches to crop protection from diseases and pests. Dr Lida Derevnina, a further Fellow supported by the partnership, studies the immune system in plants to gain knowledge to implement new agronomical approaches. Lida's goal is to create crops with long-lasting resistance to multiple diseases which will help to reduce the need for pesticides.

Soil nutrient levels are a critical factor in regulating the growth of microorganisms that are beneficial to crops. For instance, it is known that high nitrogen fertilisers application slows down symbiosis with fungi and bacteria that help with the uptake of nutrients in the plant. Dr Jeongmin Choi studies the biology behind this phenomenon so she can provide solutions to overcome this inhibition. In a collaboration with Niab's crop transformation team, led by Dr Emma Wallington, progress is made in understanding how plants sense nitrogen in the soil.

Dr Lida Derevnina is aiming to create crops with long-lasting multiple disease resistance

The CSC alliance is also contributing to training the next generation scientists as exemplified by the new Masters course in Crop Science. Researchers from Niab and the Department of Plant Sciences at the University have designed and contributed to this course by informing and inspiring new ways of thinking about what agriculture should be in the future. We favour taking a broad view of potential solutions, with an emphasis on practical, scientific approaches, from genetic engineering to regenerative agriculture.

I would like to take the opportunity to thank the support that we received from Gates Agricultural Innovations, The Gates Foundation, the Allan and Gill Gray Foundation, the Novonordisk Foundation, the Niab Trust, UKRI, and Cupgra.



Dr Jeongmin Choi is studying the impact of fertiliser use on soil microorganisms

We have a unique opportunity to demonstrate the value of applied research to tackle some of the grand challenges of our time. The CSC, supported by Niab and the University of Cambridge, sits at the heart of a buoyant research community that strives to put our agriculture sector at the cutting edge of global innovation.

Clare Leaman • clare.leaman@niab.com

Cereal candidates for 2025

As we come into spring, open days are beginning to fill the summer diary and talk turns to new varieties and the 2025 set of candidates. As usual there is plenty to talk about across a wide range of crops and end uses.

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

Three of the new wheat candidates currently have the potential for breadmaking. Firstly, we look at **Arlington** (DSV) which is a potential UK Flour Miller's Group 1 variety. After a few years of stagnation in the Group 1 set we are now on a run, with potentially three new varieties in three years. Arlington looks to have a very competitive yield for this group, both treated and untreated. It also has a desirable set of disease resistance ratings and resistance to orange wheat blossom midge (OWBM), which is a particularly valuable trait in quality wheats. It also offers short, stiff straw and good grain quality. It still has a long road of testing ahead, but the promise is there.

KWS Grebe (KWS) is a variety combining high yields with potential Group 2 quality. It has good resistance to both yellow rust and septoria as well as OWBM. **KWS Imrie** (KWS) is another potential Group 2 variety offering high yields. It has good septoria resistance and a high specific weight.

LG Lotus (Limagrain) is the sole biscuitmaking candidate. It has good yield potential, both treated and untreated, but we will need to wait and see how it fairs alongside the more recent high yielding additions to this group. LG Lotus looks to have good resistance to both yellow rust and brown rust, as well as septoria and OWBM, and is a later maturing variety.

Onto the hard feed group and we start with **KWS Aintree** (KWS),a very high yielding variety, both treated and untreated, with excellent resistance to yellow rust and moderate to good septoria resistance as well as OWBM. **LG Defiance** (Limagrain) also has very high yield potential, treated and untreated, and offers good resistance to both yellow rust and septoria as well as OWBM.

The next group of varieties are currently a couple of percent down in terms of treated yield. **Hector** (Senova) offering good resistance to yellow rust and septoria but susceptibility to brown rust, and is a later maturing variety. **KWS Fowlmere** (KWS) has excellent resistance to yellow rust, OWBM resistance, early maturity and a good specific weight, whilst **LG Challenger** (Limagrain) offers a more moderate disease spectrum as well as OWBM. Both KWS Fowlmere and LG Challenger look to have good untreated yields. **KWS Maximise** (KWS) has excellent yellow rust resistance and good resistance to septoria as well as OWBM resistance.

RGT Guardsman (RAGT) is a BYDV resistant hard feed variety with a more competitive yield than RGT Wolverine. It has good resistance to yellow rust, a lower specific weight and will require good straw management. Those in high risk areas may wish to use RGT Guardsman as part of their strategy to reduce loss.

SY Nairn (Syngenta) is a soft feed variety with high yield potential, relatively good resistance to both yellow rust and septoria but susceptibility to brown rust. It has OWBM resistance and short, stiff straw.

There are three further feed candidates still waiting to complete statutory testing, **Sparkler** (Elsoms), **Heartwood** (Elsoms) and **AWC 37** (Angus Wheat).

Spring wheat sees a continued stream of candidates although breadmaking

candidate **BA W92** (Blackman Agriculture) and feed candidate **Merkawa** (Senova) are also waiting to complete statutory testing. **WPB Clifden** (Limagrain), however, is a high yielding feed variety with a mixed disease profile.

Barley

We start off once again with quality with **Carrousel** (Agrii), a potential winter barley malting type. It is a conventional six-row variety with BDYV tolerance and competitive yields, with a moderate disease profile and early to ripen. The malting testing regime is ongoing but this variety could potentially bring genetic BYDV protection to malting barley growers.

There is one two-row feed candidate, **LG Catapult** (Limagrain), which also offers tolerance to BYDV alongside a competitive yield and moderate disease profile. The final BYDV tolerant candidate is **KWS Birdis** (KWS), a conventional six-row variety with a good yield, moderate disease profile and good straw characteristics.

There are three six-row hybrid candidates: **SY Perone** (Syngenta) is a high yielding variety with good resistance to Rhynchosporium; **SY Barnabus** (Syngenta) offers high yield plus a moderate disease profile; and **Elvys** (KWS) again with good resistance to Rhychosporium but the highest level of brackling. **Darcie** (Senova) is also a feed candidate but is waiting to complete statutory testing.

The ever broadening choice of varieties with BYDV tolerance is fantastic news for all growers as all types and markets are now potentially covered by a variety option for those that wish to lessen risk via genetics.

There are ten spring barley candidates with malting potential, but all are still to complete statutory testing. There is also one feed candidate, **KWS Thalis** (KWS), which offers high yield although it has shown some susceptibility to Rhynchosporium.

Oats

There are four winter oat candidates; three husked and one naked. **RGT Dempsey** (RAGT) is a high yielding variety, both treated and untreated. It has moderate resistance to crown rust but is susceptible to mildew. It has good grain quality with a high kernel content as well as a high specific weight. **Rannoch** (Senova) also offers high yield both treated and untreated and has good resistance to crown rust and moderate susceptibility to mildew. It has a good kernel content but lower specific weight. **KWS Pertinent** (KWS) has lower yield potential and is susceptible to both mildew and crown rust. It is, however, early to ripen and has a good kernel content and specific weight. **Avalon** (Senova) is the naked oat with good yield and specific weight for its type.

There are also four spring oat candidates, all husked. **Jacky** (Saaten Union) offers high yields both treated and untreated as well as a good kernel content and good resistance to mildew, although it is susceptible to crown rust. **Neptun** (Saaten Union) also offers high yields and good mildew resistance along with slightly improved crown rust resistance. It is early to ripen and has a good combination of high kernel content and specific weight. **KWS Vibrant** (KWS) offers similar yields, a good kernel content and good mildew resistance but is again susceptible to crown rust. Finally, we have **Nova** (Senova) with a slightly lower treated yield but again good mildew resistance.

As always, the candidate year is vital for data collection across the board, and it will be interesting to see how these varieties fair in the wider range of AHDB Recommended List trials.

Poppy de Pass • poppy.depass@niab.com

Oilseed rape variety candidates for 2025

As we move forward into the spring, the oilseed rape crops are starting to stem extend and we look forward to seeing some bright yellow fields. We are all aware that the cropping area is reduced after a few difficult years with this crop, but the numbers of cabbage stem flea beetle adults were drastically reduced last autumn, and Niab is currently undertaking a large amount of stem larvae counts which hopefully will give more confidence for the coming year if the numbers remain low.

Poppy de Pass is Niab's regional agronomist for the west region, providing strategic agronomy consultancy to members and clients, interpreting technical information from trials and translating it into on-farm advice through group field days, seminars and conferences, publications, web material and digital communications. She has also worked in the Niab trials team, both at the Sutton Scotney and Cirencester centres.

It is an exciting time of year to start looking at the potential of new varieties coming through the various breeding programmes and at this stage, there is some information on eight candidate varieties. There are others in the system, but these have yet to pass National Listing so no information can be shared at this stage.

