NIAB

1919-2019

100 YEARS OF PLANT SCIENCE





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 unreplicated 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.

Timeline continues on the inside back cover

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FOREWORD

What an amazing achievement – NIAB is 100 years old! And as part of our celebrations we have brought together this unique collection of photos and memories to represent the many aspects of the 'Institute' across the decades. They offer a brief insight into the past, present and future; snapshots of the people, crops, equipment and science that have been at the heart of what was originally the 'National Institute of Agricultural Botany'.

For 100 years, NIAB has worked proudly to improve agricultural and horticultural crop production, bringing together the specialist knowledge, skills and facilities required to understand the performance and quality of agricultural crop varieties and seeds.

In recent decades, these core skills have enabled NIAB to expand its R&D activities into new and complementary areas of crop-related innovation, with a focus on applied, translational and adaptive research. NIAB marks its centenary by occupying a unique space in the crop science landscape, spanning the entire crop improvement pipeline – from genetics and pre-breeding to applied agronomy, soil and environmental science, precision farming and knowledge transfer onto farm.

While there have been many changes over the years, NIAB today remains remarkably true to its original purpose, when it was established in 1919 under the motto '*Better Seeds: Better Crops*', highlighting the crucial role of quality seed and improved varieties in tackling food shortages in the wake of the First World War.

100 years on, food security is back on the agenda, and the world is again turning again to improved crop production – through better seeds, varieties and agronomy – to help global food supplies keep pace with a growing world population in the face of climate change and pressure on finite natural resources.

As the UK's leading independent crop research and knowledge transfer organisation with ambitious plans for continued and sustained growth in the years to come, NIAB is uniquely positioned to respond.

Dr Tina Barsby OBE
NIAB CEO and Director

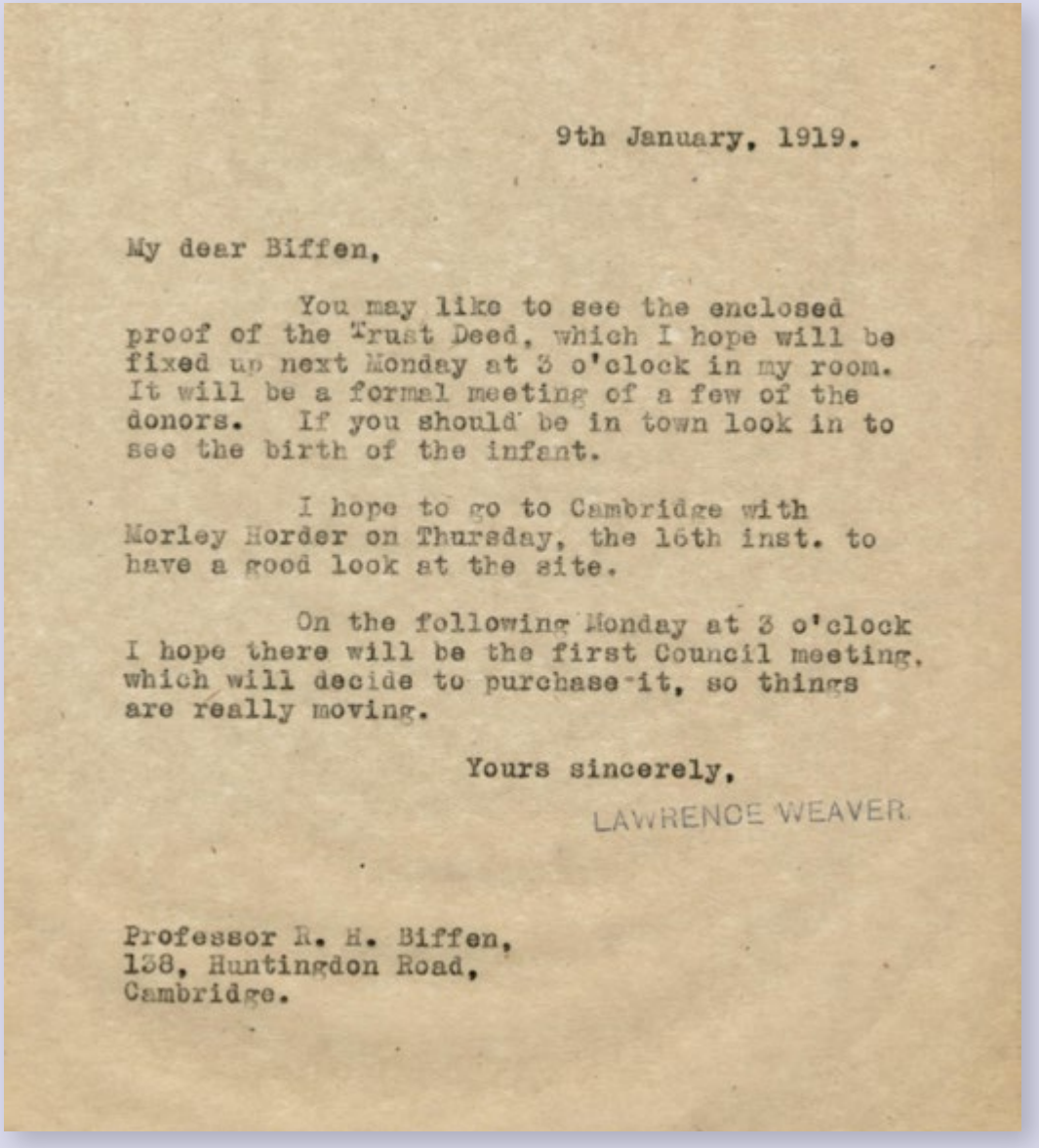
THE BIRTH OF THE INFANT

The National Institute of Agricultural Botany is one of Britain's oldest agricultural science research centres. It was founded in 1919, as a charitable trust, to promote the improvement of British crops.

In the food crisis of 1917/18 Sir Lawrence Weaver was appointed *Controller of Supplies* in the Food Production Department of the Board of Agriculture and Fisheries. Supplies of good quality cereal seed and seed potatoes were scarce and Weaver saw that an independent institute could undertake the multiplication for the cereal varieties being produced by the recently established Plant Breeding Institute (PBI) in Cambridge and the potato seed testing being carried out at Ormskirk in Lancashire.

Weaver had a vision for the Institute as an all-purpose scientific institution for agricultural botany, including "*the education of persons looking to improve agricultural crops…across the entire British Empire*". A charitable trust fund was quickly established, with large personal donations from businessman Sir Robert McAlpine, Viscount Elvedon of the Guinness family and landowner and farmer Frederick Hiam, as well as UK farmer's co-operative societies, fertiliser manufacturers, seed merchants, and millers.

Sir Lawrence Weaver in 1920



9th January, 1919.

My dear Biffen,

You may like to see the enclosed proof of the Trust Deed, which I hope will be fixed up next Monday at 3 o'clock in my room. It will be a formal meeting of a few of the donors. If you should be in town look in to see the birth of the infant.

I hope to go to Cambridge with Morley Horder on Thursday, the 16th inst. to have a good look at the site.

On the following Monday at 3 o'clock I hope there will be the first Council meeting, which will decide to purchase it, so things are really moving.

Yours sincerely,

LAWRENCE WEAVER.

Professor R. H. Biffen,
138, Huntingdon Road,
Cambridge.

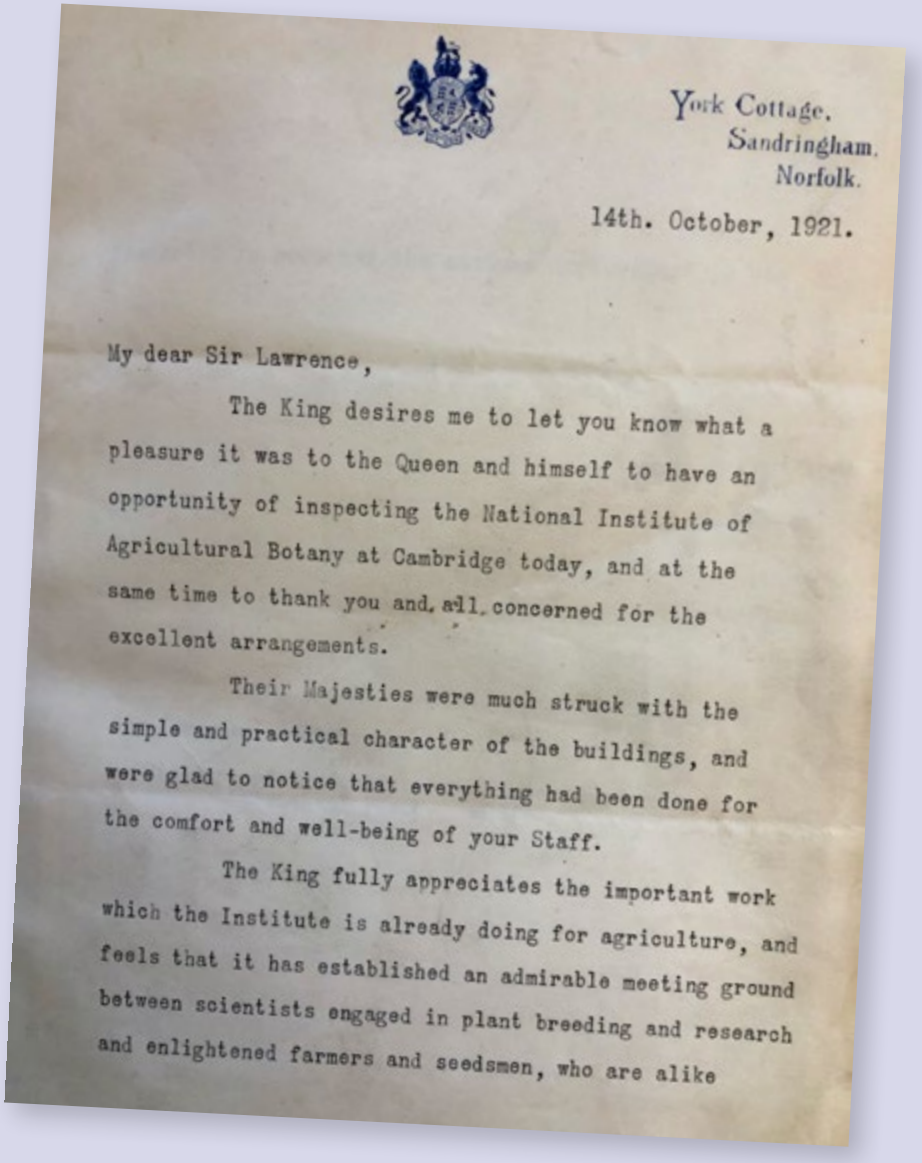
Sir Lawrence writes to Sir Rowland Biffen, head of the Plant Breeding Institute, celebrating NIAB's inauguration

