



LEADING IN CROP INNOVATION



Providing independent science-based research and information to support, develop and promote agriculture and horticulture; helping the industry to fulfil its potential in supplying food and renewable resources, while respecting the natural environment.

CONTENTS

Welcome to NIAB	3
NIAB today	4
Science at NIAB	8
Crop genetics	10
Computational biology	12
NIAB Innovation Farm	13
Crop protection	14
Crop agronomy (NIAB TAG, NIAB CUF and NIAB EMR)	16
NIAB TAG Membership	20
Field trials	22
Training and skills	24
Consultancy	26
Reducing food waste	28
Laboratory services	29
Plant characterisation	30
Seed certification	32
Crop Science Centre	34
International networks	35
Heritage	36
A future NIAB	38

WELCOME TO NIAB

Plant Science into Practice

The issues of food security, climate change and sustainable development present challenges and opportunities for agricultural research and innovation.

The NIAB Group is the UK's fastest growing crop science organisation, having trebled in size over the past decade through a strategic programme of investment, merger and acquisition. Founded in 1919, and with a longstanding international reputation for expertise in plant varieties and seeds, today NIAB's scientific capabilities span the crop improvement pipeline; from underpinning research required to develop higher yielding more climate resilient crops through to the extensive trials data, agronomy expertise and advice needed to ensure these advances are transferred effectively onto farm.

NIAB is at the forefront of the application of genetics, physiology, soil science, precision agronomy and data science to improve the yield, efficiency and resilience of crop production across the arable, forage and horticulture sectors. We are proud of our arable NIAB TAG Membership, our partnerships with our fruit industry consortia members, and our association with Cambridge University Potato Growers Research Association (CUPGRA). These close relationships keep our research relevant and our services up-to-date and offering good value for money.

The NIAB Group provides a degree of integration with the depth, scale and speed required for delivery into industry, combining world-class research and leading edge scientific services, delivered with the quality and efficiency that are essential to meet the growing expectations of customers across the public and private sector. The diversity of our funding sources means that we can be truly independent from government, industry and lobbying organisations. We will continue to adapt, putting our charitable objectives and our independence at the forefront of growing a strong, research-based enterprise.



Dr Tina Barsby OBE
CEO and Director



NIAB TODAY

NIAB is at the centre of innovation in crop science. Established in 1919 to assess the merits of varieties and seed quality, NIAB has grown in size, expanding its cropping and research expertise to the extent that it is now a major international research organisation in plant science, crop evaluation and agronomy.

With expertise in genetics and breeding, varieties and seeds and agronomy, NIAB works on a wide range of crops from cereals and oilseeds to potatoes, ornamentals, non-food crops and top and soft fruit. We produce new genetic diversity in pre-breeding material for arable crops, as well as plant breeding services for the fruit sector.

The need for innovation in plant breeding and agronomy has never been greater. With a growing global population, food security issues are a concern. Crop science and technology have a vital role to play in boosting productivity, conserving resources and coping with climate change.

NIAB is unique in being an independent science-based research organisation with a very large farmer and industry-based membership who help to ensure that research outcomes are transferred into practice.

Privatised in 1996 NIAB is a not-for-profit organisation with independent charitable status. We re-invest all of our profit into future research in crop science and production.

- **Crop genetic improvement**
- **Efficient agronomy**
- **Translational research**
- **Crop protection**
- **Data and informatics**
- **Commercial partnerships**
- **Membership base**

NIAB's scientific capabilities span the crop improvement pipeline, from the first cross through to the harvested crop. We have the specialist knowledge, skills and facilities required to support the improvement of agricultural and horticultural crops, to evaluate varietal performance and quality and ensure these advances are transferred effectively onto farm through efficient agronomy.

The acquisition of the University of Cambridge Potato Agronomy Unit (now NIAB CUF) in 2014 and East Malling Research (now NIAB EMR) in 2016 has broadened the range of crop expertise that now resides within the NIAB Group.



Crop genetics and plant breeding research
Variety evaluation and seed certification
Field crops research
Laboratory services
NIAB Ventures
Training and Skills



Arable variety and agronomy research
NIAB TAG Membership
Field trials



niab digital

NIAB
InnovationFarm
Plant genetics knowledge
transfer platform



Horticultural crop (top and soft fruit)
and environmental research



Group



Potato agronomy research



Science and technology information platform and events

NIAB is at the heart of an active science and technology-based community in Cambridge, with regional centres across the UK.

Cambridge

NIAB's headquarters is based at the Lawrence Weaver Road site in Cambridge, an innovative new campus based on NIAB's original Old Granary and John Bingham Laboratory site and opened in February 2020. The three buildings – Weaver, John Bingham and Crop Science – plus reception area and conference room, includes offices, state-of-the-art laboratories, growth room facilities and meeting rooms. The new development reflects NIAB's ambitions and aspirations across the regional, national and international agri-science and business communities. It is also base for the Crop Science Centre – a partnership with the University of Cambridge.

NIAB Park Farm includes The MacLeod Complex – our state-of-the-art glasshouses, outdoor ornamental growing facilities and variety and agronomy demonstration area – alongside The Sophi Taylor Building, our BREEAM award-winning conference centre opened in 2013 as part of the NIAB Innovation Farm initiative. Park Farm underwent redevelopment in 2018 and now features two new buildings with research laboratories and offices, crop and seed cold storage facilities, and analytical services laboratories.

The Cambridge farm and trials team, based at the nearby Whitehouse Lane Farm, manages 250 ha of commercial cropping and field trials both on-site (stretching across to Park Farm) and locally, including satellite sites at nearby Hinxton and Duxford.

The original Huntingdon Road headquarters, based around the original 1920s building, was sold for redevelopment in 2018 and remained home to NIAB until early February 2020.

Regional Centres

In addition to the headquarters in Cambridge there are ten regional arable field trial centres across the UK (Cambridge, East Malling, Morley, Sutton Scotney, Benniworth, Headley Hall, Kirton, Telford, Hereford, and Newton Abbot), numerous satellite trials sites and the Eastern AgriTech Innovation Hub, at Hasse Fen near Soham, in Cambridgeshire.

