syngenta

75

Celebrating 75 years of scientific excellence at Jealott's Hill International Research Centre

At the forefront of agricultural

The development of modern fertilisers and chemical methods of crop protection to combat the ravages of pests, weeds and diseases has played a vital role during the last century in ensuring the continued improvement required to feed a world population that has grown from approximately 1.5 billion in 1900 to over four times this amount in the last 100 years. In addition, economic growth during the same period has led to a greater demand for food of higher quality by consumers.

Since 1928, Jealott's Hill International Research Centre has been at the forefront of scientific innovation in agriculture, helping to meet the world's need for more food of greater quality.

No publication of this size can cover all of the many contributions that employees at Jealott's Hill have made to agriculture and public health across the world. However, we hope you get a flavour of the work carried out on site over the last 75 years from the pages that follow.

Front cover pictures
The top photograph was taken in the late 1920s or early 1930s and is believed to show a gathering of staff working at the site and their families.
The bottom photograph was taken on 29th April 2003 and includes employees working on the site on that date.

Soon after arriving at Jealott's Hill in 1989, I was asked by one of my managers to write down my first impressions, with the intention of review from time to time. Top of my list was the quality of our people. From my observations, this quality was based on a number of factors. As a major employer as part of a blue-chip company, it was not surprising that the best-qualified people were attracted and recruited. However, the most compelling features for me were the open-mindedness of colleagues and their consequent abilities to work effectively in multi-functional teams. Of course, there has been an oft-quoted downside to this, namely that everyone wished to present their opinions, leading to fascinating but protracted discussions. One of the difficulties in science is achieving the right balance between debate and action, and whereas we might have favoured the former overmuch from time to time, the resulting outputs were all the better for it. Another feature of Jealott's Hill is the commitment of staff to the principles of scientific method. This is a crucial and privileged aspect of scientific work and I can say with satisfaction that never did I once experience an instance when scientific probity was compromised, whatever the situation.

I was indeed asked to review my first impressions of the site from time to time and of course I needed to modify my views on a number of these. However, the one feature which was absolutely constant was the quality and commitment of our people – it pertains today and long may it do so!

I wish everyone at Jealott's Hill every success with the hope that the career paths which you follow are fulfilling and enjoyable and that the scientific credibility which you so richly deserve continues to flourish into the future.

David Evans
Former Head of Research & Technology, Syngenta


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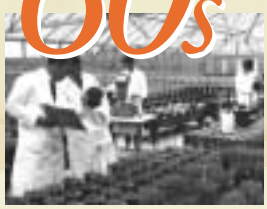
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progress for over 75 years

Today, Jealott's Hill is the UK's largest agricultural research site, the last remaining UK research site for the agrochemical industry, and an important component of the research and development infrastructure of the world's largest agriculture company, Syngenta. This is surely something the founders could never have envisaged, when work began back in 1928, and is a testament to the quality and vision of the people who have worked at and led the site over the 75 years in between.

As this publication highlights, throughout this period Jealott's Hill has been involved in some of the greatest advances in agricultural science. Its inception was driven by the successful commercial operation of the Haber process to produce nitrogen fertiliser by the firm of Brunner, Mond. In the early years, studies on the effect of fertiliser application to grasses and cereals showed the large increases in yield which could be achieved, changing agricultural practice. By the 1970's, the focus has shifted much more to the environmental impact of fertilisers, and again studies on how to maximise the productive use of applied fertiliser, minimising environmental escape, again had a great influence on agricultural practice.

In the 1940's, important discoveries were made on the selective herbicidal properties of substituted acetic acids, which led to the discovery of 2,4-D and other auxin herbicides, and on the insecticidal properties of the gamma-isomer of benzene hexachloride. At this time, telling contributions were also made which led to the practical uses of the natural products gibberellic acid and griseofulvin, which continue today. The following decade was marked by the discovery of the unique non-selective herbicidal properties of paraquat, which remains a major product today. The close involvement with fungicides began in the 1960's, when the discovery of the pyrimidine fungicides revealed the unexpectedly large reductions in yield plant diseases can cause. This was continued with the discovery and launch of the first broad-spectrum strobilurin, azoxystrobin. This success in the agrochemical field continues through to the present day.

More recently, though, Jealott's Hill has also been involved in plant biotechnology. This resulted in the first genetically modified product sold in the UK as canned tomato paste. That a safe, clearly-labelled product - which was still growing sales during the height of the GM furore - had to be taken off the market because of the lack of approval to grow the tomatoes in Europe was a bitter blow. But this is just the start of the story of plant biotechnology which will unfold over the next 75 years.

As this shows, the first 75 years has not all been smooth sailing. The industry has been through many cycles, which have impacted the size of the investment at Jealott's Hill. There has been change and consolidation in the industry, which has changed the role and direction of the work. The faith and vision of the past has been rewarded, and in Syngenta I believe we have the commitment, vision and excellent science, which will lead to continued success, despite the challenges which we are sure to face.

David Lawrence
Head of Research & Technology, Syngenta

During its long history, Jealott's Hill International Research Centre has been widely recognised as a leading centre for the creation of new ideas and products in fertilisers, crop protection and more recently plant biotechnology. Over the last 75 years, scientists on the site have discovered and developed products that have helped to feed, clothe and protect the health of countless people around the world.

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the 20s

Jealott's Hill House was purpose-built for the new research station

Farm at Jealott's Hill, 1920s

Following the purchase of the Jealott's Hill site and the formation of Imperial Chemical Industries, the late 1920s saw the first of many experiments being conducted on the site. The purpose-built offices, laboratories and library were to serve the research station well for many years.

Had it not been for the 1914-1918 war and the UK Government's decision to produce synthetic ammonia to overcome a grave shortage of nitrogen-based products for both explosives and food production, there might not have been an agricultural research centre at Jealott's Hill.