The Trust Deed for the National Institute of Agricultural Botany, signed by Weaver, as Commercial Secretary of the Board of Agriculture and Fisheries, and two major benefactors, Sir Robert McAlpine and Viscount Elvedon, was adopted on 13 January 1919. The original aims within the Trust are as relevant today as they were 100 years ago:

- promote the improvement of existing varieties of seeds, plants and crops in the UK;
- promote the improvement of methods of husbandry for the benefits of agriculture and horticulture;
- encourage the discovery of, investigating, and making known the nature and merits of treatments, inventions, improvements and processes which may benefit the industry.

Weaver secured a treasury grant equivalent to the public funds raised. The money was used to buy the 36 acre Howes Place Farm on the outskirts of Cambridge in 1919, home to the new NIAB building and the main trials site.

In 1920, the first NIAB Director, Wilfred Parker, was appointed. He was a Cambridge graduate and previously a scientific assistant to Rowland Biffen at the PBI. He was regarded as a safe pair of hands but was, undoubtedly, overshadowed initially by the all-powerful personality of Weaver.



York Cottage,
Sandringham,
Norfolk.

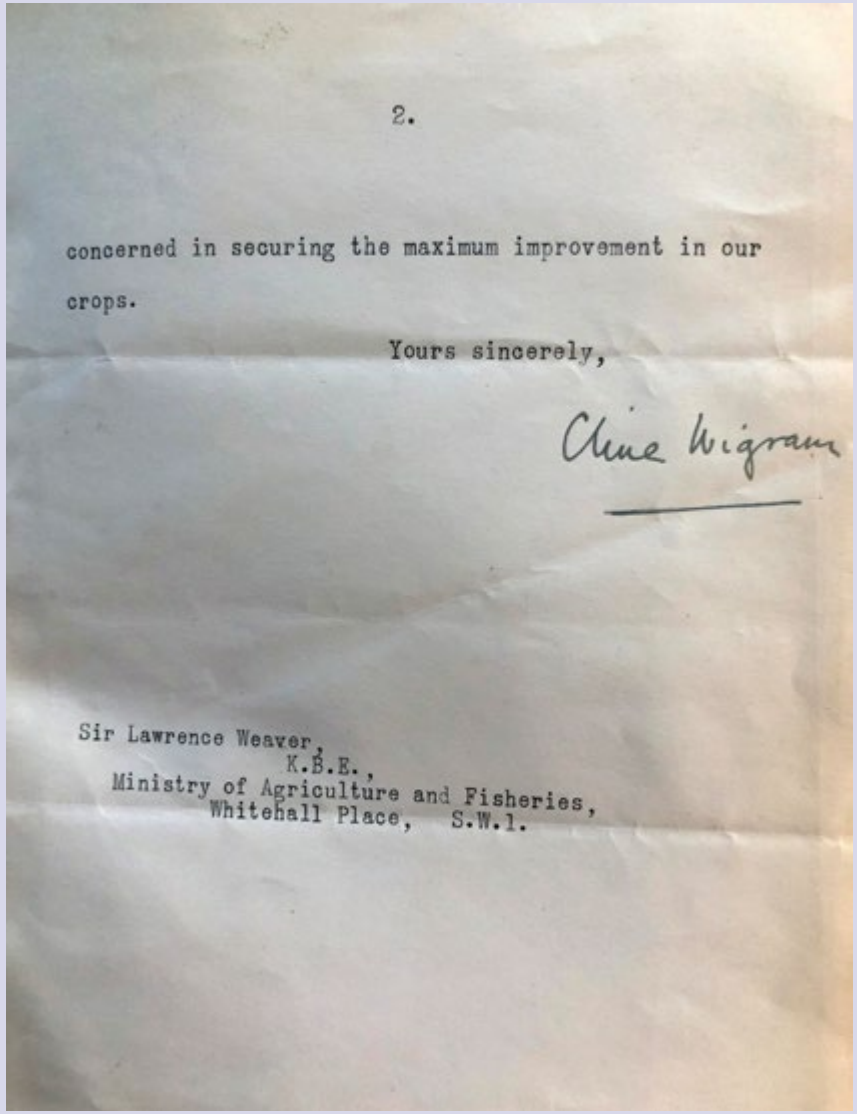
14th. October, 1921.

My dear Sir Lawrence,

The King desires me to let you know what a pleasure it was to the Queen and himself to have an opportunity of inspecting the National Institute of Agricultural Botany at Cambridge today, and at the same time to thank you and all concerned for the excellent arrangements.

Their Majesties were much struck with the simple and practical character of the buildings, and were glad to notice that everything had been done for the comfort and well-being of your Staff.

The King fully appreciates the important work which the Institute is already doing for agriculture, and feels that it has established an admirable meeting ground between scientists engaged in plant breeding and research and enlightened farmers and seedsmen, who are alike



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concerned in securing the maximum improvement in our crops.

Yours sincerely,

Clive Wigram

Sir Lawrence Weaver,
K.B.E.,
Ministry of Agriculture and Fisheries,
Whitehall Place, S.W.1.

His Majesty King George V's private secretary writes to Sir Lawrence thanking him for the opportunity to tour the new building

WAH Parker, the Institute's first Director

Without the great efforts, vision and determination of Sir Lawrence Weaver it is certain that the National Institute of Agricultural Botany would never have come into existence

Right: Prime Minister David Lloyd George congratulates Lawrence Weaver on NIAB's serious and useful work, and becomes one of the first Honorary Fellows of the Institute

3rd, November, 1921.

Dear Sir Lawrence,

I have been following with great interest the rapid progress of the National Institute of Agricultural Botany, and congratulate you and your colleagues on the serious and useful work the Institute is already doing for the farming community. You are wise to broaden the basis of your organisation by creating a Fellowship of the Institute, which will enable everyone concerned with the improvement of seeds to help forward the good work.

I gladly show my appreciation of what you are doing by asking to be enrolled as one of the first Life Fellows of the Institute.

With all good wishes for its continued progress both in successful work and in wide support from everyone interested in agriculture.

Believe me,

Yours sincerely,

Sir Lawrence Weaver, K.B.E.

D. Lloyd George

OPEN FOR BUSINESS

By the summer of 1921 the National Institute of Agricultural Botany's headquarters were nearing completion in Cambridge. But why Cambridge? Almost certainly because of the close links with Biffen at the Plant Breeding Institute and the Cambridge University Farm, across the road from the new Institute. Significant land and funds had also been donated to NIAB by local Cambridge farmers, notably Frederick Hiam, and seed merchants.

The new National Institute of Agricultural Botany building on Huntingdon Road in Cambridge opened in 1921

The 36 acre National Institute of Agricultural Botany site was located on the outskirts of Cambridge, surrounded by open countryside

The original entrance to NIAB with the NIAB Crest over the door

The new building on Huntingdon Road was completed in October 1921, and officially opened on 14 October by HM King George V and Queen Mary

Initially, NIAB was primarily a seed multiplier, modelled after the famous Swedish Plant Breeding Institute Svalöf station. Not all of the Institute's early supporters agreed with this strategy. In fact, many of those involved in NIAB's founding did not truly understand what kind of organisation they were pledging their support to. Far from being detrimental to the Institute's success, this ambiguity proved to be a positive factor. Weaver used the various, and often conflicting, interests of a number of groups to pool funding and resources for NIAB, and left open the range of possible institutional incarnations that did actually unfold.