KWS Domingos (KWS) is a hybrid variety for the South which in trials has yielded very well with gross output of 109% in the South and 106% in the North. It is showing a very good level of resistance to stem canker with a score of 8 and good light leaf spot resistance with a score of 7. It is on the taller side, but with stiff stems that are resistant to lodging, and it matures fairly early although it does flower late. It also has both TuYV and pod shatter resistance and very good oil content.

Cezanne (NPZ UK) is a hybrid variety for the South with a gross output score of 108% in the South, but a bit lower in the North at 104%. It has very good resistance to stem canker with an 8, as well as being good for light leaf spot with a 7. Another tall variety with good resistance to lodging, Cezanne also has pod shatter resistance. It is later to flower but matures fairly early.

Dirigent (NPZ UK) is a hybrid variety with full UK coverage. It has a very good gross output of 107% in both the South and the North, with a very good stem canker score of 8, but a bit less so with light leaf and its score of 6. A fairly short variety that stands well Dirigent is a little late to mature. It has TuVY resistance and a good oil content.

Karat is another NPZ UK hybrid for the UK, with a very good gross output score for the South of 110%, but slightly lower in the North at 107% but still very good. It has very good stem canker and light leaf spot scores of 8 and a very high oil content. It is a slightly tall variety that matures a little later and also has TuVY resistance.

Bachus is a conventional variety from Jennaway Consulting, suitable for all regions, with a gross output of 101% in the South and 100% in the North. It has a slight resistance to stem canker and light leaf spot with a score of 6 for both. It is a short variety with stiff stems and an average oil content.

The hybrid variety **Crios** (RAGT Seeds) is a new clubroot variety for UK wide use. It has a gross output for the South of 98% and 95% for the North. It has moderate disease resistance to both stem canker and light leaf spot, and is a very short variety that flowers very early but does not mature early with an average oil content. As always, we do put in the warning that these plants should only be used where they are needed, or there is a risk of breakdown of the genetic resistance.

LG Calvin CL (Limagrain) is a Clearfield variety, meaning that it is tolerant to certain total herbicides that can be used in the crop of that variety to remove difficult weeds whilst ensuring the oilseed rape plants survive. It is suitable for the whole of the UK with a gross output of 94% in the South and 95% in the North. It does have both TuVY and pod shatter resistance and has moderate disease resistance to both stem canker and light leaf spot with scores of 6 for both. It is a very short variety that flowers late, but does mature early with a moderate oil content. It is good to see varieties like this continuing to come into the system as they are very useful where they are needed.

Erling is a new hybrid high erucic acid variety (HEAR) from NPZ for the UK with a gross output of 92% for the South and 95% for the North. It has excellent resistance to stem canker with an 8 but less so with light leaf spot with a 6. They are slightly tall plants that flower and mature medium late, with TuVY resistance and very high oil content.

It is great to see such a wide range of breeders bring diverse material forwards, and we hope that we can further understand how to derisk this crop, giving growers more confidence in what is a very good break crop.

Julia Woerner • julia.woerner@niab.com

A new Recommended List system for sugar beet

Like most crops, potential new sugar beet varieties are trialled in the Variety List (VL), formerly called the National List (NL) trials system. There are two elements to this trialling system, VCU (value for cultivation) and DUS (Distinct, Uniform and Stable), which varieties have to pass before such times as they can be sold to growers.

Julia Woerner is a research trials co-ordinator at Niab, joining in May 2024, with responsibility for break crops including sugar beet and oilseeds. Originally from Germany, her background in environmental and ecological research has taken her across the world and included work in insect biodiversity, forest environments and water ecosystems.

Both the trial systems are coordinated by Niab, who organises all the seed deliveries and packeting via its Seed Handling Unit in Cambridge, create the plans, collate and manage the inspections and reports, organise and run relevant meetings. We also carry out all the statistical analysis of the results before reporting back to APHA (Animal and Plant Health Agency) with the results and recommendations for the VL trials and to BBRO for the RL trials. Niab does manage some of the trials but does not have the harvesting equipment, so these are harvested by BBRO. Other trials are grown and harvested by KWS, SesVandeHave, and BBRO.

The trials are carried out over two years, aiming to protect the grower from being sold varieties that have not been tested, to make sure they are better than the previous varieties available, and finally that they are genetically stable; all the seeds will produce the same type of plants. Once a variety has passed the VL testing it can be entered into the Sugar Beet Recommended List trial series. This trials system evaluates the varieties to ensure they are appropriate for addition to the British Beet Research Organisation (BBRO) Recommended List (RL). The RL shows growers the traits and benefits of each variety, similar to other Recommended and Descriptive Lists, such as the AHDB Lists for wheat, barley and oilseed rape.

Until 2020, these sugar beet trials systems were combined in one large set of trials which were also used for the DUS measurements. In 2021, the BBRO moved the RL trials away from the combined system so they could work towards evaluating how varieties worked in a more commercial system. At this point, all the sugar beet seed for the now separate trialling systems came from the same seed lots. The seed was not primed and the pellets used for the seed had to be as prescribed, with no added nutrition or biostimulants which breeders believe may help during the early growth stages.

Much of the commercial sugar beet seed planted is primed. This is a process that involves creating conditions that allow the seed start the germination process before it is stopped prior to pelleting. It ensures the sugar beet seed, when planted in the right conditions, will complete the germination process faster than unprimed seed. It should emerge and establish sooner, hence making

Drilling early sown bolter sugar beet trials

better use of sunlight and improving the sugar yield per unit area over the growing season.

Other recent changes include the commercial use of 'breeders pellets'. As mentioned earlier, the trial system previously used unprimed seed in a basic pellet, but for many years all the commercial seed sent to growers was processed through Germains Seeds for priming and pellet development. So, some argued that the RL system did not truly represent the package of primed and pelleted seed available commercially. And, more recently, sugar beet breeders have developed their own priming and pellet technology and are now selling direct to growers.

So, for planting in 2025, British Sugar and BBRO have altered the RL trials system to better reflect the package available to growers, including varietal genetics, seed priming, pellet choice and available seed dressings. The system has also been made more flexible as the breeders have the option to submit their own primed seed and pellet, or continue with the Germains option.

The 2025 trials programme is significantly larger than recent years with 61 entries; many varieties are entered twice in the different pellets. There are a larger number of trials this year; 18 trials with four fungicide untreated and four late lifted, early in 2026. The majority are lifted earlier than commercial crops so results are available to growers to aid variety decision-making for the following season.

The RL trials system demonstrates new varietal traits being introduced into sugar beet, including: ALS (acetolactate synthase inhibiting) herbicide tolerance, BCN (beet cyst nematode tolerance), CERC (*Cercospora* resistance) and VY (virus yellows tolerance). Although these traits are not tested within the RL system, breeders present data to BBRO demonstrating that the trait performs to an acceptable level.

This is the first year of the new system. It has meant a very busy period behind the scenes at Niab. Very different trials plans have been developed, there has been a significant increase in seed packets, all of which comes from Europe with the added challenge of getting seed through customs, plus the added complication of different pellets for both the VL and RL systems, plus glasshouse trials. Over 12,400 seed packets were produced this spring in the Niab Seed Handling Unit, all of which have to be uniquely labelled and sent with drilling plans to a range of sites in the east of England.

The new RL trials system evaluates varieties on a more commercial system

After all the rush in Cambridge, things will becoming a little quieter as we monitor the trials throughout the season, in conjunction with other trial operators and independent trial inspectors. Then we hit the harvest rush at the end of the year and thousands of plot results are analysed for yield and quality before the statisticians begin the complicated work of sorting the data so that decisions on the success (or not) of all the varieties can be made.

Margaret Wallace • margaret.wallace@niab.com

Outcomes from INVITE – innovation in variety testing

The Horizon 2020 funded project INVITE (INnovations in plant VarIety Testing in Europe) ended on 31st December 2024. The project was five years of research, €8 million of funding, and 28 partners across Europe, bringing together academic researchers, plant variety examiners (DUS and VCU), and plant breeders.

Dr Margaret Wallace is one of the leads in the team delivering DUS testing and seed certification at Niab. She has 18 years' experience as a DUS examiner, starting at AFBI Crossnacreevy before joining NIAB in 2013. Her expertise means she is well placed in representing UK interests in UPOV Technical Working Parties on Agricultural Crops and the recently formed Testing Methods and Techniques.

The aim of the INVITE project was to improve the efficiency of variety testing and the information available to stakeholders on variety performance under a range of production conditions, and biotic and abiotic stresses. The project was bold in its design with 10 species (wheat, ryegrass, apple, sunflower, soybean, maize, potato, tomato, oilseed rape, and lucerne) across a range of propagation and end uses, but all with important breeding activity within the EU and the UK.