In 1926 a company known as Nitram Ltd was formed to act as selling agents for sulphate of ammonia produced by members of the British Sulphate of Ammonia Federation and for all the nitrogenous fertiliser produced at Billingham by Synthetic Ammonia and Nitrates Ltd, a subsidiary of Brunner, Mond & Co Ltd.

Sir Frederick Keeble was persuaded by Sir Alfred Mond to join Nitram and accept responsibility for developing agricultural research within the company. One of the first things Sir Frederick did was to convince the Board of the recently formed Imperial Chemical Industries (ICI) that an agricultural research station and demonstration farm were essential for his work. An edict went out to Nitram

SITE HISTORY

The name 'Jealott's Hill' is probably originally derived from a well known character called Roger, otherwise known as 'Jolyf', who owned land in the area of Berkshire at the end of the 16th Century. Records from 1606 show the area known as 'Joyliff's Hill' as little more than an ill-defined area of Common Land.

Later, the name 'Jealous Hill' is referred to by Thomas Hearne (1678-1735) in his description of the boundaries of White Waltham. A 1761 map of the area shows a well-established farm with the boundaries indicated differing only slightly from those of the current site. The first mention of 'Jealott's Hill', with a spelling similar to what we know today, is on John Snares' map dating from 1846.

An artist's impression of the original farm buildings at 'Joyliff's Hill'

Interior of White House laboratory, 1929

agriculturalists to locate a reasonably-sized arable and dairy farm within easy reach of London and Oxford and having certain soil characteristics. London was specified for the convenience of the Board and Oxford for the convenience of Sir Frederick.

In June 1927 Nitram Limited bought two adjoining farms, Jealott's Hill and Nuptown – in total 433 acres near Bracknell in Berkshire – to serve as a centre for agricultural research and the demonstration of new farming methods. The intention was to encourage farmers to use nitrogen on grass and to encourage the adoption of an intensive system of grassland management.

Possession of the site on 3rd July 1927 led to the appointment of key staff, including an architect, and the erection of two ex-Army huts which were to serve as temporary offices and laboratories. Interestingly those "temporary" huts survived for 45 years and were only demolished in 1972 to make way for new engineering workshops and offices.

The following year, Professor Keeble became the first Controller of the research station and studies officially started at what is now known as Jealott's Hill International Research Centre. Sir Alfred Mond was determined that the new company Imperial Chemical Industries Limited, which had taken over Nitram Ltd, should be supported by both pure and applied research and he wanted Jealott's Hill to play a vital role in researching fertilisers and promoting their use.

The first field experiments were conducted on the site throughout 1928, carried out by staff housed in two old army huts, whilst more permanent facilities were being built.

The next year, over 700 guests, including the Egyptian Prime Minister and the Belgian Ambassador, attended the official opening on 28th June 1929 of the purpose-built Jealott's Hill House, with its offices, laboratories and library.

Guests at the official opening, 1929

Pictured (from left) at the opening ceremony are The Marquis of Reading, The Earl of Birkenhead, His Excellency Mohammed Pasha, The Prime Minister of Egypt and Sir Harry McGowan

At the launch event, visitors and newly appointed staff learned that the site would be used for the development of products to improve agricultural productivity, in particular research into new fertilisers. The invited guests toured the new laboratories, greenhouses, offices and library and were able to see demonstrations of grass preservation, intensive grassland management and deep cultivation using steam driven equipment.

A significant step in the development of the site occurred in 1929 with the acquisition of the adjoining Hawthorndale Estate, consisting of about 100 acres of land, a 16-bedroomed mansion, stables, glasshouses and four cottages. The estate also had its own water supply, obtained from a 450-foot deep borehole.

The farmhouse and Hawthorndale House, which was built in 1880,

An original architect's drawing of Jealott's Hill House

were the main residential buildings until the company's arrival in 1928, when seven cottages were reconditioned and six new cottages built, along with the new offices and laboratory. The original 16th Century farm buildings still exist.

Many interesting artefacts have been found on Jealott's Hill, including early worked flints and a surprising number of 16th Century musket balls. In addition, a remarkable collection of 58 Iron Age gold coins was found in a field on site in 1998 by an employee. This was one of the largest hoards of Iron Age gold coins ever to be found in Berkshire and is now housed at Reading Museum.

One of the Iron Age coins found at Jealott's Hill

the 30s

Workers on the farm

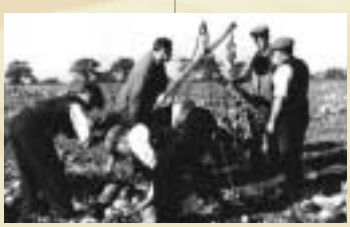
Filling a fertiliser distributor with 'Nitro-Chalk', May 1937

The 1930s saw the development of research into crop protection chemicals as well as further work on fertilisers on the Jealott's Hill site. Additional laboratories and a glasshouse on the Hawthorndale part of the site allowed expansion into the new scientific areas being developed by the Pest Control Research Unit.

By 1930 staff numbered 99, which included 36 research and experimental staff and eight trainees. However, the farm on the site occupied many of the other employees as much of the fieldwork was labour intensive. To meet the increasing demands, fields were enlarged, some hedges removed and more of the land was used to accommodate trials. These field tests were aimed at investigating novel approaches to improve the quality and quantity of crops using fertilisers and crop protection methods.

In 1930, the annual budget for the site was £50,000 with capital outlay by May 1930 being £103,785. However, against a background of steadily worsening world economic depression and over-optimistic estimates of fertiliser sales, in 1931 the site's budget was halved and staff numbers were reduced. Those employees remaining, in common with senior staff throughout Imperial Chemical Industries, took a ten percent cut in salary, though for weekly-paid workers this was only five percent. Salaries were

1930 1931 1932 1933



Weighing mangolds from experimental plots, 1931

Farm Sale at Jealott's Hill, December 1932

ICI representatives at a demonstration (Hawthorndale), 1932

Microbiology Laboratory, April 1937

restored by April 1933 as trade in other divisions of Imperial Chemical Industries recovered.