East Malling

As the UK's largest horticultural research and development organisation, NIAB EMR undertakes work in the perennial and clonally-propagated crops. It is an international leader in top fruit and soft fruit research and development.

Based on the 200 ha original site of the East Malling and Wye Fruit Experimental Station, near Maidstone in Kent, NIAB EMR includes offices, laboratories, conference, field and glasshouse facilities, alongside research, trials and commercial horticultural and arable land. The site is also used as a centre for our arable members with field trials and demonstrations.



SCIENCE AT NIAB

NIAB provides world-class research, information and advice to support the sustainable intensification of crop production through improved genetics, precision agronomy and knowledge-based decision support tools.

The unrelenting focus of NIAB's research is to deliver integrated, industry-facing solutions to improve the productivity, efficiency and sustainability of crop production.

NIAB has skills in molecular genetics, genomics, pest and disease biology and management, crop and post-harvest physiology, agronomy and environmental science. We use the knowledge of how genetics, environment and management interact to increase quality production and cope with a more variable and changing climate, in ways that are profitable for producers. NIAB also enhances the provision of other ecosystem services, increasing the efficiency of resources, resulting in less waste across the food system, and minimising greenhouse gas emissions.

NIAB's pre-breeding platform has accelerated genetic advances in wheat, including ground-breaking synthetic wheat research. It underpins and supplements the commercial plant breeding industry by providing a link to upstream genetic research. Crop protection research is focused on improving disease resistance, working closely with universities and institutes around the world.

All programmes work extensively with a network of scientific partnerships and collaborations with leading commercial and research organisations in the UK, Europe and globally.



CROP GENETICS

A global leader in genetics and plant breeding

A central objective of NIAB's research activity is to bridge the recognised gap between the basic understanding of plant genetics and the ability to apply that knowledge in practice.

NIAB has expertise in plant breeding and plant genetics, including a pre-breeding platform capable of delivering new sources of genetic innovation. Our aim is to increase crop production and improve resilience to abiotic and biotic stresses across the major arable crops – cereals, oilseed rape and pulses – as well as soft and top fruit.

NIAB provides a delivery mechanism allowing novel traits and associated marker technologies to flow from publicly-funded research through to exploitation in commercial breeding.

- Plant breeding
- Pre-breeding
- Crop physiology
- Trait genetics
- Transgenic crops
- Quantitative genetics
- Grain traits
- Disease resistance

Superwheat

NIAB's synthetic wheat programme recreates the original chance hybridisation from 10,000 years ago that led to the development of modern wheat (*Triticum aestivum*) by crossing durum wheat (*Triticum durum*) with wild goatgrass (*Aegilops tauschii*). The resulting 'superwheat' is delivering new high yielding, resilient genetic material that is now being used by researchers and commercial wheat breeding programmes across the world. New varieties with NIAB superwheat parentage will be available in the next few years.



Take-all resistance

NIAB is using crop transformation to introduce genes for take-all resistance into wheat. Take-all is the most damaging root disease of wheat worldwide with typical yield losses of 5-20%. There is no known resistance in wheat but there is in oats, which produce an antimicrobial triterpene glycoside (avenacin A-1) that provides protection against the disease. Oats are too far removed from wheat to allow the introduction of the genes for avenacin synthesis through conventional crossing, which makes genetic transformation the only viable option to introduce take-all resistance into future wheat breeding programmes.



Soft fruit

NIAB EMR began breeding strawberries in 1983 for commercial and amateur markets, and has since launched 50 varieties with sales exceeding 450 million plants. Today we work with industry consortia across the world to breed, develop and commercialise a range of soft fruit varieties, including the phenomenally successful strawberry 'Malling Centenary' with sales of 130 million+ plants, and the raspberries 'Malling Bella' and 'Malling Charm'. Using a combination of traditional techniques and genomics-assisted breeding NIAB EMR supports the efficient development of disease resistant, high quality varieties ensuring improved yield, fruit size and quality, lower fruit wastage, easier picking and season extension. For example, the Malling™ strawberry range is being extended to introduce progeny of the mid-season Malling Centenary to cover the need for similar fruit quality from late June and everbearing plants.



COMPUTATIONAL BIOLOGY

The integration of the latest advances in data science alongside expertise in plant breeding, agronomy and farming systems is key to unlocking a step-change improvement in UK crop production. NIAB's vision is to lead a new revolution in agri-data, not only in the increased application of bioinformatics for the analysis of sequence data, but also through the application of scientific computing and software development to offer innovative solutions and tools to the scientific community.

The implementation and deployment of novel computational methods for the analysis of crop data is one of the priority areas of development at NIAB. We are experts in the implementation of bioinformatics pipelines for gene annotation and variant analysis of vast datasets for large polyploid genomes such as the hexaploid bread wheat and the octaploid strawberry. The sources and diversity of data types will continue to increase as devices to generate and collect data become essential tools in life-sciences research.

Big data

NIAB is a partner in AgriMetrics – a centre for agricultural informatics and sustainability metrics, established under the Government's AgriTech Strategy. Its development will support innovation in agricultural research and its translation to improve the productivity, efficiency and sustainability of UK agri-food production systems. The integration of large datasets at this unprecedented scale will bring together resources from a diversity of areas including crop breeding, agronomy and farming systems. This will enable opportunities for the UK food sector to lead in and benefit from the new revolution in agricultural informatics.

NIAB InnovationFarm

Promoting the power of plant genetic innovation

NIAB Innovation Farm is a pioneering UK knowledge transfer platform, a unique physical showcase of agricultural and horticultural activity with particular focus on plant genetic improvement, delivered in partnership with academics and industries that utilise, develop or produce plant-derived or plant-based materials.

Its central objective is to show how plant resources and crop genetic improvement can help address the major global challenges of sustainable use of resources, climate change, food security and provision of high quality food to enhance health and nutrition.

NIAB Innovation Farm supports the translation of plant science discoveries into practical applications by linking the science base and industry. There are a range of options for businesses, research organisations and individuals to become involved including demo plots, industry events, conferences and stakeholder visits.