OSTS AND LABORATORY SERVICES

The urgent need for increased home food production between 1914 and 1918 stimulated a move to control seed supply by legislation requiring seed to be tested for purity and germination before use. One of the first actions of the newly formed Food Production Department, created during the First World War, was to establish a seed testing station and pass the 1917 Testing of Seeds Order.

The new Official Seed Testing Station first opened in London in 1917, before moving to NIAB in Cambridge in 1921, taking up much of the new building. Its primary function was to monitor the quality of seed in commerce, as required by the follow-up 1920 Seeds Act, particularly in respect of its germination and purity.

From the early days of seed testing, the importance of following the same procedures and rules was quickly recognised, so results from different laboratories could be readily understood and compared. The OSTS was heavily involved in the formation of the International Seed Testing Association (ISTA) in 1924.

The primary function of ISTA was to produce and publish a single set of seed testing rules which could be followed by all countries testing and trading in seed. ISTA now has member laboratories in over 70 countries world-wide and is a truly global network.

Accredited by ISTA, the OSTS for England and Wales is still based at NIAB Cambridge, and provides critical support to the statutory systems for Defra and the UK seeds industry. In 100 years little has changed in some of the techniques and protocols used in seed purity analysis; OSTS currently tests around 6,000 samples every year.

ISTA is formed in 1924

At its peak there were 80+ OSTS seed analysts and support staff at NIAB, testing over 80,000 samples each year

"The most essential piece of equipment is always a well-trained seed analyst, able to identify, by sight, over 200 species of crop and weed seeds to allow purity and other plant species examinations."

Dr Steve Jones, OSTS Chief Officer, 1997-2008

Aids have been incorporated into purity testing such as Optical Inspection Systems, Copenhagen Tanks have made way for more efficient incubators and there has been a move to using paper media instead of sand and soil

Jack Norfolk assessing the malting quality of barley varieties using the specific gravity method

In the 1970s, under the new statutory schemes, processing quality and nutritional value played an important part in assessing the suitability of varieties to meet marketing standards. There was a development of new tests to satisfy the changing requirements for official approval and improving efficiency for processors and consumers.

During the 1980s NIAB carried out three research programmes in crop identification and analysis: electrophoresis, near infrared spectroscopy (NIRS) and machine vision systems. The techniques developed by researchers at NIAB during the 1980s remain part of crop classification guidelines issued by international bodies today. Testing based on these techniques (VARTEST) field and laboratory services were launched in 1983 alongside seed testing services by the OSTS at NIAB.

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

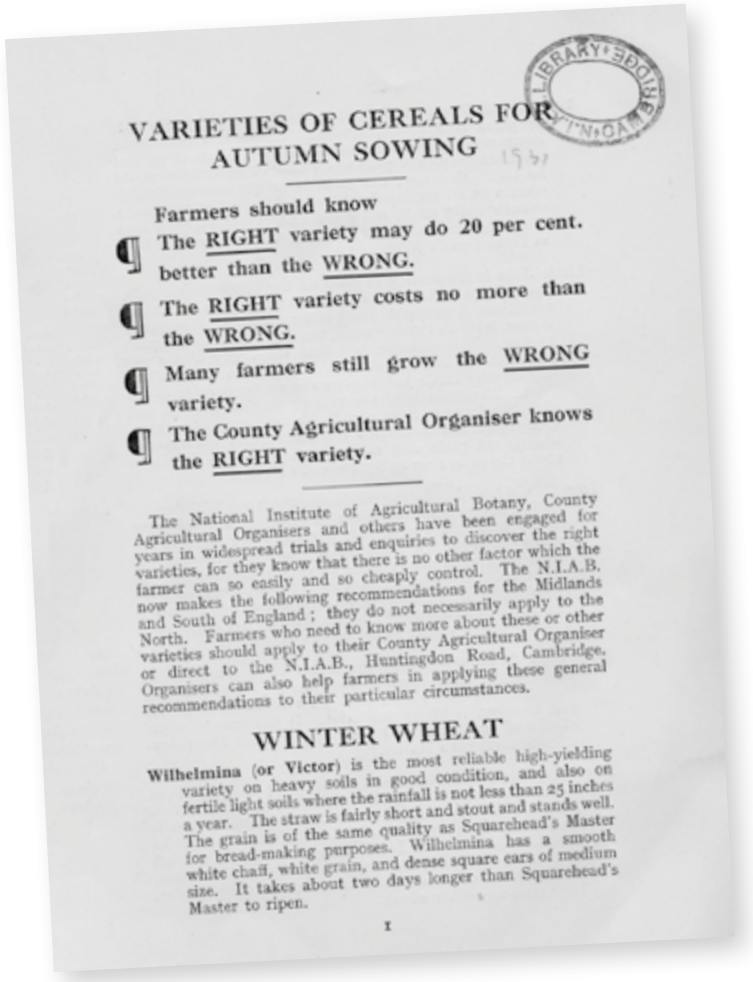
The analytical services team, including OSTS, in 2016

CROPS AND VARIETIES

An exhibit of potato varieties ready for inspection by HM King George V in 1921

From its earliest beginnings, NIAB concentrated on combinable crops and potatoes. In 1921, NIAB Director Wilfred Parker published a paper on the testing and naming of crop varieties, with proposals for a register, with descriptions indicating their merits and defects in trials and their value for farmers. He established NIAB's Crop Improvement Branch, and created a comprehensive system of performance trials, at permanent centres, to compare existing and new varieties and recommend the best to farmers.

In 1930 NIAB issued the first two Farmers' Leaflets for autumn and spring sown cereals. Similar leaflets followed in 1931 for varieties of potato, sugar beet and lucerne, with mangolds and swede varieties in 1932. They achieved a distribution of up to 60,000 copies a year.



VARIETIES OF CEREALS FOR AUTUMN SOWING

Farmers should know

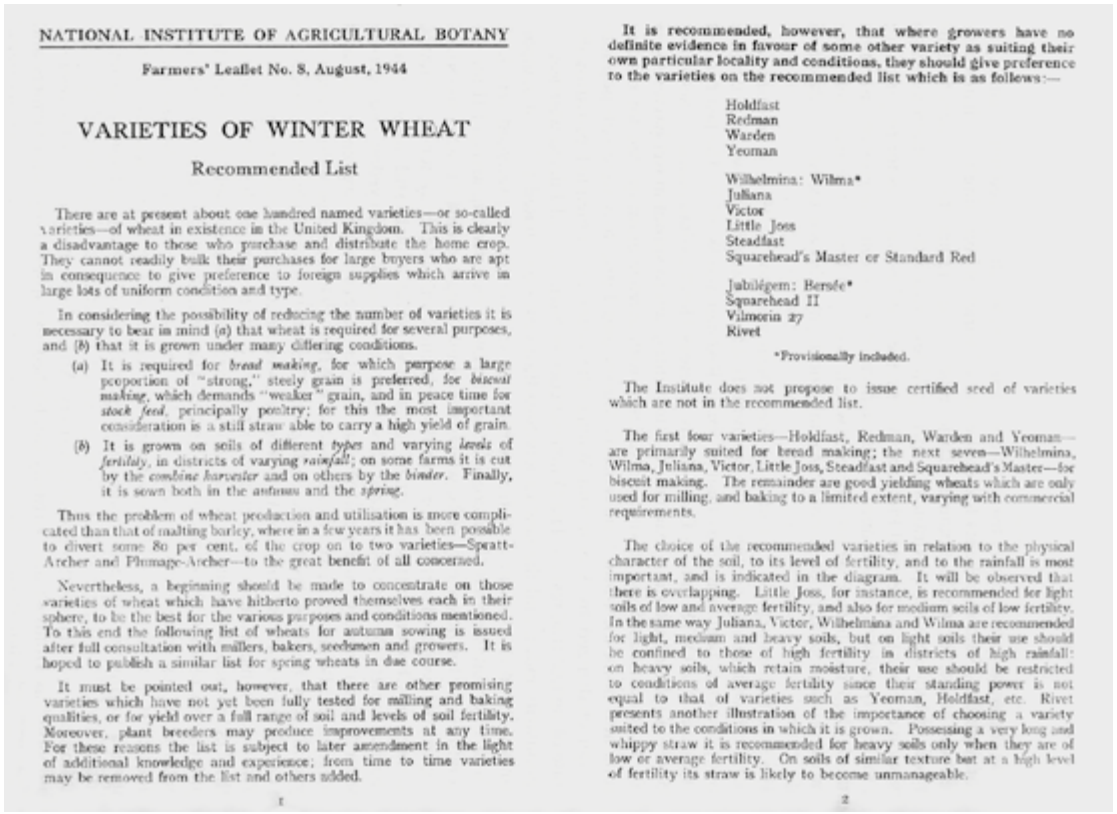
- **The RIGHT variety may do 20 per cent. better than the WRONG.**
- **The RIGHT variety costs no more than the WRONG.**
- **Many farmers still grow the WRONG variety.**
- **The County Agricultural Organiser knows the RIGHT variety.**

The National Institute of Agricultural Botany, County Agricultural Organisers and others have been engaged for years in widespread trials and enquiries to discover the right varieties, for they know that there is no other factor which the farmer can so easily and so cheaply control. The N.I.A.B. now makes the following recommendations for the Midlands and South of England; they do not necessarily apply to the North. Farmers who need to know more about these or other varieties should apply to their County Agricultural Organiser or direct to the N.I.A.B., Huntingdon Road, Cambridge. Organisers can also help farmers in applying these general recommendations to their particular circumstances.