In the mid 1930s, the company started to develop its interests in crop protection chemicals and to help accommodate its aspirations in this area, a new unit – known as the Hawthorndale Biological Laboratories – was formed. This separate unit was under the direction of the Pest Control Research Committee, which was drawn from the joint research departments of Dyestuffs and General Chemicals Divisions. This new group was mainly concerned with the biological evaluation of chemicals from Dyestuffs at Blackley and General Chemicals at Runcorn. The remainder of Jealott's Hill pursued the company's longer-term and less overtly commercially-oriented work on grassland management, soils and fertilisers, animal nutrition, and plant physiology.

Following a conversion of the Hawthorndale mansion, a group of biologists moved into the building in 1937 and entomologists started to breed a range of insects for test purposes. These included house flies, beetles, cockroaches, mosquitoes, grain weevils and, at a later stage, locusts.

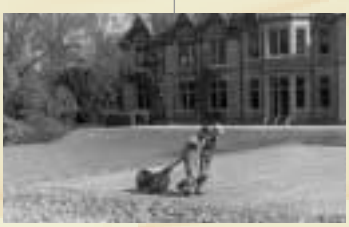
The arrival of the Pest Control Research Unit also led to the erection of an additional glasshouse on the Hawthorndale site, the eventual forerunner of a range of glasshouses and laboratories for biological research.

ICI's growing interests in crop protection began to conflict with those of Cooper, McDougall and Robertson and in June 1937 a joint company Plant Protection Limited was formed. ICI contributed to the partnership the research facilities at Jealott's Hill and took over the manufacturing side including the factory at Yalding in Kent. This partnership lasted until 1958, when ICI bought out the crop protection interests of Cooper, McDougall and Robertson and Plant Protection Ltd became a wholly owned ICI subsidiary.

By 1938, war with Germany had become virtually inevitable and plans for increasing Britain's self sufficiency in food were well advanced. The pioneering work at Jealott's Hill on the science of silage making came to the fore and a campaign to provide a million tons of silage relied heavily on help from ICI and involved training at the research centre. Work at Jealott's Hill also focused on intensive and extended grass production to give twice-yearly cropping in spring and autumn.

Aerial view of Jealott's Hill, 1934

Spraying experimental plots, 1934



Preparing an area for a tennis court at rear of Hawthorndale, 1934

Glasshouses and Hawthorndale, 1938

Hawthorndale, May 1938

the 40s

Working on experimental plots, 1940s

Lab assessment (Hawthorndale), May 1949

Work continued throughout the Second World War with the development of the herbicides 2,4-D and MCPA, and the insecticide 'Gammexane'. In addition, the site played an important role in developing methods to help feed the nation during the war and the years that followed.

Work continued on the site during the Second World War, despite many members of staff being called-up to serve in the forces, with land at Jealott's Hill being used for food production to help feed the nation. Local women in the "Land Army" were brought in to harvest the crops and vital work to improve crop productivity continued on the site.

On the site, a Local Defence Volunteer Unit (later known as the Home Guard) was formed and staff took their turn at 'fire-watching'. One night in 1940 five bombs fell in fields at the site, but it is believed that this event was accidental and that the German High Command was never advised of the importance of Jealott's Hill as a target. However, a neighbour did complain saying that the whitened buildings should be camouflaged in the future. However, Jealott's Hill was chosen in 1941 as a range for testing a top secret PIAT gun as testing on the farm was deemed unlikely to attract too much attention.

During the 1940's the laboratories at Jealott's Hill and

1940 1941 1942 1943

The White House, 1940s

The Home Guard, early 1940s

Workers on the farm during the war years

Potter Tower Test, Entomology, May 1949

Hawthorndale produced probably two of the most significant discoveries in the history of crop protection. W G Templeman's observation in 1940 of the selective herbicidal activity of α-naphthylacetic acid and the subsequent synthesis, selection and development of 2,4-D and MCPA revolutionised weed control in cereals. Whilst, in the Hawthorndale laboratories, the re-discovery in 1942 of the insecticidal properties of benzene hexachloride (BHC), and in particular its gamma isomer, shared with DDT credit for the dawn of a new era of insect control in agriculture, horticulture, stored products, timber preservation and public health. Further work on the gamma isomer ('Gammexane') produced a high rate of success in killing a wide range of insect pests, particularly locusts, for which field trials were organised in Africa. In Britain, the most pressing problem besetting crops was wireworms in cereals and potatoes, which were proving particularly virulent in the large areas of grassland newly ploughed up for agricultural use in response to wartime needs. 'Gammexane' proved very effective against these pests and many others.

Almost parallel with 'Gammexane' went the discovery of another agricultural chemical ultimately known as 'Methoxone' (MCPA), which was the first of the so-called hormone weedkillers. This grew out of work done at Jealott's Hill in the 1930s on growth hormones or phytohormones, substances naturally occurring in plants which regulate their growth much as endocrine hormones do in animals. In December 1942 a high-level Ministry of Agriculture meeting selected MCPA for field-testing at 300 experimental centres throughout Britain – the largest field trial of its kind attempted up to that time. The tests proved successful and by 1946 MCPA was available to British farmers as a one percent dust called 'Methoxone'.

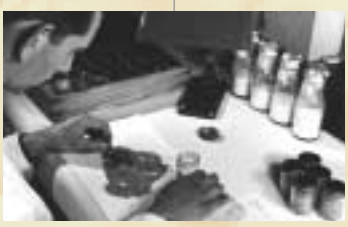
The remarkable activity of the new chemicals at low dosage called for new means of applying them and the first low-volume sprayer in Britain was developed at Jealott's Hill.