Anthocyanins

Anthocyanins are flavonoid plant compounds. They occur in plants as pigments (ranging from red to deep purple-black). They are also increasingly thought to be highly beneficial for human health, as they are antioxidants. As part of the EU and ERDF-funded BioBoost project NIAB Innovation Farm has demonstrated, in the field and glasshouse, a wide range of crops, including kalettes, soft fruit, carrots, radishes and peas, that contain high levels of antioxidants. BioBoost addresses the need for an environmentally friendly and resource efficient economy focusing on horticulture, using plant resources in a more sustainable, efficient and integrated manner.

www.innovationfarm.co.uk

CROP PROTECTION

With food security, climate change and pesticide reduction high on the agenda, protecting our crops with effective disease resistance has never been more important.

NIAB's plant pathology team deliver a wide range of research focused on the evaluation, improvement and deployment of disease resistance, working closely with universities and plant science institutes to develop novel ways to monitor and control disease.

Crop protection research programmes include:

- Diagnostics
- Disease resistance
- Pathogen populations
- Pest and disease management



For over 50 years NIAB, funded by APHA and AHDB Cereals and Oilseeds, has been monitoring the population of cereal rusts and mildew through the UK Cereal Pathogen Virulence Survey (UKCPVS), detecting and warning industry and growers of new races of pathogens emerging on resistant varieties.

Using DNA sequencing techniques, called field pathogenomics, is helping NIAB identify and characterise changes in plant pathogen populations and varietal resistance far quicker than using traditional field screening methods, in particular on yellow rust. This can help plant breeders tackle future disease challenges, screening out potential new varieties and breeding lines which may be susceptible to new races of pathogens before they get onto farm.



Spotted Wing Drosophila (SWD)

This fruit fly, which originated in Asia, was first recorded in the UK in 2012 by researchers at NIAB EMR. It is a challenging pest to control so NIAB EMR is working closely with the UK industry to manage this pest. Researchers are also investigating the behaviour of SWD and looking for new ways to monitor and control this pest in the UK.

Verticillium in oilseed rape

Verticillium longisporum is a serious, soil-borne pathogen, reducing yields in oilseed rape by up to 50%. There are currently no chemical control strategies and partial resistance has only been observed in a limited number of varieties. NIAB is developing strategies and tools to improve understanding and manage the Verticillium threat to oilseed rape yield including developing a test to detect Verticillium DNA in the soil. We are also investigating Verticillium pathogenicity and virulence and screening for genetic resistance to provide plant breeders with greater capabilities for selecting improved varieties.

CROP AGRONOMY

Transferring innovation in plant science into practical agriculture

NIAB has the specialist knowledge, skills and facilities required to support improved crop production; evaluating variety performance and quality in the field, conducting crop agronomy research and ensuring the benefits of new knowledge and genetic potential are transferred on to farm.

Working as NIAB TAG, NIAB CUF and NIAB EMR, our role includes:

- working with industry to develop key research areas
- conducting a wide range of independent field studies, trials and laboratory studies
- taking a leading role in knowledge transfer and exchange
- providing technical training
- supplying bespoke research.

As TAG Consulting we provide independent field advisory and business management consultancy services for individual farm businesses.

NIAB's crop agronomy services include technical or science-based investigations, field and laboratory screening programmes, large scale data collection, analysis and interpretation, technology transfer and communication of science.

Our research is funded from charitable, levy or government and industry sources, often in collaboration with partner organisations and institutions and by NIAB members. This research is conducted and reported either confidentially or with the facility to make this information more generally available.

- **Variety evaluation and management**
- **Crop protection and nutrition**
- **Farming systems**
- **Plant pathology**
- **Precision farming**
- **Soils and cultivation**



NIAB TAG champions the role of independent variety and agronomic research in cereals, oilseeds, pulses, grass and fodder crops, maize, sugar beet, field vegetables and non-food crops, working across the UK agriculture sector. It brings together field-based variety evaluation and crop husbandry research and expertise in interpretation and dissemination, with the specialist field and laboratory capabilities of NIAB's plant pathology team.

Cultivations and rotations

Long-term rotation studies are rare in our industry due to short-term commercial and financial pressures, but they can provide powerful agronomic and financial information for UK farmers. Part of NIAB TAG's charitably-funded strategic rotation research programme, the STAR (Sustainability Trial for Arable Rotations) project is a fully replicated field-scale study, based in Suffolk. It has been examining the interaction between four cultivation methods and four rotations since 2005 with findings demonstrating clear impacts of rotation and cultivation on agronomy and production. AHDB-funded research, using a set of long-term studies including STAR, examined the impact of adopting inversion tillage or non-inversion tillage approaches in cereal production systems and concluded that there was no strong reason not to use non-inversion tillage in preference to ploughing.

Overcoming black-grass resistance

The development of novel approaches for black-grass control is the primary focus of NIAB TAG's National Black-grass Research Centre near Cambridge, supported by its sister site at Wragby in Lincolnshire. Alongside research into traditional cultural and chemical techniques, research is also looking at more radical control methods including inter-row spraying, herbicide synergists and nano-technology.



Over the past 30 years, NIAB CUF has led the way in developing a greater understanding of the potato crop and its cultivation, working closely with the entire potato supply chain to improve production efficiency and sustainability in this important sector of the arable economy. An unrivalled source of agronomy research and expertise, NIAB CUF carries out essential work in key areas such as soil management, input use, varietal selection and new product development.

CUPGRA

CUPGRA is a charitable association of potato growers, agronomists, packers, processors and other stakeholders in the supply-chain who value independent, high-quality research. Close involvement with research by NIAB CUF, and its Agronomy Research Group, enables CUPGRA members to rapidly transfer new knowledge into practice for commercial advantage. Membership also provides the opportunity to discuss specific needs with NIAB CUF experts, either one-to-one or through member days, seminars, overseas study tours and the annual CUPGRA Conference.

Potato Crop Management

NIAB CUF offers a range of interactive, easy to access, online potato crop management and decision support services, for example potato supply prediction, crop value maximisation, crop performance budgeting, measurement and improvement and irrigation scheduling.