The project consisted of seven research areas:

1. Crop characteristics and bioindicators associated with plant sustainability and DUS criteria – identifying crop characteristics and bioindicators associated with plant resources use efficiency (RUE), adaptation to sustainable cropping systems under greenhouse and resilience to variable and more challenging environment conditions (including drought stress).
2. Setting up mobile high-throughput phenotyping tools to measure existing and new bioindicators – developing image analysis tools to assist in variety evaluation.
3. Genotyping tools to better characterise varieties and their performance – applying genotyping tools to improve the speed, precision, and efficiency of variety testing.
4. Predictive modelling of variety performance, adaptation and stability and application in a Decision Support System for Variety Choice – developing models and statistical tools allowing prediction of variety performance under a range of environments and crop management practices.
5. Integration of new methods and tools in advanced variety testing protocols and demonstration in field trials – improving existing variety testing protocols for variety identification (DUS) and performance testing (including VCU) to improve speed, precision and efficiency.
6. Improved variety testing networks – review of current practices with a view to proposing organisational innovations to improve variety-testing networks.
7. Database management and data interoperability – creating databases to securely manage and share data.

Niab was one of the partners, with our expertise contributing to the research and the potential for implementation, with an article from Camila Zanella in the autumn 2025 edition of *Landmark* (Issue 59) on our work on genotyping wheat. This work was supported by our DUS expertise and crop knowledge.

Other work included apple genotyping with particular focus on *Phytophthora cactorum* resistance, carried out by Felicidad Fernández at our East Malling site, and colleagues at Cambridge, Haidee Philpott and Bethany Love, contributed to the work package developing models and statistical tools to provide a prediction of variety performance under a range of crop management practices and environments.

The outcomes from the project were assessed according to Technology Readiness Levels (TRL), from 1) basic principles observed through to 9) actual system proven in operational environment. Even with the large scope of the project (and the timing – a global pandemic) a large number of work areas resulted in results taking it from academic and applied research (1 to 4) into development and validation for variety testing (5 to 7). More information on the findings and conclusions can be found on the website https://www.h2020-invite.eu/.

The UK policymakers met with DUS examiners, VCU crop experts, researchers, and data scientists to learn more about the outcomes of the project. How the project will effect UK variety testing is yet to be seen, but Niab continues to explore ways to innovate and develop the system that influences what varieties are available to UK growers.

This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817970.

Vanessa McMillan • vanessa.mcmillan@niab.com

The use of molecular markers in DUS testing

A case study on barley

Vanessa McMillan joined Niab in 2019 and is responsible for delivery and management of the cereal (wheat, barley and oat) and sugar beet DUS testing programmes, based at Cambridge.

To be marketed in the UK all new agricultural plant varieties must pass DUS (Distinctness, Uniformity and Stability) and VCU (Value for Cultivation and Use) tests and be added to the UK's Variety Lists (previously known as the National List). DUS testing is also essential for the awarding of Plant Breeders' Rights (PBR), the intellectual property rights over a plant variety in the UK.

The system of plant variety protection is based on principles and guidelines developed by the inter-governmental organisation UPOV (The International Union for the Protection of New Varieties of Plants), of which the UK is one of the founding members. The aim is to provide an effective system of variety protection to facilitate and encourage the development of new plant varieties to meet the challenges of a changing world, and for the benefit of farmers, end users and wider society.

Distinctness is determined by visually comparing a new variety against other varieties of the same species in common knowledge (the reference collection), and a standard test often involves two years of field trials. Differences between some varieties can be easy to detect but others may be far more subtle. Depending on the crop species the reference collection can be huge, consisting of thousands of other varieties which all need to be compared against the new candidate varieties entering testing.

The DUS test relies upon visual observations of new plant varieties to establish D, U and S. The use of molecular technologies in DUS testing has long been discussed and there is a specific UPOV Technical Working Party for Testing Methods and Techniques (TWM) which considers the possible application of molecular techniques in DUS testing (alongside other technologies such as image analysis, and statistical methods for trial design and data analysis).

Molecular markers in DUS testing represents an area of increasing interest, and currently there are two approaches used within UPOV. The first is the use of characteristic-specific molecular markers. Here, where a reliable link between a molecular marker and trait has been suitably verified, the marker can be used in place of traditional phenotyping methods to observe the characteristic. Examples in use by UPOV members include gene specific disease resistance or herbicide tolerance characteristics.

The second model is the use of genotypic distances (a calculated measure of the differences between varieties based on molecular data), sometimes in combination with phenotypic distances, to manage the reference collection. Implementation of this model has been possible for crops where there is a clear link between the calculated genetic distances and phenotypic distances, so that a distance threshold can be defined by the technical experts to exclude reference collection varieties from the growing trials which are clearly distinct and therefore not needed for direct phenotypic comparison.

One major challenge for DUS examiners is the ever-expanding size of the reference collections, and the need to develop and deliver cost efficient

Wheat and barley DUS trials at Niab's Park Farm site near Cambridge

DUS testing ensures that new varieties are unique and differ compared to existing varieties within the same species:

- **Distinctness (D)**: must be sufficiently different from existing varieties
- **Uniformity (U)**: plants within the variety must have consistent features
- **Stability (S)**: all plants should remain consistent across subsequent generations.

approaches for its assessment and management. In some crops, such as spring barley in the UK, the verification of distinctness is difficult where phenotypic diversity in traditional DUS characteristics is limited. Often this can result in additional years of testing to confirm distinctness criteria can be met.

In a two-year Defra-funded research project, finishing at the end of March 2025, Niab has been exploring the use of genetic marker data to increase the speed and efficiency of DUS testing, using spring barley as the model. Firstly, the use of genetic data has been explored for management of the reference collection. The aim is to pre-select similar varieties earlier in the testing process using the genetic data, giving more opportunity for closer phenotypic assessment and reducing the need for additional years of testing.

Barley rachilla hair type – long and short

Barley pigmentation – present and absent

Predicting phenotypes

Work has been carried out to explore a range of analysis methodologies to optimise molecular marker-informed selection of similar varieties from the reference collection for phenotypic comparison in growing trials. This has included the use of genomic prediction (GP) approaches, where thousands of genome-wide genetic markers are used to predict the DUS phenotypes.

Once accurate prediction has been demonstrated, then the DUS phenotypic characteristics could be predicted for genotyped varieties as a first step in the DUS testing pipeline, before ever having to physically assess the plant material. Accurate predictions could be used to pre-select the most similar varieties for comparison. The project work has found that different GP methodologies were more accurate depending on the DUS character in question. Implementation of diagnostic marker weighting into the GP model also gave small improvements to the predictions.

In the final stage of the project Niab is evaluating how robust the DUS criteria would be for implementing GP and using the predictions for similar variety selection. Predicted phenotypes have been compared to observed phenotypes for the 28 barley DUS traits and the similar variety selection algorithm tested on the predicted data and compared to historic information of which similar varieties have been included in previous growing trials. The recommendation for future work is to explore optimisation of the similar variety selection using predicted phenotypes and how this can be implemented into the DUS pipeline.

Minimal marker set

In a second strand of the project the genetic data has been used to identify a smaller subset of molecular markers for use in varietal identification and seed stock authentications using low cost Kompetitive Allele Specific PCR, known as KASP, assays. In order to develop a marker set which is as relevant as possible for the UK barley DUS system, we combined our newly generated 50k array data with previously genotyped varieties to curate a genotypic dataset on a collection of >1,000 barley varieties from the UK reference collection. An algorithm based on the discriminating ability of the SNPs was used to identify the optimal number of markers required to distinguish between the varieties within the collection. This analysis found that 20 to 22 molecular markers could completely differentiate between all of the varieties in the collection. KASP assays are now being developed for the molecular marker set, and experimental validation carried out to determine reproducibility and accuracy. The marker set could also be adapted and updated as necessary to stay relevant with new varieties entering the testing system.

Finally, the existing DUS database which holds variety records and phenotypic data has been expanded to store the genotyping data generated within the project, including both raw and processed data alongside associated metadata. The safe and secure storage of genetic data is an important pre-requisite for future implementation of molecular approaches within the DUS system.

Within this project Niab has provided proof of concept for the use of molecular markers within the UK barley DUS testing system. The recommendation for future research is to focus on refinement and validation of the approaches developed, alongside a focus on implementation including parallel running experiments and engagement with UPOV colleagues internationally to discuss the findings. It is essential that the DUS testing system takes advantage of new tools, models and technologies to remain relevant and effective, and continue to support plant breeding innovation.

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Staff profile – Poppy de Pass

Poppy de Pass is Niab's West Regional Agronomist. Niab Landmark caught up with her to discuss her Niab career to date, and her route from the family farm in Wiltshire, via University to her current role.

Tell us about your career path at Niab?