A single storey extension at the rear of the main Jealott's Hill building was the first of the post-war developments to be completed. It housed a newly formed microbiological section. Shortly afterwards, an extension to Hawthorndale was started, with its distinctive flat roof which was due solely to post-wartime controls on building materials.

The Library, May 1949

Sugar Beet Trial Harvesting, October 1948

Mycological Group, 1949



Counting grain weevils in the bio-assay of an insecticide, May 1949

Hawthorndale in 1949 showing its new 'flat roof' extension

the 50s

Aerial view of Jealott's Hill, June 1953

The Duke of Edinburgh in a glasshouse at Jealott's Hill, 1956

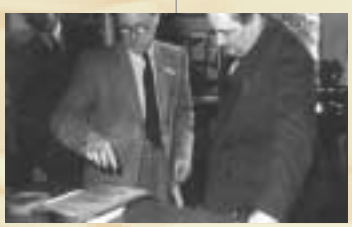
The addition of a team of organic chemists who moved to the research centre in 1954 helped pave the way for many future discoveries, including the development of the leading herbicides paraquat and diquat. The early fifties also saw the first use of a radioactive material as a tracer in an experiment.

As the 1950s progressed, crop protection chemistry was carried out by chemists at Blackley and Runcorn and the physical separation from the activities of the biologists and agriculturalists at Jealott's Hill became increasingly inconvenient. Synthetic programmes got 'out of synch' with the screening work and there were never enough opportunities for meetings and discussions. It became clear that a reorganisation was needed and, in 1954, Dr William Boon and his team of four organic chemists moved from Blackley to join two colleagues in a formulation research section at Jealott's Hill. Over the next two years more organic chemists were recruited to join them.

In 1954, their work into the development of weedkillers resulted in the discovery of paraquat, which later was to become a world-leading herbicide sold as 'Gramoxone'. The discovery of the broad-spectrum herbicidal properties of paraquat is probably one of

25th Anniversary, July 15th 1953

25th Anniversary, July 15th 1953



25th Anniversary, July 15th 1953

The new Laboratory Block, 24th September 1959

the most important events in the history of the research centre as growers in more than 120 countries across the world now use the product.

Much of the early research on the bipyridylium herbicides, of which paraquat and diquat were the most important ones, was aimed at discovering how the compounds actually worked. Work on diquat concentrated first on potatoes but the product rapidly also became popular for the pre-harvest desiccation of oilseed crops, potatoes, sunflowers, linseed, castor beans, cotton, sesame, radish and soya.

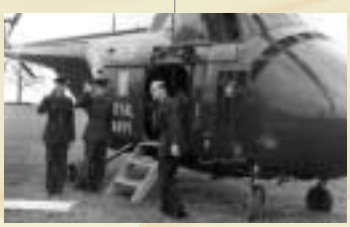
During the mid 1950s the original buildings on the site became inadequate and plans were drawn up for new laboratories, greenhouses and offices. In 1957 new chemical laboratories were commissioned and brought into operation during 1958, in time for the arrival of a second generation of chemists. The building initially provided accommodation for organic synthesis, biochemistry and formulation, and formed the core from which much of today's site was to subsequently develop. New facilities were also developed for the botanists, entomologists and plant pathologists during the late 1950s.

1959 saw the start of metabolism studies in the newly created Biochemistry Section. Early work involved the preparation of radio-labelled diquat and menazon to allow the breakdown of these compounds to be studied in plants and in soil.

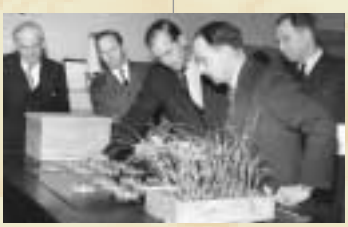
Discovering the systemic activity of a compound. The plant in the foreground has been treated and the dead aphids can be clearly seen by the scientist. The aphids on the plants which have not been sprayed are unaffected.

The Soils and Fertiliser Laboratory, 9th May 1956

Presenting exhibits in the Pot Culture House, 1956



The Duke of Edinburgh arriving by helicopter for his visit, April 1956



The Duke of Edinburgh touring the laboratories, April 1956

Visitors tour a Plant Pathology glasshouse, June 1956

the 60s

Assembling a fractionating column in the Larger Scale Laboratory, March 1960

General view of the glasshouse used for fertiliser pot experiments, 1965

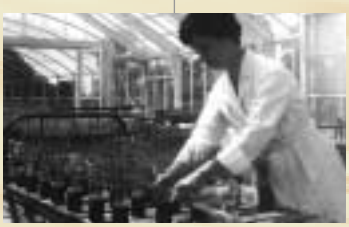
The 1960s proved to be very productive years for the site with the development of many new products including pirimicarb, pirimiphos-methyl, dimethirimol, ethirimol and bupirimate. The formation of the Environmental Sciences Group paved the way for the successful testing and registration of many more products in the future.

Following the restructuring of the now wholly ICI-owned Plant Protection Ltd, a leaner organisation moved into the 1960s and the next fifteen years were to be the most productive period so far, although many of the ideas to be developed had in fact already been conceived. The restructuring also resulted in the amalgamation of the three libraries – Jealott's Hill, Hawthorndale and Fernhurst – and in 1965 a more sophisticated Technical information Section was formed to provide comprehensive support to the site.

Following the formation of a group focusing on metabolism studies in 1959, the early 60s saw the beginning of ecological studies in the Biological Group at Jealott's Hill. An Ecology section was created, probably the first of its kind, and the extent and complexity of such work grew rapidly within ICI in line with external demands for more information on the environmental effects of crop protection products, particularly insecticides.