These forecasting systems allow potato growers to integrate and add value to data that are frequently measured in commercial crops, for example canopy size and bulking digs, by producing forecasts of yield development. This intelligence benefits both on-farm and supply chain profitability and is used by growers, agronomists and commercial organisations in the UK, mainland Europe and the USA.



With a focus on the horticultural production-to-supply chain, particularly in soft and top fruit, NIAB EMR tackles the challenges associated with climate change, food security, food chain quality and resource use efficiency, to optimise economic and environmental sustainability in crops. It also specialises in the ecology of pests and pathogens of perennial horticultural and clonal crops and the environmental and biotic factors which affect them.



Reducing water consumption

The NIAB EMR Water Efficient Technologies (WET) Centre showcases the latest developments in irrigation management and moisture sensing technologies in fruit crops on a commercial scale. Opened in July 2017 the Centre aims to reduce the amount of water needed to grow high quality, full flavoured, fruit while at the same time optimising the yield of the crop. It brings together applied research with new technologies in IT and data management with resulting reductions in water, fertiliser, pesticide and energy use and increases in yield.

Improving UK wine production

The UK is becoming increasingly recognised for its good quality wines. However, consistency and finest quality remain a challenge in our cool climate. The NIAB EMR research vineyard, the first of its kind in the UK and supported by the East Malling Viticulture Research Consortium, aims to ensure the best yield of the best quality grapes from UK vineyards and to increase sustainability through scientific research. Planted in 2015 the vineyard is for both scientific and demonstration purposes. It ensures NIAB EMR research is directly applicable to commercial vineyards and provides an essential tool to test upstream innovative practices and novel research ideas to the rapidly growing UK wine sector.

NIAB TAG MEMBERSHIP

**Large farmer and industry membership base
providing research and on-farm advice**

NIAB is an independent science-based organisation with strong links to primary agriculture and horticulture through its sector-specific in-house, and partner, membership programmes. Our plans are to grow the NIAB TAG Membership, building partnerships with others working in the arable space.

Our members are important to the success of the organisation, ensuring that our experimental programme is aligned with current and future challenges on farm. They not only guide the members' research programme, but ensure researchers are focused on real world-issues in the industry. This ensures that NIAB's research programme is industry focused, relevant and outcome-driven.

Members benefit from early access to information gathered through strategic NIAB research as well as the extensive member-funded programmes which deliver impartial, cost-effective agronomy strategies. We help members plan to cope with external pressures such as legislative changes and economic and environmental pressures.

Aimed at arable growers NIAB TAG Membership offers a service that translates the most recent science and the best practice into on-farm strategies to:

- boost yields and quality
- save money and improve margins
- build resilience into the farming system.

With a choice of membership packages NIAB TAG members gain priority access to NIAB's crop specialists and plant researchers. They sit at the heart of our industry and research networks and enjoy totally independent, science and business-driven advice.



Map, manage, store, share

NIAB Digital is an interactive farm software platform, with a range of services that give farmers and agronomists the ability to map, manage, store, share and compare farm, crop and research data.

It includes in-field agronomy alerts, AgroMet, agronomy decision support tools, satellite imagery, geo-spatial analytics and crowd-sourced pest and disease mapping information. Other products and services are continually being developed, including bespoke packages for business customers.

Launched in 2017 and available on the www.niabnetwork.com platform, these products and services, including ActivSmart (an agrochemical product comparison tool), Potato Crop Management and Farm, are sold separately on annual subscription or as part of a NIAB TAG Membership package.

niab  **digital**



Fungicide planning tool

NIAB TAG recommends a 'risk-based approach' to wheat fungicide programmes, identifying the most cost-effective strategies across seasons, whilst giving members options depending on their attitude to risk.

NIAB TAG's Wheat Fungicide Planning Tool is available online to members as an aid to planning fungicide inputs according to variety and seasonal disease pressure, allowing growers to plan near-optimal fungicide programmes.

FIELD TRIALS

The leading UK trials organisation with over 150,000 plots across 100 sites

The delivery of successful field trials is one of the most crucial elements of NIAB's operations. It is achieved by dedicated teams located at ten field trial centres in the major agricultural areas of England and Wales, combining experience with local knowledge to manage a wide range of crops.

Our field trials programme is large and complex, with over 150,000 plots incorporating a wide range of applications including:

- industry-funded trials including early plant breeding screens and disease assessment trials, evaluation of agrochemicals, including registration of new products and formulations, and field scale plots for commercial demonstration to farmers and other end-users;
- statutory VCU (Value for Cultivation and Use) field trials evaluating the performance of candidate varieties submitted for National List testing;
- variety performance trials for AHDB Recommended List and industry-supported Descriptive List trials;
- statutory control plots for the quality assurance of varietal purity of material entered for seed certification in England and Wales;
- field experiments as part of research work funded by levy bodies, government or agricultural charities;
- investigating and demonstrating agronomic and crop production issues identified by NIAB members;
- pre-breeding work investigating the traits that are likely to become increasingly important in the future;
- the development and assessment of new crops, for both food and non-food markets.

Major and minor combinable crops, including all cereals, pulses and oilseeds, are regularly grown and remain major capabilities at all NIAB's field trial centres. A range of root crop trials (including sugar beet, potatoes and stubble crops for livestock), livestock feeds (grasses, forage legumes, maize, wholecrop cereals and other forage crops) and vegetables/salad crops are also successfully grown and trialled by NIAB in major production areas. Top and soft fruit trials are carried out at NIAB EMR in Kent.

NIAB has the facilities and skills to carry out DUS and VCU tests on over 1,000 new varieties each year. The pedigree records of seed and seed crops are also maintained at NIAB; every year we drill over 3,000 plots representing every seed lot grown in the UK for seed production to check purity and germination.

Precision farming

NIAB is expanding the application of remote sensing in its crop research, trials delivery and commercial use on farm. Although the use of remotely sensed images for on-farm decision making is still in its infancy, NIAB is already using such images in its research programme, particularly as a means of assessing large experiments where data on tens of thousands of plots can be captured in a matter of minutes. For example NIAB first used drones to take plot plant counts in winter beans as a way of speeding up the process and improving accuracy, with the results ground-truthed by hand counts in the field to verify the technology and calibration.