My first introduction to Niab was as an undergraduate student at the Royal Agricultural University at Cirencester. Richard Overthrow, who was Niab's West Regional Agronomist at the time, came to talk to us. Our lecturer then encouraged us to enter the Niab Agronomy Cup, which was a plot-based wheat management competition for students to show off their agronomy skills. Which we won!

After graduating with a degree in agricultural crop science, I started at Niab as a trials officer at the Sutton Scotney centre in Hampshire. I wanted to be an agronomist, but some friendly advice from a local agronomist was to start off in research, to see and experience as much as I could and understand the value of data; collecting it, using it, and interpreting it. After a couple of years I moved into a trials manager role, including managing the Niab work for the Pepsico-funded Opti-Oat Crop Intelligence Platform at Sutton Scotney.

I then transferred to managing Niab's Cirencester trials centre, with the aim of building it up. It's an important site for Niab members and the original site from the late 1970s when the Cotswold Cereal Centre was established. I began helping Richard with membership field days and training to become an agronomist, including taking my BASIS. I shadowed TAG Consulting agronomist Andrew Chell for one day a week and, when Richard retired in 2021, I moved into his former role as Regional Agronomist for the West.

The role has evolved over the past few years, and alongside the traditional Niab regional agronomy role I now have clients that I provide individual agronomy advice and crop recommendations, field walking their farms. I appreciate the day to day variation of members' field days, crop walking and trial and data analysis.

How did Niab support you with your career?

I've been at Niab for 10 years now. Niab can be quite flexible with working arrangements, I like the stability and the support they've given me when I've been looking to take the next step in my career. From the start I was clear that I always wanted to be an agronomist and Niab recognised and supported the path I wanted to take.

What are your current challenges?

Margins in farming are getting tighter and tighter and what our farmer members need from us is evolving. They still want agronomy advice but we need to be able to work this alongside the various environmental and land management schemes, such as the now closed SFI, that are coming from government. So we need to be quickly up-to-date, aware and knowledgeable enough to advise and recommend next steps. This includes anticipating what farming will require over the next few years with our membership trials programme, for example providing advice on growing and managing alternative crops or herbal leys. But we have to remember that food production is what we're predominantly here to do, getting the best from our inputs,

The Niab regional agronomy team in 2022

ensuring we manage the land correctly and achieving the highest margin, but not necessarily the highest yield.

What excites you most about your job?

How joined up the process is – from taking a result from a trial I've overseen or even developed, to putting it into practice on farm and seeing the final outcome with our clients or members. And the satisfaction of answering agronomy and farming questions at field days and events and seeing the difference it makes. I'm also still quite heavily involved with the Cirencester trials site and really appreciate following the process through the season from developing the trials protocol, to drilling, to harvest and right through to the results conferences where we share the information. And on a more personal level I love being able to walk around different farms and appreciate everything from new and innovative farming practices right through to just the British countryside and wildlife.

What advice would you give someone wanting to do your job?

If you get a chance to work in crop research – take it. It's perhaps not the standard route to becoming an agronomist. Normally you'd come out of university or college and go into an agronomy training scheme. It's taken me longer to get there but it is where I want to be, with added experience.

Trials can be like farming but on a mini-scale – planning, drilling, managing, applying inputs, assessing, harvesting. You get to know each of those stages, giving you practical experience of farming activities, but with the addition of everything that comes with trials analysis and interpretation. The original advice was excellent, so I would pass that on to anyone considering a career in agronomy. I scrutinise data more than I may have ever done without that experience. And crop research opens up a lot more opportunities as you begin your career.

Poppy winning the Niab Agronomy Cup for the Royal Agricultural University in 2014

A new generation of crop scientists

For graduate students interested in studying for a PhD Niab has excellent resources for research in molecular plant science, quantitative genetics, breeding, transgenic technology and plant pathology both at our Cambridge and East Malling sites. The majority of our PhD studentships, in partnership with UK universities, are funded by grants from leading business, charities and other research providers. Niab also partners with European and overseas universities, hosting international students. More information is available on niab.com.

Landmark is providing an opportunity for Niab PhD students to introduce themselves and summarise their research. This issue will be the first in the regular column, featuring two East Malling student colleagues – Ece Imam Moustafa and Haidee Tang.

Ece Imam Moustafa

Improving cane crop resilience by overcoming the legacy effects on photosynthesis during the recovery from short-term combined stresses

Collaborative Training Partnership for Fruit Crop Research Programme

October 2020 to September 2024

The shifting climate in the UK has led to an increase in abiotic stresses, which significantly impact both crop yield and quality. Each growing season presents a unique set of difficult environmental conditions, and growers need to adapt quickly to maintain fruit yield and quality. In these challenging circumstances, inefficient or ineffective irrigation scheduling can quickly cause temporary rootzone water deficits, potentially reducing berry weight and quality based on the intensity of the stress.

In cane crops like raspberries, recovering from temporary water deficits in the root zone can take several days or even weeks, and the legacy stress effects on photosynthesis may restrict marketable yields and berry quality. My PhD project focused on improving raspberry resilience to these short-term abiotic stresses by understanding how the legacy effects on photosynthesis are regulated, whether they can be predicted and how they might be overcome more rapidly to better manage the risks to productivity and profitability.

The recovery of leaf gas exchange was influenced by the duration and intensity of the rootzone water deficit stress. Nevertheless, a mere four-day rootzone water deficit stress led to legacy effects on photosynthesis that persisted for days after the rewetting of the coir. To explore the involvement of the plant hormone abscisic acid in the physiological responses of leaves during both the drying and recovery phases, samples of xylem sap and leaves were taken. A more than 50-fold rise in the concentration of xylem-borne abscisic acid and a 1.5-fold increase in foliar abscisic acid concentration were observed after four days of coir dryness,

suggesting that signalling mechanisms play a role in responding to temporary rootzone water deficit stress. The impact on Class 1 yield was significant following the transient rootzone deficit stress, adversely affecting yield and berry weight for weeks. Experiments suggested that using larger pots for rooting volumes could help minimise the negative impacts of water deficit stress.

The legacy effects of transient rootzone water deficits on photosynthesis were evident after four-, seven-, and

ten-day rootzone water deficit stress. While the rise in xylem-borne abscisic acid concentrations may be associated with lower stomatal closure, leading to lower photosynthesis rates. Xylem-borne and leaf abscisic acid did not appear to influence the recovery of photosynthesis values back to pre-stress values. Even short-term water deficit stress can have a profound effect on plant physiology, significantly impacting both yield and quality, underscoring the importance of understanding not just how plants sense abiotic stress but also how they respond during recovery. An integrated approach is essential for grasping the complexities of combined stress events as they occur in real-world situations. Ultimately, these studies enhance our understanding of how raspberry plants respond to water deficit stress, paving the way to mitigate lasting effects on leaf gas exchange as well as berry yield and quality.

Haidee Tang

Using climatic and microbiome data to predict apple fruit quality

Collaborative Training Partnership for Fruit Crop Research Programme

October 2021 to September 2025

Apple harvest maturity has a causal effect on the quality of the apples after storage. Under-ripe fruit tend to be small, too firm and lacking in flavour, colour and aroma. On the other hand, over-ripe fruit are more likely to have storage disorders, thus leading to wastage. Harvesting fruit at the optimum storage maturity can help reduce waste and yield better quality fruit to consumers.

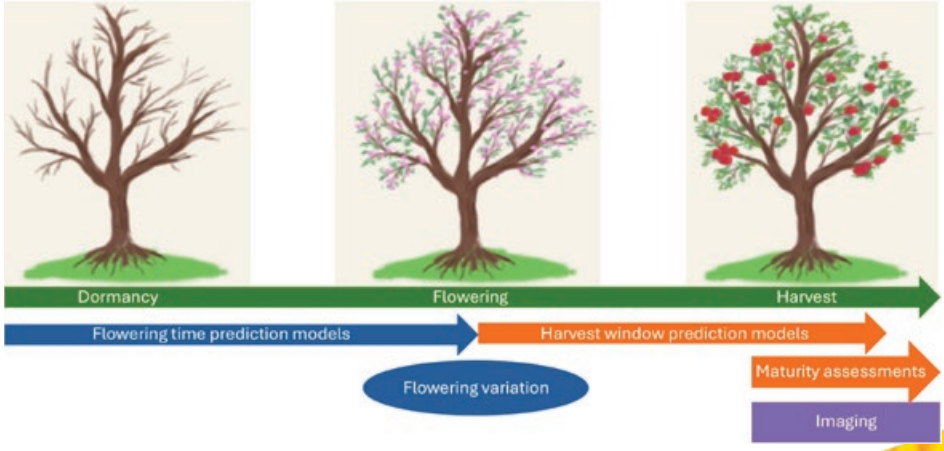
The current gold standard for maturity measurements includes harvest date predictions using phenology models from the average flowering date and maturity assessments. Phenology is the study of the timing of seasonal events in response to the environment. Therefore, by utilising climate data on phenology models, the harvest window can be predicted from spring, when the flowers bloom. The issue is that most of these models take the average flowering date as the start date in their calculations. The variation in flowering could affect the spread of apple maturity when it reaches harvest. This is especially important to consider when predicting the harvest window since increasing the flowering period can increase flowering variation and fruit maturity. Maturity assessments, physiological measurements of apples, are time-consuming, labour-intensive, and accurate as the sample collected and each sample causes the loss of product.