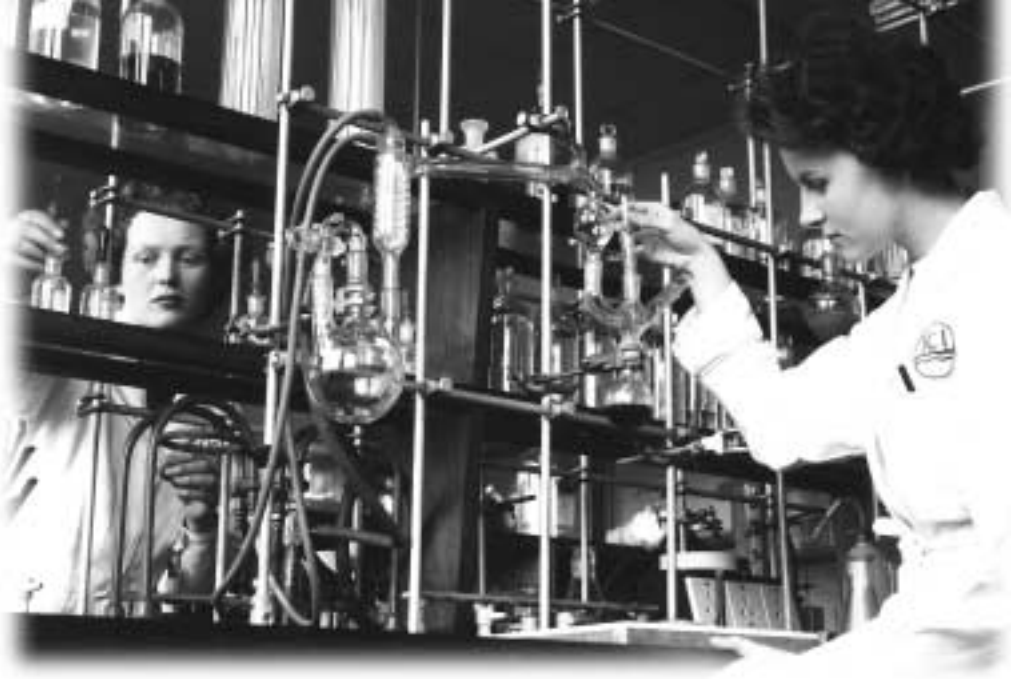
In August 1962 paraquat was

Discussing the determination of mercury residues on apples, 1960



Glasshouse tests for new fertilisers, June 1961

Adding water to wheat growing in solution culture, June 1961



Removing excess solvent under reduced pressure in Synthetic Chemistry Laboratory, March 1960

launched onto the market as 'Gramoxone'. However, from the autumn of 1961 trials at Jealott's Hill started to focus on what became known as 'direct drilling' or chemical ploughing. A programme for winter wheat was designed to last for seven years and the yields from this direct drilling experiment proved very encouraging and other trials followed on wheat, barley and kale.

In March 1963 an incident occurred which led the way for safety improvements on the site that have helped ensure that Jealott's Hill has been able to maintain a good safety record ever since. An electrical fault beneath the floor combined with a cylinder of acetylene gas above it and a plentiful supply of inflammable solvents resulted in a fire which resulted in the total destruction of one wing of the new chemistry block and extensive damage to the rest of the building. The work of the whole station was drastically reduced for a time afterwards but the new buildings constructed on the site after the fire incorporated many changes to reduce the chance of future fires.

A relatively brief excursion into carbamate chemistry produced pirimicarb in 1965 whilst the longer-term involvement with related pyrimidine phosphorus chemistry resulted in the selection of pirimiphos-ethyl in 1965 and pirimiphos-methyl in 1967 as insecticides of more general application.

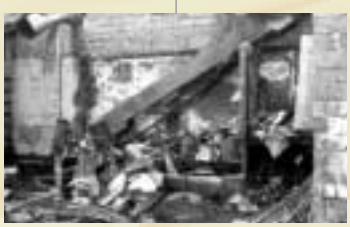
Work in the 1950s on systemic fungicides had paved the way for the discovery in the 1960s of the remarkable systemic fungicidal properties of the pyrimidines and the development of dimethirimol in 1965, ethirimol in 1966 and bupirimate in 1969 for mildew control.

By the mid-1960s, the Agricultural Division was the most profitable in ICI. Its fertiliser achievements, many of which had been developed and researched at Jealott's Hill, and the development of new pesticides had allowed the company to develop a close and mutually beneficial relationship with growers across the world.

In 1969, ICI Plant Protection Ltd brought together all of its environmental studies by the formation of an Environmental Sciences Group at Jealott's Hill. Three years later the wisdom of this move was realised when the amendment of the US Federal, Insecticide, Fungicide and Rodenticide Act enabled the United States Environmental Protection Agency (EPA) to regulate the registration of pesticides in the USA and, by issuing a series of demanding guidelines, to dictate a standard subsequently followed by the registration authorities of many other countries where crop protection chemicals were used.

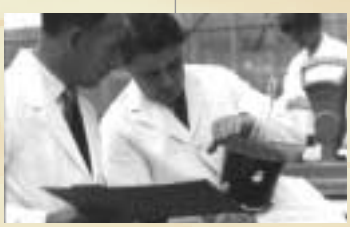
Ecology Laboratory, March 1966

Fire damage to the new Chemistry block, 1963



Fire damage to the new Chemistry block, 1963

Spray cabinet being used, March 1965



Examining the growth of a pot of lawn grasses, 1965

the 70s

Aerial view of Jealott's Hill, 1975

The Chemical Laboratories and White House, March 1970

Much work during the 70s focused on the development of synthetic protein for animals, known as 'Pruteen'. Fifty years after the original opening of the site, the new Environmental Sciences Building highlighted the importance of the growing need to ensure that the products being developed were fully tested for any effects on the environment.