TRAINING AND SKILLS

NIAB has a long established and successful reputation in delivering specialist training to plant breeders and researchers, farmers, advisors and agronomists, government and commercial customers. In the field, in the classroom and online, courses range from crop inspection methods to statistics in quantitative genetics and practical approaches to precision farming.

NIAB has trained many generations of crop inspectors and seed analysts from across the UK agricultural industry. Our training, including refresher courses, is based around the seed certification schemes. We train more than 300 crop inspectors each year, who go on to officially check the various levels of certified seed that are sold in the UK, with 550 field plots set-aside specifically for training purposes. Courses are also available on seed sampling, grain variety identification, seed analysis and seed certification administration.

Taking time out of the business to upskill and provide a professional training framework for staff can be a challenge. Managed by NIAB, ARTIS was developed in 2014 to deliver the technical skills needed by farmers, growers, agronomists and the supply chain to improve crop production in a flexible way. It gives participants access to the best science and knowledge, delivered by over 40 of the best independent experts in the field.

ARTIS delivers practical learning in a flexible way which is becoming increasingly popular across the industry; practical skills-based training which is business focused, accessible and value for money. Suitable for all agricultural and horticultural crops and run in the field, classroom and online, courses utilise existing CPD schemes, including BASIS and NRoSO, enabling industry to use the platform in staff development programmes.

www.artistraining.co.uk



Training a new generation of plant breeders

NIAB runs the only intensive training programme of its kind on the role and application of statistical and quantitative genetics in practical plant breeding programmes – 'Quantitative Genetics in Plant Breeding'. The two week intensive postgraduate-level training course is targeted at both existing and prospective plant breeders from across the world. It provides a statistical and genetic background to the wide spectrum of quantitative methods, traditional and new, relevant to plant breeding – from practical trial design and analysis through to the role of modern computer software in marker-assisted selection and association genetics.

Kellogg's Origins

Building good relationships with farmers and millers is vital for Kellogg's to achieve security of supply of ingredients that meet the right quality specification and minimise impact on the environment. As part of the Kellogg's Origins Programme, NIAB works with farmers, The Game and Wildlife Conservation Trust (GWCT), European Food and Farming Partnerships (EFFP) and Kellogg's to provide farmer suppliers with the tools and knowledge required to improve yields and profitability, while bringing environmental benefits at the field and farm level.

Impartial scientific and agronomic advice is delivered directly to farmers, with a particular emphasis on cover cropping. This includes technical workshops and individual farmer support, alongside bespoke ARTIS e-learning courses and a guide on growing cover crops and soil amendments. Working with NIAB has allowed the farmers involved to access leading independent agronomy experts in the field, and the right support tools to develop solutions for their own farming system.



CONSULTANCY

Helping industry fulfil its potential in supplying food and renewable resources

Businesses in the agricultural, horticultural and food industries are increasingly opting to out-source specialist technical services. These activities require constant investment in highly skilled, trained staff and specialist equipment or facilities that NIAB can supply.

The services are generally knowledge-based and delivered as bespoke packages, with no two projects ever being the same. This calls for a full understanding of our clients' needs as well as flexibility in the delivery and implementation of each project.

To continue to expand and grow, NIAB explores new business models within the agritech sector, as an alternative to our traditional research-based services. Interaction with small and medium-sized enterprises (SMEs) is an important element, with NIAB investigating the potential for NIAB-based SMEs and ways in which we can work with other SMEs in the marketplace, including taking equity.

NIAB runs a scheme called Meeting of Minds. This is a no-cost way for SMEs to meet with NIAB experts and consultants to discuss their business and their technology. Companies benefit in terms of immediate feedback and ideas and the meetings often lead to some form of commercial association, for example work under joint grant-funded projects or use of specialist equipment and facilities. It is also a valuable opportunity to understand the types and range of innovative technology under development.

NIAB is a founder member of Cambridge Agritech Ltd, an investment consortium seeking to invest in venture capital backed, innovative SMEs in the agricultural sector in the UK, Europe and US. Businesses are invited to pitch to members at quarterly meetings held at NIAB.

www.niab.com/ventures

REDUCING FOOD WASTE

The Eastern Agri-Tech Innovation Hub, near Soham in Cambridgeshire, is a unique facility for fresh produce/field vegetable farmers and growers, food businesses, and other users wishing to engage in applied research work to reduce all forms of waste in the food supply chain and improve resource use efficiency.

Research and trial activity includes:

- Waste reduction – healthy soils, crop production, field and post harvest storage
- Waste management – packing, processing and alternative uses and markets
- Increasing value or application potential for new products from waste streams
- Identifying opportunities to recycle waste or generate energy and co-products
- Targeting total and marketable field losses, due to weather, pests and diseases or other damage
- Reducing loss of quality or specification in store due to crop physiology, disease or storage conditions

Managed by NIAB, services include project management, business development, research and technical personnel with specific knowledge related to crop science, waste management and field trials. The Hub is also set up for technology transfer events and provides a centre for training and apprenticeships. Links are being forged with schools and colleges to support learning throughout the region and to develop the skills required for a thriving agri-industry.

LABORATORY SERVICES

NIAB provides commercial and statutory analytical services across a range of crops as part of NIAB LabTest and East Malling Services. These include potato virus testing, grain quality tests, variety identification, seed health, germination, plant disease identification and DNA fingerprinting.

This specialist expertise is closely integrated with all the functional areas of the NIAB organisation including collaboration with other organisations and industry partners to offer benefits to a large and varied customer base.

Quality and traceability

NIAB LabTest has a unique capability of scale, scope and staff experience in crop quality testing, covering cereals, herbage, sugar beet, oilseeds, vegetables and potatoes. These services are increasingly valued by breeders, processors and researchers seeking high throughput, cost-effective biochemical screening services to determine crop quality and variety characteristics.

Pathogen diagnostics

NIAB LabTest's pathogen diagnostics encompasses a wide range of research and technical applications, backed by extensive knowledge in the detection and control of crop diseases, including seed health testing, potato tuber health, soil testing for various pathogenic agents, and a wider plant-clinic service diagnosing problems in the growing crop.