My research focuses on non-destructive methods to predict the optimal apple harvest window. I work on 1) flowering time predictions using phenology models on the winter to flowering period to attain an earlier harvest window prediction, 2) determining the variation in fruit maturity at harvest due to flowering time variation and 3) utilising imaging to predict apple maturity (Figure 1).

The key findings of my PhD show that a PhenoFlex model, a new type of model which combines a traditional chilling and a traditional forcing model into one framework, trained with multiple cultivars is more accurate than models trained with single cultivars. The model is accurate within five days of the flowering date. This model can be used to predict the flowering time of multiple cultivars within the Kent region. Secondly, I found that flowering time variation can cause up to 20% of variation fruit maturity but this is largely dependent on cultivar. The fruit maturity of early flowering cultivars, such as Cox and Gala, were more affected by flowering than late flowering cultivars such as Fuji and Braeburn. Lastly, hyperspectral imaging can be used as a non-destructive method to predict fruit maturity. Hyperspectral imaging, as a quicker, less intensive, non-destructive alternative to determining fruit maturity show promising Brix, firmness and starch predictions despite high variance in model predictions. Adjustments to the model can be made to improve model accuracy.

When taken together, phenology models using climate data and imaging data can be used as an alternative to traditional methods of harvest window predictions.

Figure 1. Project focus points compared with traditional approaches. In the green bar are apple phenology stages. In orange are the traditional approaches. My project objective points, in blue: phenology models used to predict flowering and to investigate the effects of flowering time on harvest maturity, and in purple: imaging to predict apple maturity



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Helen Appleyard • helen.appleyard@niab.com

Potato disease testing

Niab's Analytical Services and Potato teams work together to provide potato growers with a testing service for potato virus, fungal diseases and germination. The information gathered from the tests help the grower/agronomist make decisions about whether to keep, sell, how to grow, what IPM strategy to use, and more. Together they are a very valuable tool.

Helen Appleyard is Chief Officer of the Official Seed Testing Station (OSTS) and Head of Analytical Services at Niab. She joined Niab in 1988 as a trainee seed analyst and previous roles include a biochemical technician, seed pathologist and technical services manager. Her department provides a range of scientifically driven diagnostic services including quality testing, variety identification, pathogen diagnostics and seed testing.

Virus testing

Virus testing can be done on leaf or tuber material; Niab recommends testing a sample size of 100 leaves or tubers and ask for 110 tubers to be submitted. The submitted sample should be taken throughout the field to give a representative sample, rather than taking from a small part of the bulk which will give a biased view of the level of virus in the crop.

Niab can test by either ELISA and RNA-based methods. The ELISA method uses specific antibodies to attach to the protein coat of the virus and, using a colour change reagent, the virus is detected. It requires leaf material, which means growing tubers in controlled glasshouses for about eight weeks until there is enough material to test in the laboratory. The RNA method is a lot quicker as material can be used direct from the tuber, taking around five days to complete. The test extracts virus RNA from the plant material which is then quantified.

Niab can test up to seven different viruses: Potato virus Y and the Potato virus Yn strain, Potato Leaf roll virus (PLRV), Potato virus A, Potato virus S, Potato virus V and Potato virus X. The most common virus found is Potato virus Y.

Fungal diseases

Fungal diseases, such as silver scurf, black dot and black scurf, can be detected on the surface of the tuber. Niab offers a test to determine the incidence and surface area coverage of the diseases.

Powdery scab

Plant with Potato virus Y

There are two tests for fungal diseases – a visual whole surface tuber test and a microscopic analysis. The whole tuber test is carried out first, with an examination of the entire surface area of the tuber to determine the percentage coverage of the disease. For a more thorough result microscopic analysis is carried out. The main apical eye is removed from the tuber, with the remaining pieces left in a temperature-controlled incubator, with lights, for seven days to allow the disease develop. It is then examined under a dissection microscope to identify and quantify the diseases present.

Germination testing

Niab recommends sending in a sample of 100 tubers after harvest. The whole tubers are incubated with lights and a constant temperature to help sprouting. The tubers are monitored weekly for signs of growth and the number of sprouts reaching the right criteria are recorded. The test is complete when all tubers have sprouted. This can take anything from 3 to 12 weeks to complete depending on variety and if the seed has been exposed to any treatments. The customer report shows the germination progression graphically.

The test will show the vigour of the potato seed and the test indicates which stocks will emerge irregularly or have incomplete emergence. Tuber age is an important factor in this test; stocks received in November may start to germinate at the same time as stocks received in September when planted at the same time.

Send us your samples

Potato testing mainly occurs between September and March.

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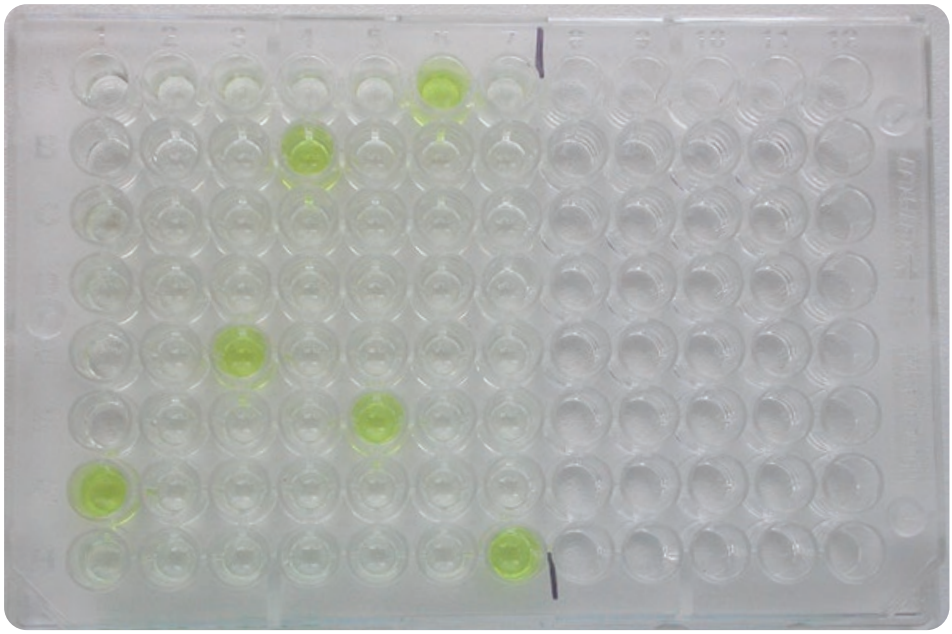
Plant with Potato leaf roll virus

Silver scurf on potato surface



ELISA test showing positive reactions

Shona Burch • shona.burch@niab.com

An introduction to the UK herbage seeds market

The Herbage Seeds Technical Working Group, held at Niab in Cambridge, brings together herbage seeds industry members, seed growers and processors annually to discuss issues and challenges in the sector. Over the past 40+ years that the Group has been in existence the topics of discussion have varied greatly, including the impact on the herbage seed trade of Brexit and the first UK case of resistance to glyphosate found in an Italian ryegrass. The Group receives regular updates on available herbicides; often grass seed is not included on a label because the manufacturer or agent has not carried out the tests, so EAMUs (Extension of Authorisation for Minor Use) are required. Specialist are often called upon to share their work and opinions, with industry representatives, such as the NFU and Agricultural Industries Confederation, also reporting on their work relevant to the herbage seed industry.

The seed certification figures are presented every year and, looking back, the area of herbage (e.g. ryegrasses and fescues) and herbage legume (including blue lupins, vetch, and clovers) crops approved for multiplication in the UK is not a far cry from what it was ten years ago. Approximately 6,700 ha of herbage and herbage legumes were approved in 2024 compared to the 6,309 ha approved in 2014. In that time the area of herbage and herbage legume crops approved rose steadily to a peak of just over 9,000 ha in 2022 before dropping to approximately 8,300 ha in 2023, and then to 6,700 ha in 2024.

Herbage seed includes amenity grasses used for lawns and sports pitches

The main crops contributing to these figures are the intermediate and late heading perennial ryegrasses. In 2024 there were 2,106 ha and 2,156 ha of intermediate and late heading perennial ryegrasses approved for certification respectively. Over the past ten years they have made up, on average, 61% of herbage and herbage legume crops approved for certification. The 9,184 ha peak seen in 2022 was mainly due to an increase in late heading perennial ryegrass crops of which 3,320 ha were approved.