WINTER WHEAT

Wilhelmina (or Victor) is the most reliable high-yielding variety on heavy soils in good condition, and also on fertile light soils where the rainfall is not less than 25 inches a year. The straw is fairly short and stout and stands well. The grain is of the same quality as Squarehead's Master for bread-making purposes. Wilhelmina has a smooth white chaff, white grain, and dense square ears of medium size. It takes about two days longer than Squarehead's Master to ripen.

1



NATIONAL INSTITUTE OF AGRICULTURAL BOTANY

Farmers' Leaflet No. 8, August, 1944

VARIETIES OF WINTER WHEAT

Recommended List

There are at present about one hundred named varieties—or so-called varieties—of wheat in existence in the United Kingdom. This is clearly a disadvantage to those who purchase and distribute the home crop. They cannot readily bulk their purchases for large buyers who are apt in consequence to give preference to foreign supplies which arrive in large lots of uniform condition and type.

In considering the possibility of reducing the number of varieties it is necessary to bear in mind (*a*) that wheat is required for several purposes, and (*b*) that it is grown under many differing conditions.

(*a*) It is required for *bread making*, for which purpose a large proportion of "strong," steely grain is preferred, for *biscuit making*, which demands "weaker" grain, and in peace time for *stock feed*, principally poultry; for this the most important consideration is a stiff straw able to carry a high yield of grain.

(*b*) It is grown on soils of different *types* and varying *levels* of *fertility*, in districts of varying *rainfall*; on some farms it is cut by the *combine harvester* and on others by the *binder*. Finally, it is sown both in the autumn and the *spring*.

Thus the problem of wheat production and utilisation is more complicated than that of malting barley, where in a few years it has been possible to divert some 80 per cent. of the crop on to two varieties—Spratt-Archer and Plumage-Archer—to the great benefit of all concerned.

Nevertheless, a beginning should be made to concentrate on those varieties of wheat which have hitherto proved themselves each in their sphere, to be the best for the various purposes and conditions mentioned. To this end the following list of wheats for autumn sowing is issued after full consultation with millers, bakers, seedsmen and growers. It is hoped to publish a similar list for spring wheats in due course.

It must be pointed out, however, that there are other promising varieties which have not yet been fully tested for milling and baking qualities, or for yield over a full range of soil and levels of soil fertility. Moreover, plant breeders may produce improvements at any time. For these reasons the list is subject to later amendment in the light of additional knowledge and experience; from time to time varieties may be removed from the list and others added.

1

It is recommended, however, that where growers have no definite evidence in favour of some other variety as suiting their own particular locality and conditions, they should give preference to the varieties on the recommended list which is as follows:—

Holdfast
Redman
Warden
Yeoman

Wilhelmina: Wilma*
Juliana
Victor
Little Joss
Steadfast
Squarehead's Master or Standard Red

Jubilégem: Bersée*
Squarehead II
Vilmorin 27
Rivet

*Provisionally included.

The Institute does not propose to issue certified seed of varieties which are not in the recommended list.

The first four varieties—Holdfast, Redman, Warden and Yeoman—are primarily suited for bread making; the next seven—Wilhelmina, Wilma, Juliana, Victor, Little Joss, Steadfast and Squarehead's Master—for biscuit making. The remainder are good yielding wheats which are only used for milling, and baking to a limited extent, varying with commercial requirements.

The choice of the recommended varieties in relation to the physical character of the soil, to its level of fertility, and to the rainfall is most important, and is indicated in the diagram. It will be observed that there is overlapping. Little Joss, for instance, is recommended for light soils of low and average fertility, and also for medium soils of low fertility. In the same way Juliana, Victor, Wilhelmina and Wilma are recommended for light, medium and heavy soils, but on light soils their use should be confined to those of high fertility in districts of high rainfall: on heavy soils, which retain moisture, their use should be restricted to conditions of average fertility since their standing power is not equal to that of varieties such as Yeoman, Holdfast, etc. Rivet presents another illustration of the importance of choosing a variety suited to the conditions in which it is grown. Possessing a very long and whippy straw it is recommended for heavy soils only when they are of low or average fertility. On soils of similar texture but at a high level of fertility its straw is likely to become unmanageable.

2

NIAB issued the first Recommended List for winter wheat in 1944. It had four milling varieties (Holdfast, Redman, Warden and Yeoman), seven biscuit varieties (Wilhelmina, Wilma, Juliana, Victor, Little Joss, Steadfast and Squarehead's Master) and five others (Jubilegem, Bersee, Squarehead II, Vilmorin 27 and Rivet). This was in stark contrast to the situation with malting barley where 80% of the UK crop was sown to only two varieties – Spratt-Archer and Plumage-Archer.

In 1944 there were still over 100 wheat 'varieties' being sold in the UK, many of them the same variety. Parker had singled out the problem of synonyms in one of his first publications as Director of NIAB. He proposed a scheme in which any purportedly new variety would have to be submitted to NIAB, and its synonym committee, before it could even be given a name. After NIAB had certified the variety to be distinct, the producer could go on to name it and enter it into NIAB's trials. For example Carters Red Wheat was a synonym of Squareheads Master. To avoid the synonym committee the name was changed to 1933 Red Stand-up Wheat.

"No breeder worth his salt would allow the judgement of another man (scientific or otherwise) to decide whether or not he had produced a distinct variety"

Edwin Beaven

Many breeders resisted this proposal. Edwin Beaven, a malting barley breeder and Chairman of the NIAB Council, argued that *"no breeder worth his salt would allow the judgement of another man (scientific or otherwise) to decide whether or not he had produced a distinct variety"*. On occasions the breeder would be invited to NIAB and asked to pick out his own variety from a series of plots of other varieties, with the inevitable consequences.

Over the years, NIAB's crucial role in variety evaluation has improved the performance information available to farmers. It also supported the early development of the plant breeding industry and the associated regulatory frameworks for variety registration. NIAB's production of the UK Recommended and Descriptive Lists, expanded across combinable, forage and vegetable crops. However, over the past few decades many of the RL and NLs have been transferred to the relevant levy board or The British Society of Plant Breeders (BSPB). NIAB remains the major UK contractor for the cereals and oilseeds Recommended and National List trials, as well as providing the secretariat for sugar beet, herbage and forage maize.

Right: The Cereals Department team in the 1980s with a few familiar faces, and members of the Crops and Agronomy division in 2015


1982
SOWN

FIELD TRIALS AND REGIONAL CENTRES

NIAB's trialling programme began in the 1920s, with a network of long, side-by-side, paired strips of variety performance trials at regional centres across England – thought to be the best way to demonstrate differences.

Large unreplicated field plots formed the basis of trialling, split into blocks by placing a plank of wood in the centre of the drill to split it into two

Harvesting 'half-drill strip' wheat trials in 1923 at Cambridge

Across the 1920s and 30s the concept of randomised design trialling created great debate throughout the early research community, including some resistance from NIAB's own Director Wilfred Parker. Statistician and geneticist Ronald Fisher of Rothamsted Experimental Station, promoted the new plot design. Frank Engledow and Udney Yule, statisticians at Cambridge University, held a different view, stating that "*sowing randomised plots would call for constant reshuffling of the seed packets*" and that "*there is a great risk of mistakes of the 'damn fool' order*".

Despite this, in the 1930s NIAB was one of the first organisations to introduce the new plot design in place of large scale, unreplicated trials which had been the mainstay of early variety testing. The use of randomised trialling methods was widely contested from their inception – "*A farmer looking for evidence of varietal adaptability to his region would rarely have the opportunity (or inclination) to invest time and resources in an experiment arranged so poorly (i.e. randomised), regardless of the statistical reliability of its results*".

Right: Plot harvesting in the late 1940s/early 1950s with Huntingdon Road in the background

"A farmer looking for evidence of varietal adaptability to his region would rarely have the opportunity (or inclination) to invest time and resources in an experiment arranged so poorly (i.e. randomised), regardless of the statistical reliability of its results."

Wilfred Parker, NIAB Director, 1930

By 1935 NIAB had seven regional trials centres in England and Wales, including Cambridge and Ormskirk, run under the Crop Improvement Branch. NIAB's first regional station, the Ormskirk Potato Station, taken over by NIAB in 1920, finally closed in 1940 when its superintendent Harold Bryan died. Advances in laboratory testing for potato wart disease had superseded the field trials and the Lancashire site was considered unnecessary. NIAB moved into potato variety trialling and virus-free seed multiplication, eventually opening a Potato Branch in 1952. NIAB's potato research capabilities were further expanded in 2014 when the potato research team from the University of Cambridge joined NIAB to form NIAB CUF.

"The adoption of random distribution (of plots) on a field scale is ruled out by the absence of suitable implements, by the greater technical skill required in handling and by the great increase in statistical work which they entail. No amount of statistical analysis can compensate for errors in the field or discover those practical points of difference measurable by eye alone."