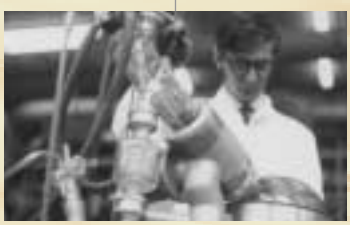
In the late 1940s an attempt at Jealott's Hill to produce protein economically from unicellular algae had not met with success, but there had been many advances in this field during the 1960s. Following work at Billingham into the creation of synthetic protein for animals, work commenced into this area in earnest at Jealott's Hill in the early 1970s.

In 1971 when a fermenter of one cubic metre capacity came into use it became possible to carry out replicated comparisons of diets containing single-cell protein with soya bean meal and fishmeal. Such trials involving pigs and poultry soon required more staff and facilities and new animal research facilities were established at Jealott's Hill. The team at Jealott's Hill established a co-operative work programme not only within ICI but also in independent establishments both in the UK and in other countries where it was hoped to sell the product, subsequently named 'Pruteen'.

In 1976, the ICI Board endorsed an investment of

1970 1971 1972 1973

Unit for large scale production of chemicals for development, 1970



Unit for large scale production of chemicals for development, 1970

Visit by European agricultural journalists, June 1970

£40 million to construct the world's first commercial plant to manufacture protein from methanol, based on much of the work conducted at Jealott's Hill. However, the effect of the oil crisis, which increased the costs of methanol, combined with the 'Green Revolution' which resulted in improved crop yields in many countries including India, meant that the expected "protein gap" never materialised. The work was not wasted as 'Pruteen; was found to be a highly successful as a replacement for expensive milk powder in the diets of calves and young pigs. In addition, the work formed the basis for the formation of a specific ICI Biological Products business which then went on to create many more products.

In the 1970s much work was also conducted on site to develop a novel application method known as 'Electrodyn', which used electrostatically charged droplets to precisely target a crop with a chemical, removing the need for water and reducing the amount of chemical required. Specially developed formulations were tested at Jealott's Hill and the technology proved popular during testing in the late 1970s and 1980s, especially in the developing world where water was scarce. The first hand-held sprayers were sold in 1984.

The mid 1970s saw much progress in the development of crop protection products on site, with work on permethrin, cypermethrin, diclobutrazol and paclobutrazol proving that Jealott's Hill was at the forefront of product innovation. Later, the discovery of the pyrethroid cyhalothrin led subsequently to the development of the new insecticide 'Karate'.

June 1978 saw a joint celebration as the site marked its fiftieth anniversary and the formal opening of the new Environmental Sciences Building. Approximately 175 guests were present for the opening, when Dr BGF Weitz, Chief Scientific Adviser to the Ministry of Agriculture, Fisheries and Food declared the new premises opened.

During the seventies the work at Jealott's Hill was recognised by the receipt of several prestigious Queen's Awards for Industry. Four awards for Technological Innovation were presented for 'Milstem', Direct Drilling, Pirimicarb and Pirimiphos-methyl.

Much work on 'Electrodyn' was done at Jealott's Hill

Queen's Award

Visit by European agricultural journalists, June 1970

The Environmental Sciences Building starts to take shape

The completed Environmental Sciences Building, 1978

During the 1970s much work was done at Jealott's Hill to develop special 'Electrodyn' formulations

the 80s

Soviet Leader Mikhail Gorbachev (centre) toured the site in 1984

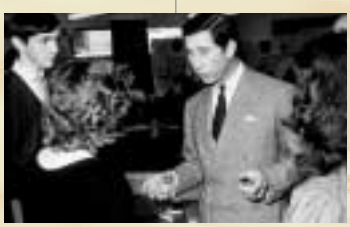
With many new product launches as the result of work at Jealott's Hill, the 1980s were a very successful decade for the site. Many of the active ingredients developed and launched during this period are now world leading products, including the pyrethroid insecticides 'Karate' and 'Force', the fungicide 'Amistar' and the herbicide 'Touchdown'.

The 1980s started with a shockwave running through the company when ICI declared its first trading loss - £10 million in the third quarter of 1980. This resulted in much belt-tightening across the company as a whole including Jealott's Hill. The combined effects of world recession, UK inflation and a strong pound had been stretching the global business almost to the limits of its viability. Competition was intensifying and product development costs were rising.

The resulting business improvement exercise provided a secure cost base from which to launch new products and drive forward with existing ones. At this time, the company demonstrated one of its increasing strengths, the ability to develop compounds and bring them to the market quickly and efficiently. This was done in record time with the cereal fungicide 'Impact' (flutriafol) which was taken from laboratory to registration in only three and a half years. The early 1980s also saw the

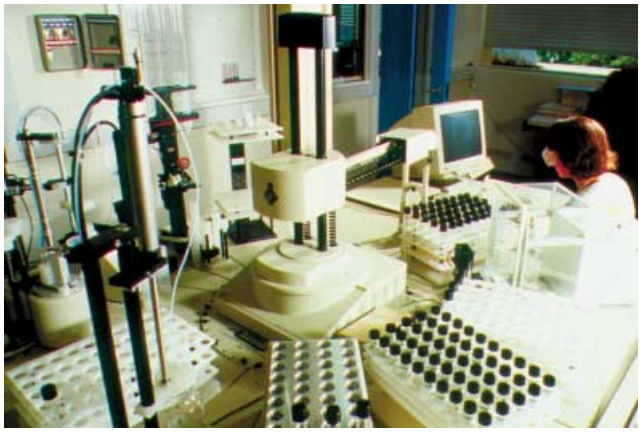
1980 1981 1982 1983

Soviet leader Mikhail Gorbachev took the chance to meet staff during his visit in 1984



The Prince of Wales learned about our Youth Training Scheme during his visit to the site

Chemistry Wing being built, 1985



During the 1980s computers and robots were used to complement the work of the scientists

launch of the herbicide 'Fusilade' across the world.