Seed quality

NIAB's seed quality section covers both the function of the Official Seed Testing Station (OSTS) and commercial services to growers and their advisers. Accredited by the International Seed Testing Association (ISTA), the Official Seed Testing Station (OSTS) for England and Wales is based at NIAB Cambridge, and provides critical support to the statutory systems for Defra and the UK seeds industry. Using standardised and precise techniques and extensive specialist knowledge NIAB has unique expertise in seed sampling, biology and purity. The traditional skills first used by NIAB when it was established 100 years ago still form the basis of the work, enhanced by faster, modern analytical methods.

DNA fingerprinting

East Malling Services provides a comprehensive DNA fingerprinting service of rosaceous plant samples to establish accurate species and varietal identification and comparison. The service, using plant tissue samples obtained at the point of propagation, within the field or at the point of sale, is based on a unique fingerprinting toolkit, developed at NIAB EMR, which can be applied to individual needs.

PLANT CHARACTERISATION

Supporting the delivery of Plant Breeders' Rights legislation

NIAB's foundations are built on the provision of statutory services to the agricultural and ornamental sectors. This includes characterising and evaluating new crop varieties in Distinctness, Uniformity and Stability (DUS) tests. This is based upon unique and long-established plant phenotyping skills, datasets and biological resources developed by NIAB, backed up with appropriate facilities for data management, testing facilities, analytical services together with glasshouse and field trials across a wide range of agricultural and ornamental species.

NIAB's work provides the basis for protecting plant breeders' intellectual property or Plant Breeders' Rights. It allows variety registration and consumer protection through the National List system. In the UK these tests are administered by the UK Government's Animal and Plant Health Agency (APHA) for National Listing and UK Plant Breeders' Rights (PBR). On their behalf, NIAB carries out the DUS testing of wheat, barley, oats, winter oilseed rape, field beans, sugar beet and fodder kale.

We have the facilities and expertise to test over 1,000 new varieties each year. This involves growing and maintaining a diverse range of plant species, and recording many hundreds of thousands of characteristics in growing plants and seeds.

Using image analysis for phenotyping in variety assessment, the team can measure the precise dimensions of plant parts including petals, pods, leaves and cotyledons. It is also used in other areas of research, for example in identifying holes made by bruchid beetles in field beans and measurement of wheat embryos.

Ornamental plants

NIAB tests ornamental variety applications on behalf of the UK Plant Variety Rights Office, and equivalent bodies in other International Union for the Protection of New Varieties of Plants (UPOV) member states.

Particular specialities are: Chrysanthemums, Dahlias, outdoor container plants such as Diascia and Nemesia and many herbaceous plants such as Echinacea, Heuchera, Campanula, Salvia and Penstemon, and woody plants such as Clematis, Hebe and Ilex.

The Ornamentals team has access to a purpose-built micropropagation unit, maintaining a collection of 2,500 varieties of chrysanthemums, 2,500 square metres of high specification glass and 3,000 square metres of protected outdoor growing space.

SEED CERTIFICATION

Ensuring the quality of UK seed

In order to be marketed, European Union Directives require that seed of most agricultural species must be officially certified. Seed certification schemes protect farmers and their customers by guaranteeing that all certified seed meets prescribed standards for varietal identity and purity, germination and freedom from foreign material. NIAB operates a seed certification generation, management and tracking system, under contract to APHA, and underpinned by the Seed Marketing Regulations.

NIAB provides quality assurance and consumer protection, through a management and tracking system using documentary control and official monitoring of crops and seed lots. Impartiality and confidentiality for the companies involved is paramount. We maintain pedigree records for all seed lots and seed crops in England and Wales. A sample of each multiplication generation seed lot entered for certification is sown into plots at NIAB. The findings from these plots provide important information regarding the purity of seed lots and an insight into potential problems that may be present in current crops.

Around 275,000 tonnes of cereal seed and 34,000 tonnes of other seed are certified by NIAB during the year. NIAB's Agricultural Crop Characterisation team records over 3,300 certification plots, covering 38 species, and co-ordinate an annual programme of over 1,200 seed crop inspections.

NIAB provides training and assessment of licensed crop inspectors, seed analysts and seed samplers to maintain the viability and integrity of these vital schemes. Certification data is available as part of the NIAB TAG Membership scheme, and online as part of Seedstats and Seed Production information. We also offer a range of services to help with variety identity and purity, including laboratory analysis, botanical descriptions and interactive variety ID tools.



Extending our reach, profile and scale through strategic alliances

Food security is the defining agenda for our growing global population. Uncertainties associated with a changing climate and instabilities in markets for food and fuel will require significant advances in crop production to allow crops and soils to be sustainably exploited to meet these demands. For this to happen we need to bridge the gap between basic and applied crop science and bring together scientific, academic and commercial research centres and organisations to improve crop production.

The University of Cambridge and NIAB have taken one of the first steps in this process with the establishment of the Crop Science Centre; a coalition of expertise between NIAB, the University's Department of Plant Sciences (DPS) and Sainsbury Laboratory Cambridge University (SLCU). The centre will provide leadership in crop science, generating a dynamic research community whilst training a new generation of researchers in crop science.

The Crop Science Centre combines skills and develops expertise from all the organisations, including cutting-edge and fundamental plant science research underpinning yield enhancement, crop pre-breeding, and the translation of basic research into sustainable agriculture and extension services. This will involve bringing together a range of disciplines and departments from the University to work alongside NIAB's agronomic and breeding expertise, at the new research centre and laboratories, based at NIAB's Lawrence Weaver Road site in Cambridge.



INTERNATIONAL NETWORKS

Agricultural science is a global concern, dealing with such issues as climate change, food security, variety selection, international disease threats and nutrient use efficiency.

Collaboration of skills and expertise, translating fundamental research into agronomic practice, is core to addressing these challenges. NIAB is truly an international organisation, working in partnership with over 40 leading research organisations around the world, and with particular interests in India, China and Africa.

NIAB is involved in several Sustainable Crop Production Research for International Development (SCPRID) projects; harnessing bioscience to improve food security in developing countries.