Amenity ryegrasses, those used for lawns and sports pitches, usually make up the next largest proportion of herbage seed certified after the intermediate and late perennials. However, in 2020 and 2021 the amenities were briefly overtaken in area approved for certification by hybrid ryegrasses. Festulolium, a hybrid between tall fescue and Italian ryegrass has started to increase in recent years, almost doubling in area certified from 87 ha in 2023 to 141 ha in 2024.

The Working Group will meet again in Spring 2026. If you would like to contact or have a subject of interest to the Group, email shona.burch@niab.com or seedcert@niab.com.

Shona Burch is a technical specialist in Niab's Agricultural Crop Characterisation team, focussing on the official controls plots for seed certification. She is a qualified crop inspector and assists with Distinctness, Uniformity and Stability testing of cereals and sugar beet. Originally from Northern Ireland, Shona grew up on a smallholding near Ballygowan.

Certification figures for herbage legumes, including vetch, have recently dropped

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A subscription to Niab Seeds Membership provides access to information on the seed statistics of all crop species certified in the United Kingdom.

For more information go to niab.com or scan the QR code below.

Nichola Hawkins • nichola.hawkins@niab.com

Fungicide resistance in Septoria

Septoria leaf blotch is the UK's most damaging wheat leaf disease, and is usually the main target of T1 and T2 fungicides. However, the fungus responsible for Septoria leaf blotch, *Zymoseptoria tritici*, is highly adaptable and has rapidly evolved to overcome fungicides like the strobilurins as well as resistant varieties like Cougar. Niab is aiming to better understand both the current levels of fungicide resistance in Septoria and the evolutionary forces driving it, to help develop longer-lasting strategies to control Septoria and other diseases.

Dr Nichola Hawkins is a research scientist at Niab, based in Cambridge, working on fungicide resistance. Antibiotic resistance is a well-known problem in healthcare but similar problems are seen in agriculture, with resistance to the fungicides, herbicides and insecticides that are used to protect our crops.

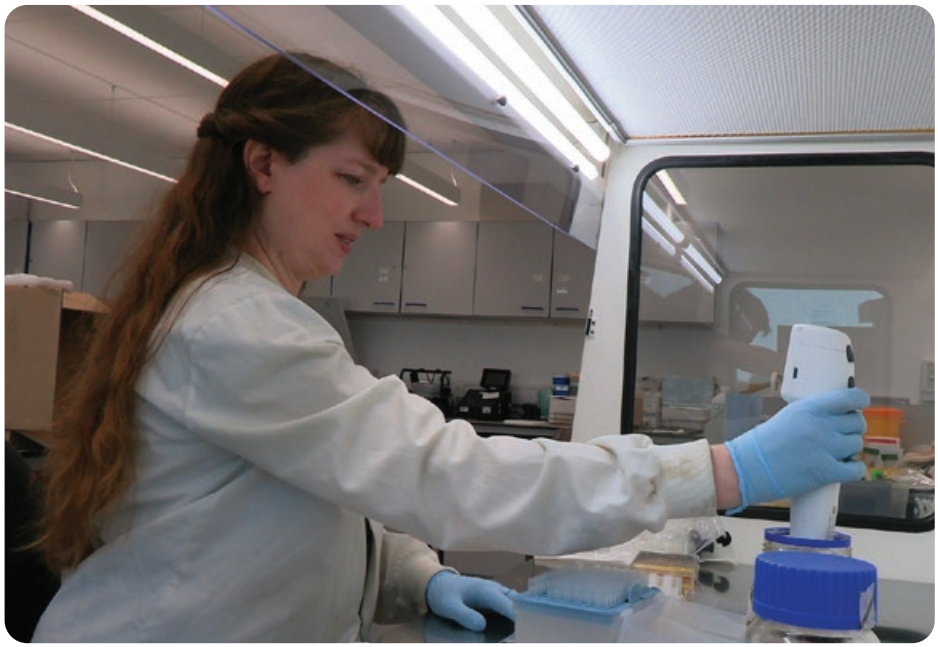
The fungicide performance trials, funded by AHDB and carried out at ADAS, Niab, SRUC and Teagasc, test how well different fungicides control key diseases including Septoria. This is vital to give an overall picture of fungicide sensitivity of the current Septoria population relative to field doses of available (and forthcoming) products. However, the performance of a fungicide treatment in a given year can be affected by various factors including weather, spray timing and overall disease pressure, as well as resistant strains of the fungus. By isolating the Z. tritici fungus from Septoria-infected wheat leaves and testing its growth with a range of fungicide doses in controlled lab conditions, we have shown that the long-term slide in azole performance is indeed due to changes in the fungus itself, and this is associated with multiple different mutations in CYP51, the gene coding for the target of azole fungicides within the cells of the fungus.

There has been increasing numbers of Septoria strains with lower sensitivity to fungicides in the SDHI group. At present, most of these strains have a single mutation, sdhC-N86S, giving an intermediate level of resistance. This means older SDHIs may be somewhat less effective than when they first came out, but this is not a complete control failure, and new highly active compounds like isoflucypram and pydiflumetofen perform very strongly. However, initial results from 2024 indicate that consecutive sprays with a solo highly active SDHI can select for more highly resistant strains with multiple mutations. Therefore, to avoid these harder to control strains reaching higher levels more widely, it is vital to stick to resistance management guidelines (see separate box).

Once we know the genetic mutations found in the more resistant strains, DNA tests can be developed to detect these mutations directly. Testing the fungus itself in the lab will still be important, to determine whether any new mutations are causing higher levels of resistance, but by supplementing this existing testing with new DNA tests, we could test more of the population, look more widely and get data more quickly. This will give an earlier warning of any new changes that could further affect fungicide activity, for example if resistance to QiI fungicides develops in the future. New testing methods are currently being developed to look at incoming fungal spores from the air over a crop, with Nanopore sequencing of the genes where resistance mutations occur.

These projects all analyse the resistance currently present in field populations. 'Test tube evolution' is being used to see if we can anticipate what

mutations might evolve in the future, so management advice can be tailored based on the resistance levels and cross-resistance patterns of these mutants before they become a problem in the field. For example, fungicides within the azole class are not all equally affected by each mutation, so different patterns of azole use will select for different mutations, with different implications for future resistance and control. By supplementing field monitoring with lab studies, we can run many more different scenarios far more rapidly than would be possible in the field, aiming to get a step ahead of the disease.



Fungicide resistance management:

- Use fungicides in combination with resistant crop varieties, and other non-chemical measures such as later drilling.
- Use fungicides in mixtures (pre-formulated or tank mix)
- Mixtures must contain a mixing partner from a different mode of action group (e.g. Azoles group 3, SDHIs group 7, QiIs group 21)
- The mixing partner from a different mode of action must also be effective against that disease (e.g. a strobilurin counts for rusts but not for Septoria in the UK), with the control from both fungicides as balanced as possible.
- Follow any label instructions limiting the number of sprays of a given product or mode of action within a growing season.

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Alex Cooke, Certis Belchim

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Louisa Robinson-Boyer • louisa.robinson-boyer@niab.com

Seeking improved consistency in raspberry propagation

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 (PGPR) and Arbuscular Mycorrhizal Fungi (AMF) 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.

A Growing Kent & Medway funded project has identified benefits from using arbuscular mycorrhizal fungi in raspberry production. The annual demand for high-quality long-cane raspberry material is continuing to rise, but demand is outstripping supply and the quality of plants purchased is not always uniform, with survival rates lower than growers would expect. The industry needs to find a way of producing consistently higher quality canes with root systems that can sustain growth and production of high yields of raspberry.

Arbuscular mycorrhizal fungi (AMF) and plant growth promoting rhizobacteria (PGPR) have been extensively studied by Niab and others, and are known to enhance root growth in various ways. Both are commercially available for use by growers. AMF has been shown to increase plant health, water and nutrient uptake and resistance to biotic and abiotic stress whilst PGPRs are known to fix atmospheric nitrogen, enhance phosphorus availability to the plant, increase natural plant hormone production and contribute to organic matter.

Virgin coir substrate is sterile and not only lacks plant nutrients, but also lacks a balanced diversity of soil microorganisms. Previous research to colonise virgin coir with AMF has given mixed results, but if this process could be improved, it is thought that the propagation of raspberry, cane establishment and growth might be enhanced (Figure 1). In this project, Niab set out to question whether microbial amendments to both virgin and recycled coir will enhance raspberry tip propagation and whether they might improve primocane and long-cane crop establishment and production. Finally the project aimed to investigate the suitability of re-used coir from strawberry crops for commercial raspberry production.