During the 1980s the use of early computers helped considerably in the assessment and recording of results in the glasshouses and the laboratories. Supplemented later with the introduction of robotics, particularly in the Chemistry and Residues areas, the new technologies helped with the increased workload which resulted from the many new compounds being tested.

Of the new synthetic pyrethroids invented at Jealott's Hill, 'Force' gave the company the distinction of being first in the market with a soil-acting pyrethroid insecticide. In addition, the development of lambda-cyhalothrin, sold as 'Karate', was a major achievement during the 1980s. This leading insecticide was launched initially in nine countries during 1985 following much work at Jealott's Hill.

In 1982, the research centre began a substantial programme of research to develop fungicides based on molecules that were to be found in naturally occurring mushrooms. Work focused on developing photostable products that could be used in daylight. With the aid of computer modelling, more than 1,400 chemically related compounds were synthesised and analysed over six years. In 1988, the innovative strobilurin fungicide azoxystrobin was first synthesised and subsequently patented.

Other developments included the post-emergent broad-leaved herbicide 'Flex' which in its first year of sales won a 20 percent share of the market sector in soya in the important Argentinean market. Other launches which were the result of work at Jealott's Hill included 'Grasp', 'Anvil' and 'Touchdown'.

1986 saw the formation of an international seeds business group within ICI, with much of the major research and development activities being located at Jealott's Hill.

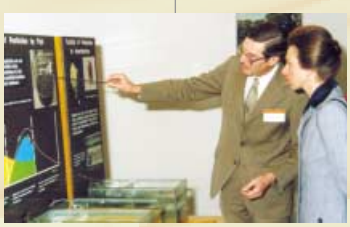
The 1980s also saw many important visitors to the site including, in 1984, a visit from the Soviet Leader Mikhail Gorbachev.

Following the arrival of our first group of Youth Training Scheme trainees in 1984, His Royal Highness Prince Charles visited the site to learn more about our involvement with the scheme to train young people.

During this decade, many new buildings were erected on site including new Chemistry and Environmental Sciences Laboratories and the development of the Exploratory Plant Sciences Building. This intense period of building activity saw the site expand greatly and aerial views of the site during the late 1980s show how Jealott's Hill had grown to become one of the UK's largest research centres.

Aerial view of Jealott's Hill, 1988

The Princess Royal opened the new Chemistry Wing, 1987



The Princess Royal learned about the environmental work carried out at Jealott's Hill

The Rt. Hon. John Macgregor toured the Environmental Sciences Building in 1988

The Environmental Sciences Building extension was opened by the Rt. Hon. John Macgregor in 1988

the 90s

The 1990s saw the launch of the strobilurin fungicide 'Amistar' based on chemicals naturally occurring in mushrooms

Aerial view of Jealott's Hill, 1996

During the 1990s, work at Jealott's Hill focused on the development of the strobilurin fungicides and the decade saw the increasing role of biotechnology in the development of new products. A new Weed Control Research Building and Central Research Dispensary added significantly to the site's ability to test new products at the end of the decade.

The 1990s saw further work at Jealott's Hill being focused on chemicals based on natural products. Work on the strobilurin fungicides continued and, at the end of 1992, azoxystrobin ('Amistar') was officially announced at the British Crop Protection Conference at Brighton. Much work was carried out during the decade to develop 'Amistar' for use on all the world's major crops, including wheat, barley, rice, oilseed rape, sugar beet and on a wide range of fruits, nuts and vegetables. In addition, the product proved extremely effective against diseases on turf and is now used on leading golf courses and in stadiums across the world.

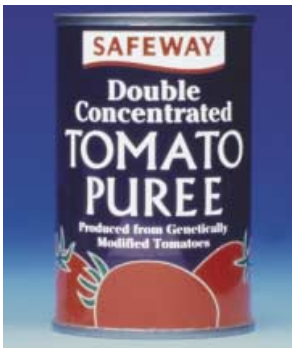
In 1992 Jealott's Hill was also in the spotlight as the company was awarded another Queen's Award for Technological Achievement for the two synthetic pyrethroids tefluthrin ('Force') and lambda-cyhalothrin ('Karate'), which were both invented and

1990 1991 1992 1993

The Queen's Award for Technological Achievement was received for 'Force' and 'Karate'

1993 saw the formation of Zeneca

A young child learns more about agriculture at one of the Jealott's Hill open days during the 1990's



The first genetically modified food sold in the UK,1996

A flag was raised to mark the receipt of the Queen's Award for Technological Achievement for 'Amistar' in 1999

developed at Jealott's Hill. A further award was received in 1999 for the invention and development of 'Amistar'.

1993 saw the demerger of Zeneca, but apart from a change of flag being flown on the site, the work continued at Jealott's Hill.

Following the opening of the Exploratory Plant Sciences Building in the 1980s, the early nineties saw much activity on site being focused on the rapidly developing area of agricultural biotechnology. The site was also at the forefront of developments in high throughput screening technology, which was, and still is, at the heart of the chemical and biotechnology invention process.

The outcome of some of the research into genetically modified foods could be seen on the shelves of leading UK supermarkets Sainsbury's and Safeway in 1996. Tins of tomato puree, developed as a result of a collaboration between the company and the University of Nottingham, were the result of many years of research into genetically modified tomatoes. Despite being clearly labelled as genetically modified they outsold conventional tins and in total over 1.8 million cans were sold. As the first genetically modified food to be sold in Europe, they also became a popular product of choice when preparing samples of food for visiting groups to the site.

During the nineties the trend of building new facilities continued and June 30th 1998 saw the opening at Jealott's Hill of the £10 million state-of-the-art Weed Control Research Building which included a 3,900 square metre glasshouse complex. Other building work included the completion of the Central Research Dispensary in 1999, which featured an innovative system to locate and retrieve compounds quickly and safely from the many hundreds of thousands of samples held on site. A system of robots and automated carousels, known as the Haystack, helped provide a significant increase in the preparation of samples for testing in the high throughput screens.