Wilfred Parker, NIAB Director, 1930

Today, NIAB is the leading UK agricultural trials organisation with over 150,000 plots across 100 sites. It covers more than 50 different crop species, across all major and minor combinable crops, root crops, livestock feeds, vegetable and salad crops, and top and soft fruit.

NIAB trial centres, 1935

- ■ Permanent Sub-stations
- ● County Winter Oat Trials
- ● Additional Trials

1. Cambridge
2. Ormskirk Potato Station
3. Askham Bryan (replaced Good Easter 1934)
4. Newport
5. Cannington (replaced Seale Hayne 1929)
6. Long Sutton
7. Sprowston

NIAB trial centres, 2019

NIAB TAG TRIAL SITES

MAIN REGIONAL CENTRES

1. Headley Hall
2. Benniworth
3. Kirton
4. Telford
5. Hereford
6. Morley
7. Cambridge
8. East Malling
9. Sutton Scotney
10. Newton Abbot

Trials range from plant breeding screens to disease assessments, evaluations of new agrochemicals to agronomy and crop production studies. Also included are pathology trials, assessments of potential new crops and statutory varietal purity and multiplication tests, right through to the traditional variety trialling that NIAB built its reputation on. Customers are in-house and external, with industry-funded trials on behalf of manufacturers and plant breeders, statutory trials on behalf of Animal and Plant Health Agency (APHA) and BSPB, Recommended and National List trials, pre-breeding work including yield and multiplication plots, variety screens for plant breeders and field experiments on behalf of our members, government, levy bodies and agricultural charities.

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.

In 1925 the NIAB regional trials officers (then known as crop recorders) came to Cambridge for the first of what was to become an annual conference at one or other of the trial centres. Nearly 100 years later the NIAB trials teams now gather together several times a year: an opportunity to exchange information and ideas and learn more about the science behind the trials they are responsible for.

They may be on a smaller scale, but the evolving design, technology and mechanics of field plot machinery has kept up with, if not moved beyond, that of their larger field cousins over the past 100 years. Originally trials officers adapted field machinery to cope with the small field plots. As the crop research and plant breeding sector expanded the market for specialist plot combines, drills, sprayers and other machinery developed.

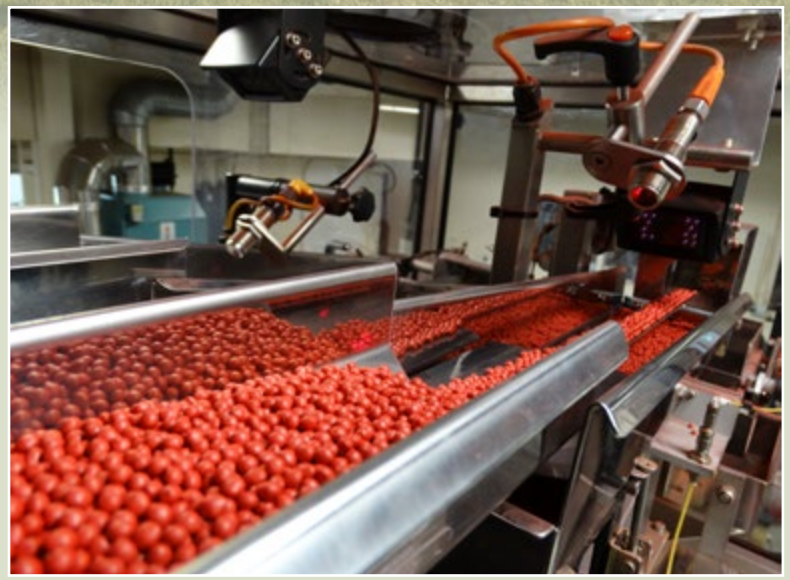
Top left: RTO conference at Seale-Hayne in 1952

Left: NIAB Trials Delivery Team in 2018


NIAB
HALDRUP 1500

In 2019, plot combines are a vital resource that have been adapted to ensure fast and efficient harvest. NIAB has 17 combines across its 10 regional centres, a mix of Sampo 2010s, the industry standard, and Haldrups for more specialist work. The combines average 40 plots/hour with a 2 m cut and 40 m of cutting capacity. The newest member of the fleet, the Haldrup C-85, has a NIR spectrometer and can harvest up to 100 plots/hour, analysing grain weight, moisture, hectolitre weight, sample weight, and straw weight.

NIAB's bespoke seed handling unit (SHU) at Cambridge is responsible for receiving, sampling, treating, packeting and dispatching seed across 40 different crops for national and international trials, including the AHDB Cereals and Oilseeds Recommended Lists. This equates to an annual 120,000 packets, each fully traceable with unique identification numbers, issued to internal and external customers



SHU packing sugar beet seed 2018

SEED CERTIFICATION AND CHARACTERISATION

NIAB's foundations are built on the provision of statutory services to the agricultural and ornamental sectors. The Institute has developed unique plant phenotyping skills, datasets and biological resources, which, over the years, were backed up with appropriate facilities for data management, testing facilities and analytical services together with glasshouse and field trials across a wide range of agricultural and ornamental species.

Following the UK's accession to the European Community in 1973, and the loss of NIAB's seed multiplication function, NIAB entered into a new contract with the Ministry of Agriculture with the introduction of variety National Lists and official seed certification as required by EEC Directives to protect Plant Breeders' Rights. DUS (distinctness, uniformity and stability) and VCU (value for cultivation and use) statutory variety testing was defined under the new contract.

The new contract involved a major reorganisation of the land and buildings, as well as a new staff structure. As part of the process the new PVRO (Plant Variety Rights Office) moved to NIAB's Whitehouse Lane site, with the old granary site redeveloped into new offices, laboratories and storage for the seed certification department.

Examining cereal seed crops in 1956

Today, now on behalf of (APHA), NIAB still carries out the DUS testing on over 1,000 new varieties of wheat, barley, oats, winter oilseed rape, field beans, sugar beet and fodder kale 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.

NIAB also manages a seed certification generation, management and tracking system, under contract to APHA and underpinned by the Seed Marketing Regulations. It provides quality assurance and consumer protection using documentary control and official monitoring of crops and seed lots. Pedigree records are maintained for all seed lots and seed crops in England and Wales. A sample of each multiplication generation seed lot entered for certification in England and Wales is sown into plots at NIAB. During the growing season NIAB's Agricultural Crop Characterisation team assess approximately 2,500 cereal plots for varietal identity and purity. 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.

The Agricultural Crop Characterisation team in 2014

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 coordinate an annual programme of over 1,200 seed crop inspections. The training of crop inspectors is carried out at NIAB. The ACC team train in excess of 300 inspectors per year on behalf of APHA.

CROP AGRONOMY

Although the early days of NIAB were concerned with distributing new varieties from the PBI and official seed testing, Lawrence Weaver had always seen NIAB as an "*all-purpose scientific institution for agricultural botany*", encompassing not only variety and seed testing, but also "*the education of persons looking to improve agricultural crops across the entire British Empire*".

Throughout the inter-war period, NIAB expertise had focused almost entirely on the management of trials of farm crops. Immediately after the Second World War, this situation began to change, with the addition of new laboratory facilities and staff in chemistry, mycology and pathology. In the mid-1950s there was great interest in the use of nitrogen fertiliser which prompted a change of emphasis in NIAB trials, more focused on husbandry rather than varieties alone. Glyphosate was introduced in 1974, followed by triazoles in 1976, establishing the use of routine fungicide programmes and further expansion of the types of trials that NIAB undertook.

Increased production continued to be emphasised after 1955, but with the return of world food supplies to pre-war levels, this policy became increasingly controversial, requiring negotiations between government, food processors, and the farming interest.

NIAB extended its applied agronomy research and farm knowledge transfer and advisory services with the creation of NIAB TAG in 2009, NIAB CUF in 2014 and NIAB EMR in 2016. NIAB now has the specialist knowledge, skills and facilities required to support improved crop production; evaluating varietal 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.

Richard Overthrow

NIAB's role includes working with members, industry, government, levy bodies and agricultural charities to develop key research areas and conducting a wide range of contract and independent field studies, trials and laboratory studies into all areas of crop agronomy. NIAB takes a leading role in knowledge transfer and exchange, providing technical training as well as bespoke research.

Right: Technical Director Bill Clark in 2017

As herbicide-resistant black-grass became a widespread problem NIAB TAG opened a specialist black-grass research site, at Hardwick near Cambridge, in 2013, with a sister site in Lincolnshire. Trials cover a range of chemical and cultural control approaches to ensure effective black-grass management throughout the rotation.

STAR project trials in 2010

Soil scientist David Clarke in 2017

A better on-farm understanding of soil health and management lies at the heart of the work carried out by NIAB's Farming Systems team, based at Morley in Norfolk. A key project is the Sustainability Trial for Arable Rotations, known as STAR, one of the few long-term fully-replicated field-based soil studies in the UK, covering the interaction between rotations and cultivations.