Raspberry tip propagation

Malling Bella raspberry plants were planted into pots of virgin coir, amended with AMF and grown for eight months. The roots were then harvested and transplanted into cutting trays and the emerging shoot tips were recorded (Figure 2). Compared to roots that had not been treated, the AMF-treated roots produced increased shoot numbers for

Figure 1. Might AMF enhance root growth and cane establishment in coir?

cuttings and also improved survival rates of these cuttings, although the results were not statistically significant. A similar trend was seen in AMF-treated Malling Bella canes grown in the field. The treated plants produced more spawn than the untreated.

Primocane crop establishment and production

In 2023, Malling Bella tips were planted into pots of virgin coir, amended with AMF, PGPR, both AMF and PGPR or neither. The canes were mown down and grown and cropped in 2024. There were no significant differences in yield or waste fruit, although a slight yield increase occurred in PGPR-treated coir. However, AMF treated coir gave rise to a significant increase in berry size, whilst PGPR resulted in a slight increase in berry size that was not statistically significant. The AMF treatment also led to a three-day delay in the time taken to get the first ripe fruit.

Long-cane crop establishment and production

In 2023 long cane Malling Bella was also planted into pots of virgin coir which was amended with AMF, PGPR, both or neither. However, in contrast to primocane production, there were no significant differences in growth or yields.

Suitability of recycled coir for raspberry production

To assess the performance of raspberry in coir recycled from strawberry production, pots of both virgin and recycled coir were planted in 2023, either with or without AMF, using Malling Bella either as a primocane or a long cane (Figure 3). The primocane crop was mown down in 2023, cropped and recorded in 2024. The long cane was cropped in 2024.

In the primocane crop, there was no significant difference between recycled and virgin coir, although the recycled coir produced a slight increase (not statistically significant) in Class 1 yield and a significant reduction in waste fruit. However, the berry size increased significantly with the addition of AMF in the recycled coir.

In the long canes, there were no significant yield differences between treatments, although there was a slight reduction in Class 1 yield in recycled compared to virgin coir but also a slight reduction in waste fruit. However, where recycled coir was treated with AMF, an increase in berry size compensated for the reduced yield in recycled coir alone, increasing the yield to that achieved in virgin coir.

Trends so far

Further assessments will be made, and data will also be collected from the 2024 planted primocane in 2025. However, the results so far suggest that treatment with AMF increases berry size in both virgin and recycled coir, that recycled coir from strawberry crops is likely to be good for raspberry crops, and that the addition of AMF to recycled coir can help to sustain yields at the level expected from virgin coir.

Figure 2. AMF treated roots produced higher numbers of shoots for cuttings

Figure 3. Raspberry canes were grown in coir recycled from strawberry production

Michelle Fountain • michelle.fountain@niab.com

Employing baits in attract and kill strategies for fruit crops

Dr Michelle Fountain is Niab's Head of Pest and Pathogen Ecology at East Malling, specialising in the minimisation of pesticide use in fruit horticulture, improving pollination in fruit crops and incorporating modern fruit growing practices with Integrated Pest Management.

Research into the use of bait sprays in fruit crops has identified novels way of improving pest management. Niab has previously collaborated with Microbiotech to demonstrate the use of bait sprays to successfully control spotted wing drosophila (SWD) in soft and stone fruit crops. One of the successful baits was further developed by Niab, Microbiotech and Russell IPM to create the new bait spray adjuvant ProBandz, now commercially available from Russell IPM. The research demonstrated that by applying 40 l/ha of a narrow band spray of large droplets to the foliage of the crop (Figure 1) combining ProBandz (5%) with 50% or less of the recommended rate of a plant protection product such as Tracer (ai spinosad) or Exirel (ai cyantraniliprole), was as effective at controlling SWD as a full rate overall crop spray of Tracer or Exirel. In trials, reducing the rate as low as 4% was equally effective.

Adult flies are attracted to the bait ingredient (ProBandz) and feed on the narrow band of sprayed foliage, ingesting the plant protection product which kills them. This system avoids the control product being applied to the fruit, reducing the risk of residues whilst also reducing exposure to naturally occurring beneficial insects, introduced predators and pollinators, minimising disruption to IPM and expensive biocontrol programmes. Avoiding the use of an overall crop spray also avoids contact with the adult SWD and reduces the risk of pest resistance developing. Time required for spray application is lowered by approximately 85% compared to full rate sprays and water use is also significantly reduced.

Previous research by Niab PhD student Csaba Nagy at East Malling has shown that sugar baits can distract ants from aphid colonies (Figure 2) in apple trees, exposing the aphids to predation from other insects. It was not clear if ProBandz would be effective at deterring ants from visiting aphids.

Although, earwigs are useful predators in apple and pear orchards, feeding on pests such as codling moth, aphids and psyllids, on strawberry tabletop systems they hide under the grow bags in the daytime, emerging at night, and sometimes feed on strawberries. Harvesting live earwigs from strawberry crops would provide a free supply of predators for introduction to apple and pear crops providing pest control. It would be useful to investigate if earwigs could be attracted to ProBandz for this use.

In a new Innovate UK funded project, managed by Niab in 2024, the entomology team at East Malling set about three experiments to assess the impact of baits as a means of managing pest control. The first assessed the efficacy of ProBandz used as a bait spray with Hallmark (ai lambda-cyhalothrin) for SWD control. The second assessed different formulations of ant bait to distract them from rosy apple aphid colonies on apple trees. The third tested an attractive bait, developed by Russell IPM, in a trap with the intention of attracting earwigs into the trap which is clipped to a tabletop in a strawberry crop.

The work was done in partnership with Microbiotech Ltd, Russell IPM Ltd, Plumford Farms Ltd, New Farm Produce Ltd, Littywood Farm Ltd and Chandler & Dunn Ltd.

Figure 1. Bait spray being applied to a reduced area of cherry canopy

Hallmark use with ProBandz as a bait spray

In testing, 5% ProBandz was added to 8% of the standard Hallmark rate and applied as a band spray to strawberry and compared to full rate Hallmark

applied as an overall spray for SWD control. The results demonstrated that Hallmark was as effective at controlling SWD when used as a band spay with ProBandz than a full rate spray without the bait. Hallmark is broad-spectrum and can damage introduced predators and natural enemies in crops so applying as a narrow band spray of large droplets and at a lower rate with the bait should minimise disruption to IPM programmes. Bait sprays are only permitted for use with products that have standard or EAMU authorisations, and not emergency authorisations. As Hallmark has an EAMU authorisation for use (either outdoor, protected or both depending on the crop) on most fruit crops that are susceptible to SWD, it could be used as a bait spray for eradicating SWD populations once a crop has ended.

Using Hallmark in this way after harvest would minimise disruption to IPM programmes and help to reduce SWD populations going into the winter. This type of use could be particularly helpful where different varieties or different fruit crops such as cherry or blueberry ripen and are harvested sequentially with SWD moving onto unpicked varieties as the previous ones are harvested. A similar situation can occur on mixed farms where SWD may move from cherry to raspberry as the season progresses. It should be noted that the bait or adjuvant label always requires operators to use only 50% or less of the maximum product rate recommended on the product label.

Microbiotech also screened a range of other insect targeted plant protection products in the laboratory, including Decis, in combination with ProBandz, but none of these were effective at controlling SWD.

Baits to distract ants from aphid colonies

Although previous sugar baits have deterred ants visiting aphids ProBandz was not attractive to ants and did not prevent rosy apple aphid damage. In addition, most ant baits are highly water soluble and not rain resistant or require a high level of labour to deploy. The Russell IPM team developed different formulations of ant baits which were subsequently tested for longevity in the British weather and attraction to ants.

Figure 2. Ants attending rosy apple aphid colony

By the end of the project, with Niab, a formulation was developed which could be tested in the future for efficacy against rosy apple aphid damage.

Baits for trapping earwigs on tabletop strawberry crops

Niab compared an attractant from the Russell IPM Wignest device with fish formulations commonly reported to be attracted to earwigs (Figure 3). The Russell IPM bait was more attractive and was further field tested in a range of different trap types attached to tabletop strawberries. Russell IPM further developed the trap which is now commercially available as an earwig trap and lure (Earwig Catcher and *Forficula auricularia* Lure). Further work is needed to test the density of traps needed in a crop and the regularity of topping up the earwig lure to reduce economic damage to the fruit. Thought should be given to providing a way to release them in apple and pear orchards to improve pest control in these crops whilst reducing damage to strawberry.