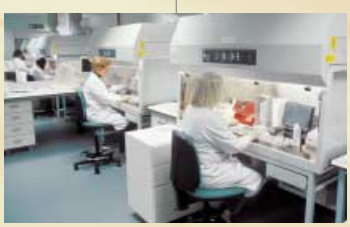
The site also saw a significant amount of visitors pass through its laboratories during the 1990s, including a high level Chinese delegation, led by the Chinese Agriculture Minister, who came to learn more about the high technology developments at Jealott's Hill. Staff on the site also gave much support during other visits by Chinese officials who came to learn more about 'Gramoxone' prior to the opening of our production facility in Nantong. It is interesting to note that over 40 years after the discovery of paraquat at Jealott's Hill there was still scope for expansion of the product.

The new Weed Control Research Building was opened in 1998 by the Rt. Hon. Dr Jack Cunningham MP

Computer-aided design was used at Jealott's Hill to enhance the performance of products

The Rt. Hon. Dr Jack Cunningham MP (second from right) tours the new Weed Control Research Building, 1998

Robotic systems were introduced to help dispense chemical samples



New facilities for chemical storage and dispensing were opened in 1999

2000+

Jealott's Hill employees, 29th April 2003

The new millennium saw the formation of Syngenta and a refocusing of work at Jealott's Hill into key areas required for the success of the new company. Much work started in the nineties came to fruition with the launch of 'Callisto' and 'Acanto' in 2001.

The start of the new millennium saw Jealott's Hill once more in the news as it was announced that the strobilurin fungicide 'Amistar', which had become in three years the world's best-selling fungicide, had been granted Millennium Product status by the UK Prime Minister. In a ceremony in London, Tony Blair confirmed that the fungicide developed at Jealott's Hill had been selected as a product that challenged existing conventions, was environmentally responsible and demonstrated the application of a new technology.

Other product innovations developed during the nineties at Jealott's Hill were also coming to fruition. Launches of 'Karate' with 'Zeon Technology' in the late 1990s and in 2000 were helping to demonstrate how advances in formulation technology – such as micro-encapsulation and the development of water soluble sachets – were able to optimise the application and beneficial effects of existing products, whilst offering significant environmental benefits over previous products.

2000 2001 2002 2003

The farm became a LEAF demonstration farm in June 2000

Young scientists from local schools met at Jealott's Hill as part of a Syngenta sponsored scheme

In 2003 the site won a Diamond safety award from the Chemical Industries Association

2001 saw the first registrations of the novel herbicide 'Callisto'. The product owed its origins to a natural herbicide secreted by the bottle brush plant

The continuous improvement over many years of the environment on the site, and in particular the farm area, resulted in the Jealott's Hill Farm becoming a Linking Environment and Farming (LEAF) demonstration farm in June 2000. The achievement of LEAF status offered a clear demonstration that it was possible to balance profitable farming with the environment using Integrated Farm Management techniques.

With the formation of Syngenta in November 2000, the role of Research and Technology as a key driver for growth was reinforced. Following the merger, it was announced that Jealott's Hill would act as a focus for centres of excellence for Discovery, Bioperformance and Product Biology. In addition, it would play a role as a key site for Environmental Sciences and a key European site for Crop Genetics research.

November 2000 also saw the official launch of picoxystrobin, a new broad-spectrum strobilurin fungicide for use on cereals, at the British Crop Protection Conference. This innovative product was well received and achieved its first registration, followed by many more, in 2001.

Much work at Jealott's Hill during the early years of the new millennium focused on supporting the further development of azoxystrobin into a wide range of new crops and also to support the registrations and launches of the maize (corn) herbicide 'Callisto' based on the active ingredient mesotrione. This innovative product owed its origins to the discovery that the bottle brush plant secretes a natural herbicide. Continued synthesis led to the callistemone class of chemistry and to the invention of mesotrione.

The work on 'Callisto' (mesotrione) and 'Acanto' (picoxystrobin) at Jealott's Hill came to fruition as 2001 saw the achievement by Syngenta of the first registrations for four new active ingredients – mesotrione, picoxystrobin, pyriftlid and trifloxysulfuron – from four different classes of chemistry. This unprecedented achievement within the crop protection industry illustrated the tremendous efforts undertaken at Jealott's Hill and elsewhere in the company during the previous years. Since then, these outstanding products have become popular with growers and are playing a vital role in enhancing crop production across the world.

2002 saw the company take an increased focus on bringing new ideas in biotechnology to the market. The company is convinced that biotechnology offers growers and consumers a powerful method of improving food, feed and fibre production and quality, while contributing to sustainable global food production. With a history of innovation in biotechnology spanning back many years, employees at Jealott's Hill are working on a range of projects which should help growers realise the potential of this new technology.

As we look back over the last 75 years of scientific excellence at Jealott's Hill, it is as obvious today as it was in the late 1920s that employees on site are at the forefront of agricultural technology, working to help feed, clothe and protect an ever-growing world population.

SOURCES AND FURTHER READING

In researching this brochure we have used many different sources of information. However, for those interested, here are a few of the main publications that we have used to offer insights into the work of Jealott's Hill.

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- ICI's International Agrochemicals Business, published 1969
- Jealott's Hill – Fifty years of Agricultural Research, edited by F C Peacock published 1978
- Fifty Years of Enterprise and Endeavour – A History of ICI Agrochemicals, Walter Boag, published 1988
- Plantector (internal ICI magazine), April 1978 pages 6-7 & June 1978 pages 5-7
- Agworld (internal ICI and Zeneca magazines), various issues
- Synthesis (internal Syngenta magazine), various issues
- Syngenta Annual Report 2002
- Syngenta website www.syngenta.com

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