MEMBERSHIP

NIAB was established partly through the establishment of a trust fund which helped raise money for the buildings and land required by an institute. Large personal donations were received from Sir Robert McAlpine, Viscount Elvedon, Fred Hiam and others, mainly from seed merchants, flour millers (via nabim) and their members. Farming organisations were also asked for their support but only the potato growers of Lancashire agreed to support potato variety trials at Ormskirk.

In 1921 the NIAB Fellowship service was authorised by the Trust Deed, aimed at creating a body of supporters who would help make known the work of NIAB. Support was very positive initially, with almost 500 NIAB Fellows signed up within the first few months, with the Prince of Wales (the future King Edward VIII) and the Duke of York (the future King George VI) first on the list. The scheme was the first step towards "*making known the work of NIAB*" as well as providing some income to meet running costs. The first AGM was held on Friday 10th November 1922.

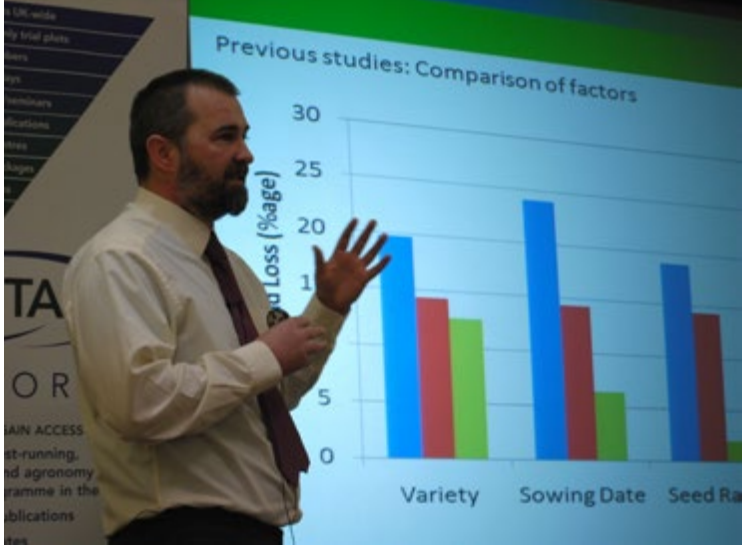
Right: Potato trials demo at NIAB Ormskirk in 1922

NIAB Fellows Day 1956

The NIAB Fellowship service continued through the decades, focused on delivering crop variety and seed information. Following the Second World War, and the expansion of NIAB's remit, there was a significant increase in numbers, from 762 in 1945 up to 2,551 in 1955. The first crop conference took place in 1952, adding to the regular NIAB Fellows Day. By 1969, the 50th anniversary year, the Fellowship scheme had become the major route for information dissemination with membership at an all-time peak of over 5,000 Fellows.

With the merger of NIAB and TAG in 2009, the NIAB Association (as it had then become) membership and TAG membership schemes were combined and the NIAB TAG Network was created, offering a range of agronomy and seed subscription packages.

In 2019 the service, now called NIAB TAG Membership, boasts around 2,500 members from across the whole industry, including farmers, advisors, agrochemical manufacturers, distributors, seed suppliers and plant breeders.



Members have access to regional agronomists and variety specialists across the season, with exclusive technical events such as local field discussion groups, conferences and results meetings. They also benefit from a range of publications to support crop management and strategic planning

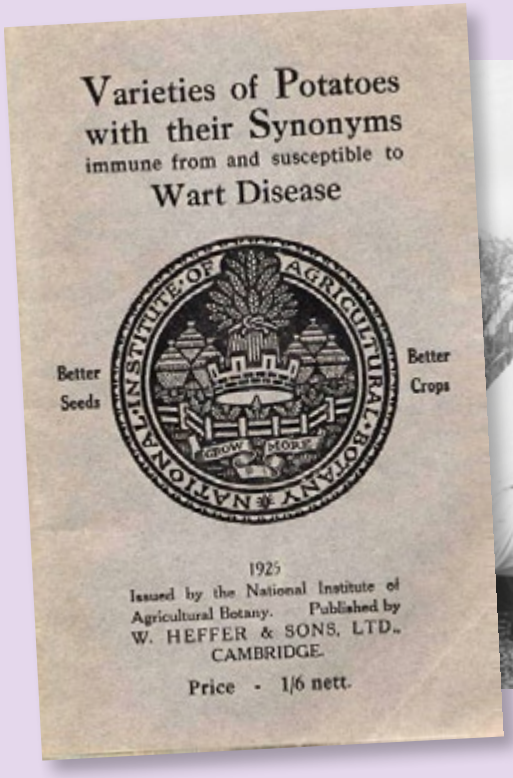
PATHOLOGY

Pests and diseases took their toll as much on the crops of 100 years ago as they do today, but the spectrum of organisms involved was very different, and of course the armoury available to growers for control was very limited. NIAB has played a role in mitigating the impact of crop diseases since its inception.

The first mention of disease resistance evaluation came in the shape of immunity testing against potato wart disease, carried out in the first years of NIAB's existence. The test is still carried out by other organisations today, under carefully controlled conditions.

Other early disease work was carried out by the OSTS, testing for seed-borne diseases on arable and vegetable crops and, again, those tests for organisms such as smut, bunt, and ergot on cereals are still carried out today.

In the earliest Farmers' Leaflets in the 1930s, disease susceptibilities of cereals were recorded as observations in trials. So, in 1932, growers of the wheat variety Little Joss were warned that it was susceptible to loose smut, and in 1933 that it was "unusually resistant to rust", but that Red Marvel was more susceptible to rust. The first disease ratings appeared in 1952 for mildew, loose smut and yellow rust in wheat


Varieties of Potatoes
with their Synonyms
immune from and susceptible to
Wart Disease
Better Seeds
Better Crops
1925
Issued by the National Institute of Agricultural Botany. Published by
W. HEFFER & SONS, LTD.,
CAMBRIDGE.
Price - 1/6 nett.

Inoculating trials in 1956

Spray trials in 1950

During the 1960s and 1970s, there was a major expansion in the pathology function at NIAB, with the setting up of a Pathology Branch. Though cereal diseases were a prime objective, driven by the impact of new wheat yellow rust races, there was also considerable resource developed for break crops, fodder crops, forage grasses, field vegetables, potatoes and sugar beet. By the 1980s, NIAB pathology was instrumental in devising inoculated test protocols which still form the basis of today's National and Recommended List procedures.

Wheat yellow rust has, of course, remained a persistent threat. This disease has been a fixture in the longest running pathology project at NIAB, the UK Cereal Pathogen Virulence Survey (UKCPVS), which has been in operation for 52 of the 100 years of NIAB's existence. The complex nature of the current populations of yellow rust make this surveillance project more vital than ever, so that variety testing can be carried out with relevant pathotypes and breeders can be alerted to changes which may threaten some breeding material.

Resistance testing of varieties for UK growers has formed the core of pathology activities at NIAB, particularly from the 1960s onwards. However, many more research-based activities have become established over the past 20 or so years, encompassing new diagnostic methods, new sequencing technologies applied to pathogen populations, and the development of molecular marker approaches for disease resistance traits, linked to NIAB's pre-breeding and genetics programmes. New approaches to disease management, including the use of biocontrol and biostimulants, have also been an increasing feature, working with industry and bringing our crop and pathogen expertise to their product development pipelines.

PLANT BREEDING

NIAB has supported the science of modern plant breeding from its beginnings in the early 20th century. It is now a global leader in crop genetics research and plant breeding, from its ground-breaking resynthesised wheat, MAGIC populations and crop transformation, to its commercial success in soft fruit, including the strawberry variety Malling Centenary™.

In 1917 AB Bruce, a superintendent on the Board of Agriculture and Fisheries commented on the economic results of plant breeding, in a memorandum on 'The establishment of a National Institute of Agricultural Botany', that "*it is now possible to make a new plant possessing valuable economic qualities…out of the fragments of another*".

Gregor Mendel

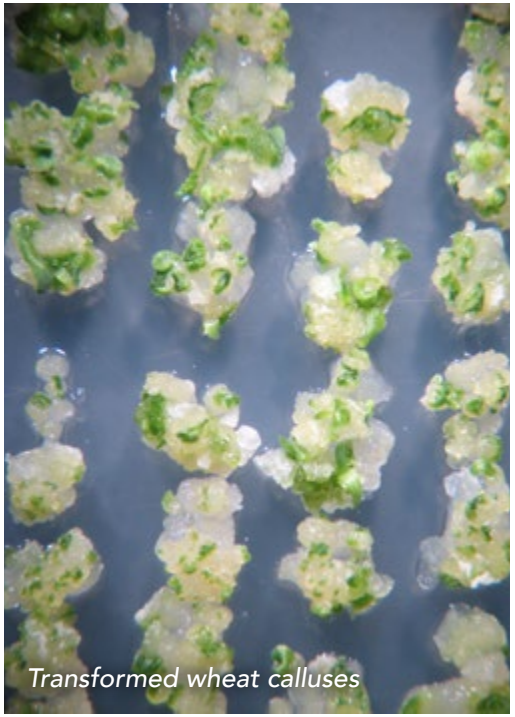
The start of modern plant breeding had begun; these were indeed the principles that Rowland Biffen was applying in practice at the PBI, breeding the new varieties Little Joss and Yeoman. NIAB's original Cambridge location and early work was influenced by the nearby PBI, supporting the distribution of its new varieties and ensuring the merits and benefits of these varieties were understood and taken advantage of by growers.