Figure 3. Earwig exposed to different attractants

Asia Roberts-Yalland • asia.roberts-yalland@niab.com

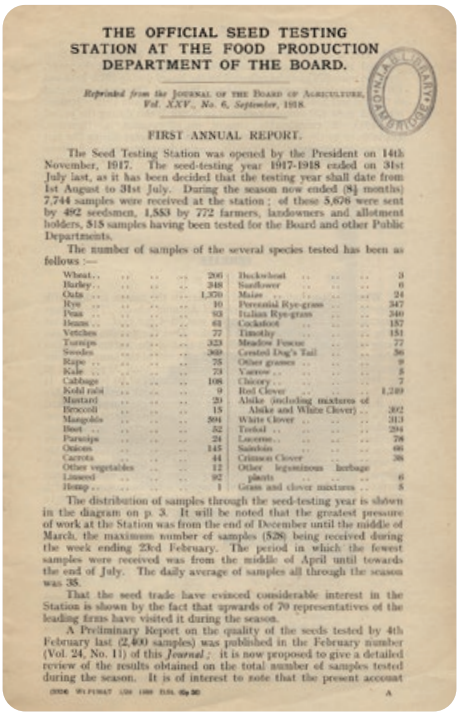
The role of women in the Official Seed Testing Station

By August 1917 over 1.5 million tons of food supplies carried by merchant ships destined for Britain lay at the bottom of the ocean; the First World War was causing devastation to the UK's food security. But, in a small laboratory in Westminster the seed analysts of the newly formed Official Seed Testing Station (OSTS) were working their way through 7,744 seed samples in their first year. These results contributed to battling the continuing food crisis, that eventually led to compulsory food rationing by the end of the year. The contribution of men to the war effort at this time is both self-evident and, in the main, tragic. However, the work being done at the OSTS was being carried out by women.

Asia Roberts-Yalland is a deputy laboratory manager at the OSTS and has been a fully qualified seed analyst for over five years. As a member of the ISTA technical committee for tetrazolium, I am also involved in developing, standardising, and validating methods associated with tetrazolium testing.

For a career that is for the most part unknown to the general population, UK seed analysis has a long history and an important role to play in agriculture. Ensuring quality and reliability in the seed trade and, subsequently food security, the practical methods have remained largely unchanged since their development. It is the nature of these methods that historically made this career a female only avenue; the patience, attention to detail and intricate nature of the work was deemed to suit the perception of women when the OSTS was set-up in 1917. Consequently, for many years UK seed analysts were all female.

Of course, at that time career options for women outside the home were limited so it would seem that this opportunity should only be celebrated. However, in the 1920s not all women could yet vote and less than half the female population were employed, so there were inevitably limits to this opportunity. In 1921 the OSTS moved to the newly created National Institute of Agricultural Botany on Huntingdon Road in Cambridge, and the female analysts that made up the majority of OSTS moved from London with the organisation. These analysts would have been young and unmarried. They lived on site in the upstairs rooms of the old Niab HQ building, which is still there today, but converted into private resident flats. They were always chaperoned if they left the site, with documented cases of women being let go for breaking the strict rules. These women worked and trained very hard and made a significant contribution to the seed trade of the UK. The results sent out would have been reported and signed by the chief officer, a role that would have been held by a man.



THE OFFICIAL SEED TESTING STATION AT THE FOOD PRODUCTION DEPARTMENT OF THE BOARD.

Reprinted from the Journal of the Board of Agriculture, *Vol. XXV., No. 6, September, 1918.*

FIRST ANNUAL REPORT.

The Seed Testing Station was opened by the President on 14th November, 1917. The seed-testing year 1917-1918 ended on 31st July last, as it has been decided that the testing year shall date from 1st August to 31st July. During the season now ended (8½ months) 7,744 samples were received at the station; of these 5,676 were sent by 492 seedsmen, 1,583 by 772 farmers, landowners and allotment holders, 515 samples having been tested for the Board and other Public Departments.

The number of samples of the several species tested has been as follows:—

Wheat	206	Buckwheat	3
Barley	348	Sunflower	6
Oats	1,370	Maize	24
Rye	10	Perennial Rye-grass	347
Peas	93	Italian Rye-grass	340
Beans	61	Cocksfoot	137
Vetches	77	Timothy	151
Turnips	323	Meadow Fescue	77
Swedes	369	Crested Dog's Tail	36
Rape	28	Other grasses	9
Kale	73	Yarrow	5
Cabbage	108	Chicory	7
Sold rāpi	9	Red Clover	1,249
Mustard	20	Alsike (including mixtures of Alsike and White Clover)	302
Broccoli	15	White Clover	313
Mangolds	304	Trefoil	294
Beet	52	Lucerne	78
Parsnips	24	Sainfoin	66
Onions	145	Crimson Clover	36
Carrots	44	Other leguminous herbage plants	6
Other vegetables	12	Grass and clover mixtures	5
Linseed	92		
Hemp	1		

The distribution of samples through the seed-testing year is shown in the diagram on p. 3. It will be noted that the greatest pressure of work at the Station was from the end of December until the middle of March, the maximum number of samples (528) being received during the week ending 22nd February. The period in which the fewest samples were received was from the middle of April until towards the end of July. The daily average of samples all through the season was 35.

That the seed trade have evinced considerable interest in the Station is shown by the fact that upwards of 70 representatives of the leading firms have visited it during the season.

A Preliminary Report on the quality of the seeds tested by 4th February last (2,400 samples) was published in the February number (Vol. 24, No. 11) of this *Journal*; it is now proposed to give a detailed review of the results obtained on the total number of samples tested during the season. It is of interest to note that the present account

Over the years the OSTS has taken many forms. In 1957 it expanded into new, custom-built, laboratories with four departments over three floors, and employed 88 analysts, still all women. The analysts of this time seemed to enjoy their work. There were social activities and, with the introduction of formal seed

analyst qualifications, opportunity for career progression. However, there were still societal restrictions that bled into life at OSTS. For example, women were not permitted to wear trousers to work and would need to request to return to work if they decided to marry.

The next couple of decades would bring improvements, but it took until 1973 for the first male seed analyst to be hired, which suggests generalisations about a 'woman's character' persisted. Greater change would come with the turn of the century. It took nearly 60 years before seed analyst positions were opened to men but it would take over 90 years for a woman to become Chief Officer, and it has been held by a woman since. First, in 2008, Jane Taylor then Linda Maile (58 years' service in OSTS including the final eight years as CO), to our current CO Helen Appleyard. Helen joined as a trainee seed analyst in 1988 and stayed in the role for 17 years before moving within analytical services at Niab to become a biochemical technician. She moved to seed pathology and a technical services manager before taking on the joint role of Chief Officer and Head of Niab Analytical Services in 2022. Despite seed analysis no longer being a female-only career path the team today is still 80% women.

So what is it about being a seed analyst that appeals to the women who work here today?

"There's never a dull moment in seed testing. There's lots of variety in the kind of tests and species we deal with."
Anna Phipps

"Seed analysis has brought me back to the agriculture sector which is where I always wanted to be."
Paula Castillo Marambio

"I've been a seed analyst for quite a few years now, it suits me, and it is supportive of my family commitments."
Ruvini Udugampola

"I really enjoy being a seed analyst. I have a background in horticulture and identifying seeds feels like an extension of the plant ID I did through my education."
Fern Champney

"Seed analysis may not be the most conventional career, but for those of us who have found our niche within it, it's a journey filled with purpose, teamwork, and continuous learning. It provides a sense of purpose knowing that our work makes a difference by ensuring quality in the seed trade, and when job satisfaction is often elusive this purpose is invaluable."
Nikita Acharya

Park Farm
Villa Road, Histon
Cambridge CB24 9NZ

T: 01223 342200
E: info@niab.com
www.niab.com

Agronomy Services

Mark Fletcher
Head of Agronomy Services
07561 684543

Andrew Watson (East)
07768 143730

Gary Rackham (East)
07936 963573

Patrick Stephenson (North)
07973 537427

Poppy de Pass (West)
07900 166784

Syed Shah (South)
07714 081662

Steve Cook (South)
07775 923025

Will Vaughan-France (South-west)
07794 177451

Keith Truett (South-east)
07818 522763

Aoife O'Driscoll
Crop Protection and IPM • **01223 342200**

Clare Leaman
Cereal Varieties • **01223 342341**

Colin Peters
Break Crops • **07745 775176**

Elizabeth Stockdale
Soil Health and Farming Systems
07957 966802

Joe Martlew
Soils and Weed Management
07743 905776

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Cover Crops, Soils and Cultivations
07974 391725

Ellie Roberts
Forage Crops including Maize
07734 567597

Bruce Napier
Vegetable Crops • **07885 586098**

Eric Ober
Crop Physiology and Rooting
07799 830341

Sarah Roberts
Potato Physiology and Agronomy

Greg Crawford
SFI and Farm Business Resilience Support
07453 965836

Membership Administration Office

membership@niab.com

Mary McPhee
Membership and Training Administration Manager • **01223 342495**

When contacting by email, please use **forename.surname@niab.com**

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