Supporting nitrogen research in India

The Cambridge-India Network for Translational Research in Nitrogen (CINTRIN), is one of eight Virtual Joint Centres (VJC) supported by the Newton-Bhabha Fund, investigating ways to sustain or improve crop production. Led by NIAB and ICRISAT it includes partners from the University of Cambridge, ADAS, Punjab Agricultural University, NIPGR in New Delhi and the technology SME KisanHub, building on established research links.

CINTRIN aims to improve cereal crop nitrogen use in India, via genomics-led pre-breeding and variety selection. This will be translated onto farm through a range of extension services and outreach programmes with breeders, advisors and farmers. It includes developing online information and training tools to aid on-farm variety choice and agronomy.

HERITAGE

The National Institute of Agricultural Botany was founded in 1919, under the motto Better Seeds: Better Crops. The initiative of Sir Lawrence Weaver, the Commercial Secretary of the Board of Agriculture and Fisheries, its establishment followed a time when food shortages during the First World War highlighted the crucial role of quality seed and improved varieties in safeguarding food supplies.

Since then NIAB has played a key role in supporting the development of improved crop varieties and seeds, and transferring advances in plant science knowledge into practical agriculture. It remains true to its core objectives, while successfully innovating and adapting to meet changing technological, commercial and political demands.



1919

The National Institute of Agricultural Botany is established by Sir Lawrence Weaver under the motto 'Better Seeds: Better Crops'. The Institute is a response to the need for quality seed and improved varieties in safeguarding food supplies post-WW1.



The NIAB Crest sits above the original entrance to the 1921 NIAB Building on Huntingdon Road.

1920s

The National Institute of Agricultural Botany's Huntingdon Road HQ is opened in 1921, and the OSTS joins the Institute.

The first Fellows Scheme is launched and a regional trials network is established.



1930s

NIAB issues the first Farmers' Leaflets across a range of crops, precursor to the Recommended, Descriptive and National Lists today.

The Institute pioneers the use of randomised trial design in 1936 and releases authenticated stocks of proven state-bred varieties in 1939.



NIAB adopts the new 'randomised control trial' system in place of large scale, multi-site un-replicated trials which had been the mainstay of early variety testing.

1940s

NIAB launches the first winter wheat Recommended List in 1944, and introduces virus-tested potato seed into Northern Ireland in 1946.

A seed production committee is formed to supervise home-produced seed and Hill Farm, near Cambridge, becomes NIAB's seed production farm in 1947.



1950s

The 1-9 trait scoring system is used for the first time in the 1952 NIAB Recommended List.

The first Fellows Crop Conference is held in 1952, with a Cereal Field Approval Scheme introduced in 1956.

The first international seed analysts training course begins in 1954 and NIAB becomes the technical co-ordination centre for international seed certification schemes in 1958.

A new seed multiplication branch handles the increase in state-bred varieties and seed production for trials.

1960s

NIAB's Huntingdon Road Building extension opens in 1960, with the regional centre network expanding to 13 in 1961.

OSTS celebrates 50 years in 1967 with NIAB celebrating its golden anniversary in 1969.

The first vegetable advisory leaflet is issued in 1961.

In 1964 MAFF commissions NIAB for the first time to test varieties for distinctness, uniformity and stability (DUS) and conduct statutory performance trials.

1970s

DUS (distinctness, uniformity and stability) and VCU (value for cultivation and use) statutory variety testing is defined under a new NIAB: MAFF contract following UK accession to the European Community.

The PVRO (Plant Variety Rights Office) moves to NIAB's Huntingdon Road site.

NIAB's Hill Farm is sold and Park Farm at Histon is bought. The granary on Whitehouse Lane is redeveloped into new offices, laboratories and storage for the seed certification department in 1973.

1980s

VARETEST field and laboratory services are launched in 1983 alongside seed testing services via OSTS. Electrophoresis is used by NIAB for the first time in varietal ID in 1980 and by 1989 a new molecular biology laboratory opens which complements biochemical and image analysis technology.

NIAB opens the Library Building at Huntingdon Road in 1983 and becomes the single European Centre for PBR tests for ornamentals.



1990s

In 1996 the National Institute of Agricultural Botany formally moves into the private sector and officially changes its name to NIAB. The National Institute of Agricultural Botany Trust is created with responsibility for land and assets.

NIAB SeedStats service is launched in 1993.



2000s

Genetic research and pre-breeding capabilities are established at NIAB in 2005. NIAB extends its applied agronomy research and farm knowledge transfer and advisory services with the creation of NIAB TAG in 2009.

The MacLeod Complex research and plant breeding glasshouses open at Park Farm in 2009.



2010s

NIAB Innovation Farm is established in 2010 to showcase plant genetic innovation, with the Sophi Taylor conference centre opening its doors in 2013.

NIAB extends its potato research capabilities with the creation of NIAB CUF in 2014 and moves into the soft and top fruit sector with the integration of East Malling Research to form NIAB EMR in 2016. BCPC joins the NIAB Group in 2018.

A new alliance with the University of Cambridge forms the Crop Science Centre in 2015.

Park Farm redevelopment begins in 2017, followed by the Lawrence Weaver Road site in 2018. And it is the end of an era as the Huntingdon Road HQ is sold.

2019+

NIAB celebrates 100 years of plant science in 2019.

A new crop science campus and NIAB headquarters building is opened at Lawrence Weaver Road in 2020.



A FUTURE NIAB

NIAB's vision is to connect the science base and industry by providing an integrated research and knowledge transfer hub for the entire crop improvement pipeline, with a clear focus on improving the productivity, quality and resource use efficiency of crop production.

Leading the UK in crop innovation NIAB provides world-class research, information and advice to support crop production through improved genetics, precision agronomy and knowledge-based decision support tools.