Previous to NIAB's inception it was widely believed that varieties grown in a particular region would adapt to that region and somehow 'drift' away from the original variety. This led to the sale of literally hundreds of local 'variants' of varieties (even though they were genetically identical). Throughout the 1920s and 30s NIAB battled the UK seed trade over this 'naïve deterministic Mendelism'. Although Mendel had published his work on the genetics of inheritance in 1866, the significance of his work was not recognised until the early 20th century. The opening sentence in the very first NIAB Recommended List in 1944 states "There are at present about one hundred named varieties – or so-called varieties – of wheat in existence in the United Kingdom".

"There are at present about one hundred named varieties – or so-called varieties – of wheat in existence in the United Kingdom"

NIAB Recommended List 1944

Crossing process



Transformed wheat calluses

In the past 15 years NIAB has become more closely involved in the science behind plant breeding and crop genetics, working on the molecular genetics of the major UK arable, soft and top fruit crops and key global crops such as rice and pulses. A key part of these activities is a successful pre-breeding platform that generates genetic diversity and facilitates transfer of novel traits from public research to commercial breeders.

Going forward, the Cambridge Centre for Crop Science (3CS), a partnership between NIAB and the University of Cambridge, will provide new opportunities, training and leadership in crop science.

Wild goatgrass

NIAB's award-winning 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.

NIAB's superwheat research was short-listed for hte BBSRC's 2014 Innovator of the Year award

TRAINING

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 the unique statistics in quantitative genetics course aimed at plant breeders, alongside provision for growers and trade with practical approaches to crop production through NIAB's ARTIS brand, developed in 2014.

From the start, Sir Lawrence saw NIAB as an all-purpose research institute. Although initially it was predominantly a seed testing station and seed multiplier NIAB was instrumental in establishing international standards (such as ISTA) and trained staff in seed testing techniques. It has since trained many generations of crop inspectors and seed analysts in the UK and globally.

NAAS seed crop inspectors' course in 1955

Above: Seed analysts course in 1961

Right: Crop inspectors course in the main hall at Huntingdon Road in the 1990s

Below: Cereal crop inspectors starter kit 2019 and training course at the Sophi Taylor Building in 2019

NIAB OSTS Brazil course 2009

Pulse Crop Inspectors exam

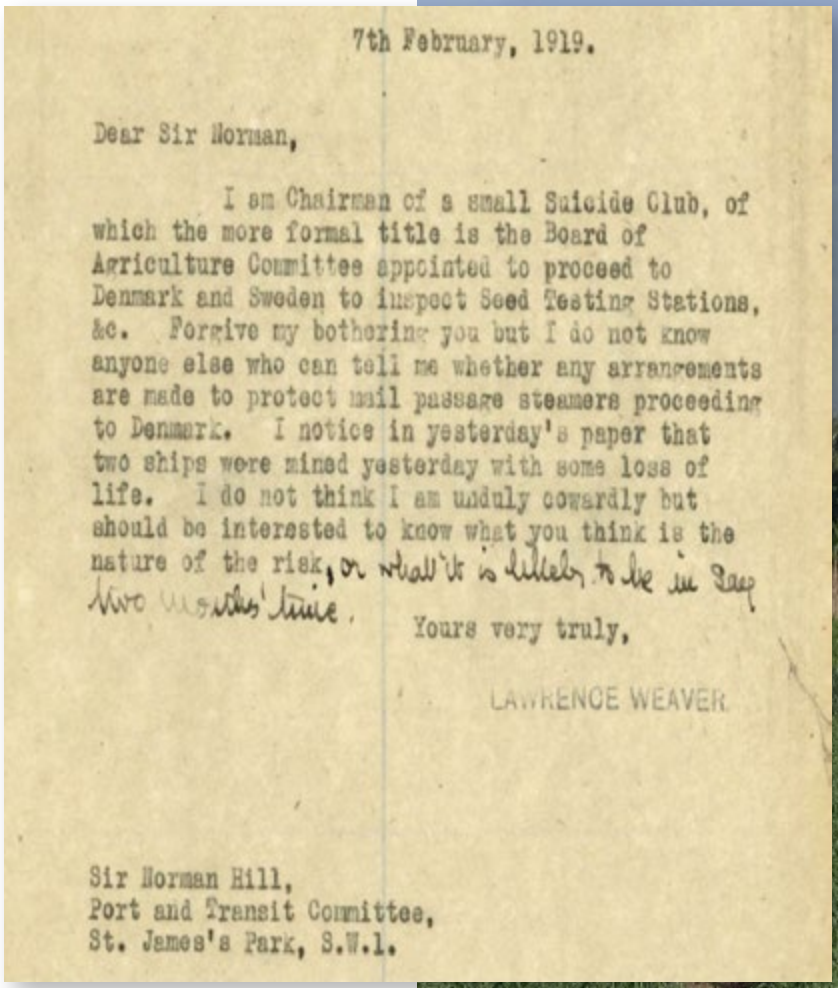
ARTIS potato agronomy course in 2017

INTERNATIONAL

NIAB was initially modelled after the Swedish Plant Breeding Institute's Svalöf station, with Sir Lawrence leading visits in 1919 to the official testing stations in Denmark, Sweden, Hamburg and Holland, to discuss close international co-operation.

From the start NIAB welcomed international visitors, sharing information, showing NIAB's work, carrying out training and developing links and partners.

Visit by the Russian agriculture delegation in 1955



7th February, 1919.

Dear Sir Norman,

I am Chairman of a small Suicide Club, of which the more formal title is the Board of Agriculture Committee appointed to proceed to Denmark and Sweden to inspect Seed Testing Stations, &c. Forgive my bothering you but I do not know anyone else who can tell me whether any arrangements are made to protect mail passage steamers proceeding to Denmark. I notice in yesterday's paper that two ships were mined yesterday with some loss of life. I do not think I am unduly cowardly but should be interested to know what you think is the nature of the risk, or what it is likely to be in [illegible] two months' time.

Yours very truly,

LAWRENCE WEAVER

Sir Norman Hill,
Port and Transit Committee,
St. James's Park, S.W.1.

NIAB staff visiting a field trial and research facilities in Kazakhstan in 2019, as part of a wheat improvement workshop

NIAB and ICRISAT currently the Cambridge-India Network for Translational Research in Nitrogen (CINTRIN) which aims to improve cereal crop nitrogen use in India, via genomics-led pre-breeding and variety selection, working with the Punjab Agricultural University

Today, 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.

In 2019, NIAB is involved in several Sustainable Crop Production Research for International Development (SCPRID) projects; harnessing bioscience to improve food security in developing countries.

Top right: NIAB provides advice, consultancy and training on the ISTA principles of seed sampling and testing in countries around the world

Bottom right: In 2016 NIAB worked with partners in Kenya to support the uptake of new crop varieties by local smallholder farmers and promote new agricultural and dissemination technologies, including at school level.

EVENTS

Events and open days have been a key element of NIAB's success, fulfilling Sir Lawrence's original vision in the "...education of persons looking to improve agricultural crops...".

From industry shows, such as the Royal Show and Cereals Event, to NIAB's own field demonstrations, conferences and seminars these events provide an interface between science and practical agriculture. They are a showcase of NIAB's expertise in varieties, plant breeding, crop agronomy, plant protection, and soils and cultivations research, providing independent advice and information to improve the productivity, efficiency and sustainability of crop production.

The NIAB Fellows Day was superseded by the Varieties & Seeds Day in 1988, an industry event that became a key date in the calendar across the 1990s, for farmers, plant breeders and the seed trade. With an increase in arable events held by the distribution trade, manufacturers and breeders in the early 2000s, the Varieties & Seeds Day was re-launched as the NIAB Cambridge Open Day. It features a mix of seminars, field demonstrations and glasshouse tours focused on NIAB research and advice only.