NIAB has established points of differentiation from other research organisations:

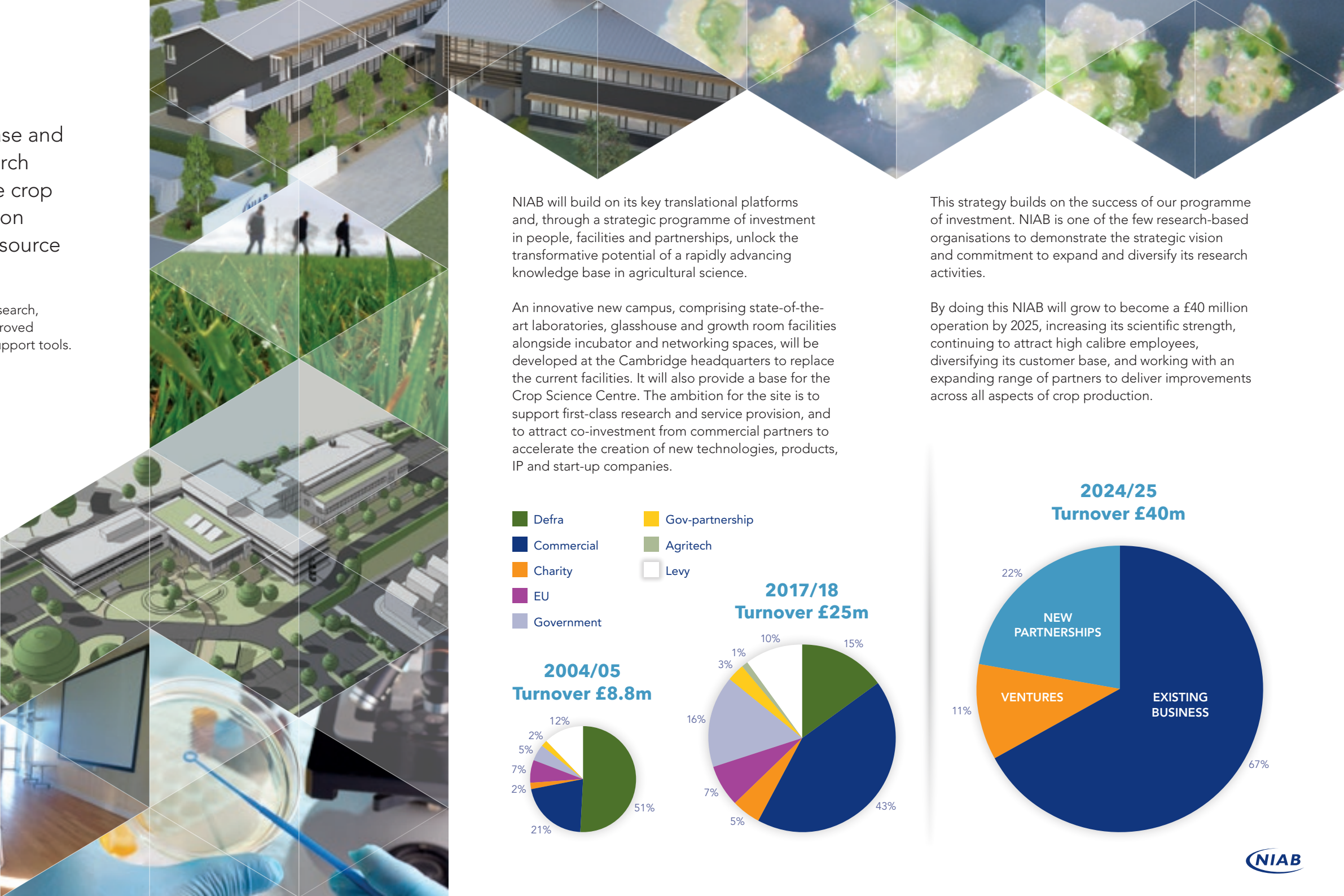
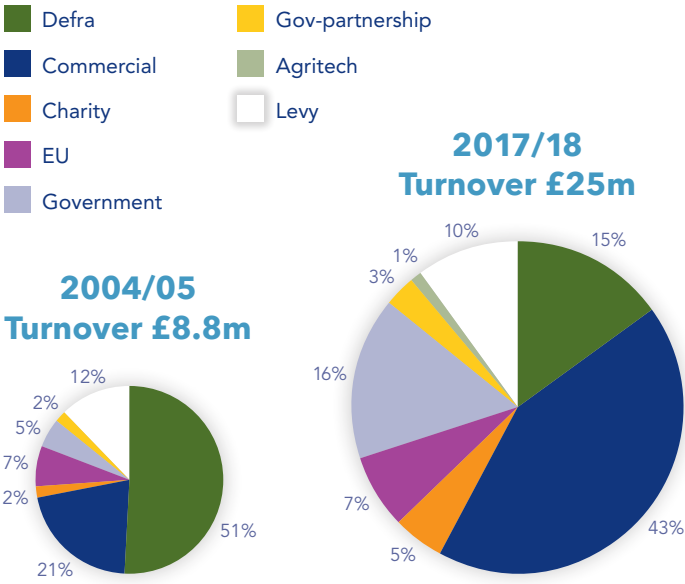
- breadth of translational research activity, from pre-breeding to applied agronomy
- productive partnerships with the science base and agri-food chain
- very significant farmer and industry membership base
- UK's largest independent trialling capability
- Cambridge location at the intersection for UK agri-tech
- unique, internationally recognised expertise.

NIAB will build on its key translational platforms and, through a strategic programme of investment in people, facilities and partnerships, unlock the transformative potential of a rapidly advancing knowledge base in agricultural science.

An innovative new campus, comprising state-of-the-art laboratories, glasshouse and growth room facilities alongside incubator and networking spaces, will be developed at the Cambridge headquarters to replace the current facilities. It will also provide a base for the Crop Science Centre. The ambition for the site is to support first-class research and service provision, and to attract co-investment from commercial partners to accelerate the creation of new technologies, products, IP and start-up companies.

This strategy builds on the success of our programme of investment. NIAB is one of the few research-based organisations to demonstrate the strategic vision and commitment to expand and diversify its research activities.

By doing this NIAB will grow to become a £40 million operation by 2025, increasing its scientific strength, continuing to attract high calibre employees, diversifying its customer base, and working with an expanding range of partners to deliver improvements across all aspects of crop production.





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