NIAB's National Black-grass Centre, near Cambridge, opened in 2013, providing a trials site for research on cultural and chemical control of black-grass

The Park Farm demonstration field during the NIAB Open Day in 2017

The NIAB stand at the Cereals Event 2018

A science and agronomy seminar in the Sophi Taylor Building during the NIAB Cambridge Open Day in 2016

The Director's Invitation Day in June each year welcomes NIAB's partners, funders, trade, stakeholders and government contacts for tours and presentations on NIAB's science and research

The NIAB TAG regional centres hold open days through May and June each year, focused on variety and agronomy advice and information

Left: In 2016 NIAB worked with the Cereals Event organisers and industry partners to establish the Soil Pit exhibit at the show. It is now one of the most popular stands at the event

Right: A NIAB TAG Open Day at the Sutton Scotney centre in Hampshire

Right: NIAB runs a series of annual field vegetable open days, including field onions and pumpkin and squash

ROYAL VISITS

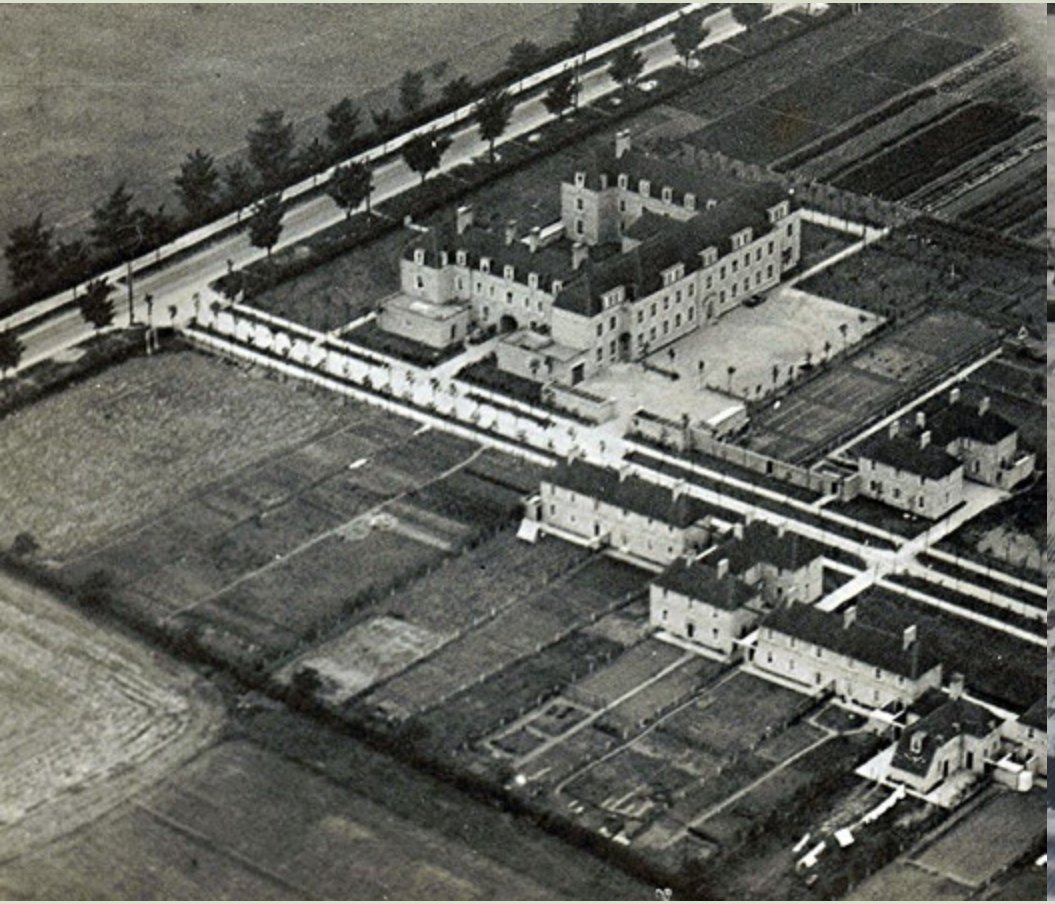
Since its foundation by a Deed of Trust in 1919, NIAB has been honoured to have Royal support and is immensely proud to have Her Majesty The Queen as Patron.

HM King George V and Queen Mary, accompanied by HRH Princess Mary, were the first members of the Royal Family to visit, opening the new NIAB building on Huntingdon Road on 14 October 1921.

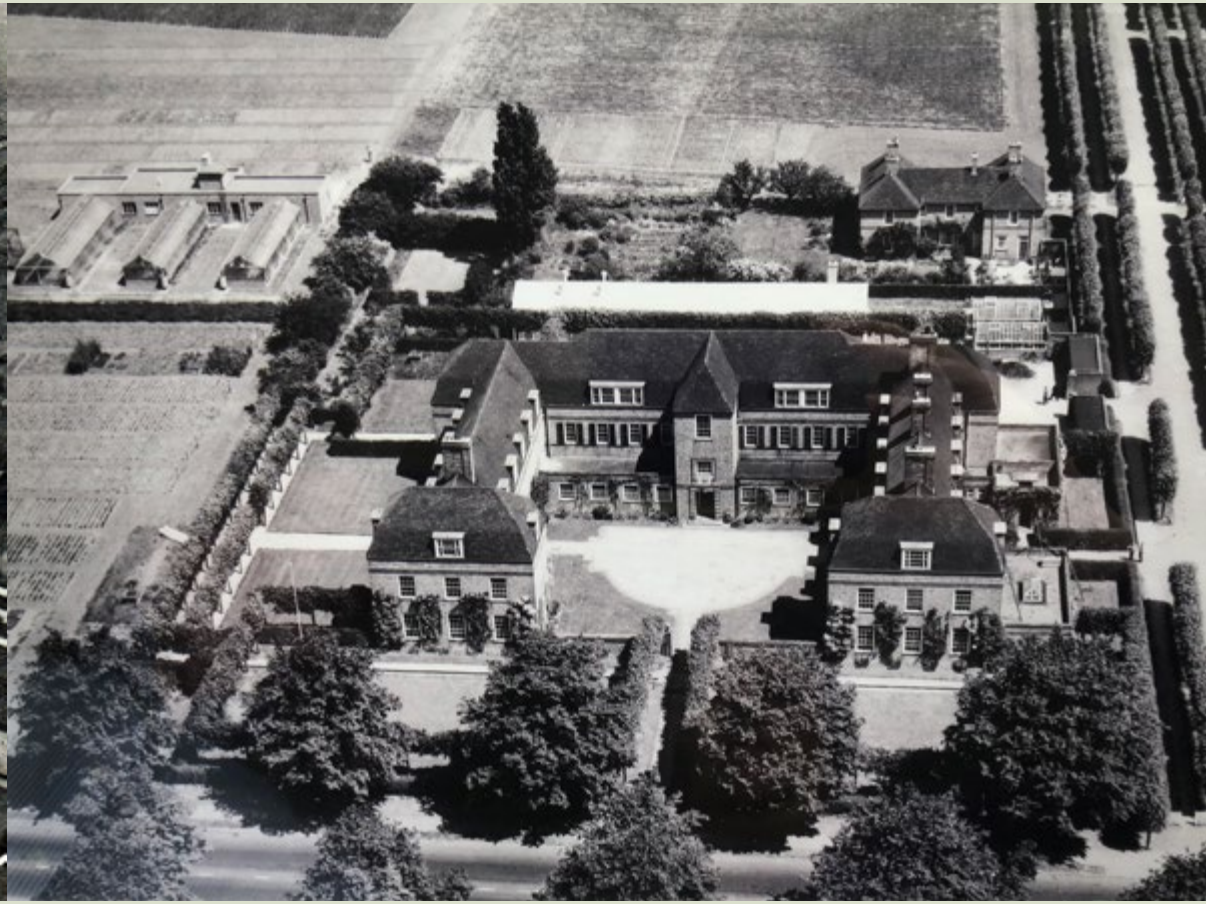
King George VI became NIAB's first Patron, followed by HM Queen Elizabeth II, who first visited the Institute in 1969 on the occasion of its 50th anniversary.

HM The Queen returned with HRH The Duke of Edinburgh, Prince Philip, in 1994 for NIAB's 75th anniversary. The visit included viewing the chrysanthemum work in the glasshouse, seed health testing, variety identification, the potato virus testing work, and plant pathology research, as well as an exhibition of historic photographs from the past 75 years.

A CHANGING NIAB AT CAMBRIDGE



Huntingdon Road in 1924



Huntingdon Road in 1949

New, modern glasshouses, laboratories and offices became essential as the work and staff expanded in the 1940s and 1950s. In 1952 the NIAB Council made a case to the Ministry for substantial enlargement of the main building to provide new accommodation for the OSTS, as well as an assembly hall, a new Council Room and a teaching laboratory. After a grant for the extension was made, visits were made to the post-war buildings of the Dutch testing authorities at Wageningen. The new extension came into operation in 1959 and was opened in 1960 by the Minister of Agriculture John Hare

Huntingdon Road in 1960 with the entrance from Whitehouse Lane

The Wellington Wing library was opened in June 1983 by Sir Richard Butler

Huntingdon Road in 2011 with the new Lawrence Weaver Road and housing estate splitting the original Howes Close Farm site into two

NIAB Park Farm, on the edge of Cambridge, in 2014. Originally bought in the late 1970s it is now home to the MacLeod Complex, state-of-the-art glasshouses and outdoor ornamental growing facilities, it includes the Sophi Taylor Building, NIAB's conference centre, and the NIAB variety and agronomy demonstration area

The MacLeod Complex was opened in 2010 by former NIAB Director John MacLeod

Right: The Sophi Taylor Building, a BREEAM award winning conference centre, was opened in 2013

The redevelopment and expansion of NIAB Park Farm, finished in 2019, provided new research laboratories and offices, seed processing facilities and analytical services laboratories, including OSTS moving from Huntingdon Road

It was an end of an era when the original Huntingdon Road site was sold in 2018. A new campus accessed from Lawrence Weaver Road, built on the former site of the Old Granary and John Bingham Laboratory, opens in 2020

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

VARTEST 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 Cambridge Centre for Crop Science (3CS) 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.

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1919-2019

100 YEARS OF PLANT SCIENCE

June 2019