1927 – 1948

From fertilizers to crop protection

The findings at the **Research Station Limburgerhof** impressively demonstrate that **yields** can be **increased** with the use of **mineral fertilizers**. At the site, new technologies and facilities enable scientists to undertake research in **plant breeding** and initial studies with active ingredients for **crop protection.** With the increasing influence of the National Socialist dictatorship, Limburgerhof also begins preparing for a "**production battle**." Even BASF, as part of I.G. Farben, cannot help achieve the "Autarkie" (self-sufficiency) in food production the regime is striving for. At **zero hour** after the war, the Research Station Limburgerhof faces an **uncertain new beginning with new areas of research**.

History

In 1928, **Alexander Fleming** discovers **penicillin** by accident as a natural product of the fungus *Penicillium chrysogenum*.

On October 24, 1929, the **New York Stock Exchange** crashes. The world quickly descends into a dramatic **economic crisis**.

In 1929, **Marlene Dietrich** sings **"Falling in love again."**

Mahatma Gandhi's Salt March in 1930 will lead to the independence of India 17 years later.

The **Olympic Games in Berlin** set a new record with 49 participating nations and 3,961 athletes. The Games are used by the ruling National Socialists as a forum for propaganda. **Jesse Owens** is the most successful athlete of the Games, winning four gold medals.

On May 6, 1937, the ***Hindenburg***, the largest airship ever, is engulfed in flames while landing at Lakehurst in the United States.

On December 17, 1938, **Otto Hahn** discovers nuclear fission of the uranium atom, the scientific and technological basis for the use of nuclear energy.

From 1939 to 1945, the **Second World War** and its consequences plunge millions of people around the world into misery.

Three years after the last entry, **the diary of Anne Frank** is published in 1947.

Greenhouses and test fields made it possible to test various crops

Research creates success – yields increase exponentially

With Nitrophoska, Limburgerhof had proved that sound testing can make breakthroughs in fertilizer possible. The compound fertilizer was a milestone for the research station and for agriculture, as it also put concerns about mineral fertilizers to rest.

The success of Nitrophoska strengthened the position of Limburgerhof in I.G. Farben, under which BASF and other major German chemical companies had joined forces in 1925. The ammonia laboratory in Oppau and the research station were given the key task of further researching and optimizing nitrogen fertilizer; the Group invested in research and development.

In the fall of 1927, construction began on a lysimeter plant, which to this day is one of the oldest and largest in Europe. Now, it was possible for Limburgerhof to determine how substances move through the soil and how nutrients can be lost. The site for field testing was expanded to 16 hectares, and the number of employees rose. Research turned to new crops and climates: The tropical greenhouse was greatly expanded in 1926 and was now suitable for tropical and subtropical plants, ranging from sugar cane and rice to bananas and cotton.

However, the main interest remained focused on domestic agriculture. The research team studied the best storage conditions and optimized the physical properties for standard fertilizers, such as calcium nitrate, sodium nitrate, calcium ammonium nitrate ("Rieselkorn") and Nitrophoska. The full potential of the products could only be realized when the right combination of granulation, solubility and spreadability was achieved. Since fertilizers were still spread by hand at that time, they could not be slippery or too dusty, yet still had to be easily soluble.

In 1927, long-term field tests began in Limburgerhof on barley, rye, oats, wheat and corn (maize), as well as sugar beets, tobacco, garden vegetables and field vegetables. The key questions included: How much does fertilizer increase yields exactly? How much nitrogen is needed, in which composition and at what time it should be used? Working closely with the advisory centers, the researchers in Limburgerhof improved the fertilizers' performance. Farmers and advisors exchanged information from test results and practical experience. After a few years, the research station presented impressive results. Yields increased by up to 70 percent when phosphoric acid and potash were supplemented with the targeted use of nitrogen.

The use of fertilizers always paid off, even if the increases were greater for some types of grain than for potatoes, and likewise for sandy soil compared to heavy clay soil.

In the lysimeter plant, leachate was collected in vessels and then analyzed

The Limburgerhof employees used mobile decimal scales to measure harvest yields and the success of fertilization while still in the field

New fields of research – crop protection and seed breeding

Inspired by the success of fertilizers, the research station expanded its work. How does fertilization affect the quality of the harvest? And what is its impact on pests and diseases?

Protecting plants from pests and diseases was a major challenge for farmers. Harmful insects, fungal diseases and especially weeds could destroy entire harvests, making fertilization futile. Since 1922, researchers in Limburgerhof had studied different substances for possible use in crop protection. But in this area, other divisions within I.G. Farben were in the lead and already had products on the market that they continued to refine. Company management therefore decided that in the area of crop protection, Limburgerhof should limit itself to preliminary tests and general research.

The research station focused on fertilizer research, since products such as Nitrophoska were selling very well. Limburgerhof enjoyed the trust of farmers and scientists. They visited the nitrogen plant in Oppau annually by the thousands and then went to the research station to get the latest information direct from the source. Given the high level of expertise there, it was only natural to address other issues relating to agricultural production. For example, in the early 1930s, the research station studied soil biology and plant physiology. The establishment of the storage test facility in 1933 provided new insights into silage. The year 1935 saw the first breeding of cover crops, such as Lihonova, a cross between rapeseed and kale, as well as Lihoraps and Lihorogen – products which ultimately succeeded in the market after the war. Paul Pehl, the director of new seed cultivation in Limburgerhof since 1935, received the Federal Cross of Merit in 1968 for these achievements. However, the focus remained on fertilization, which was seen as the surest way to increase yields.

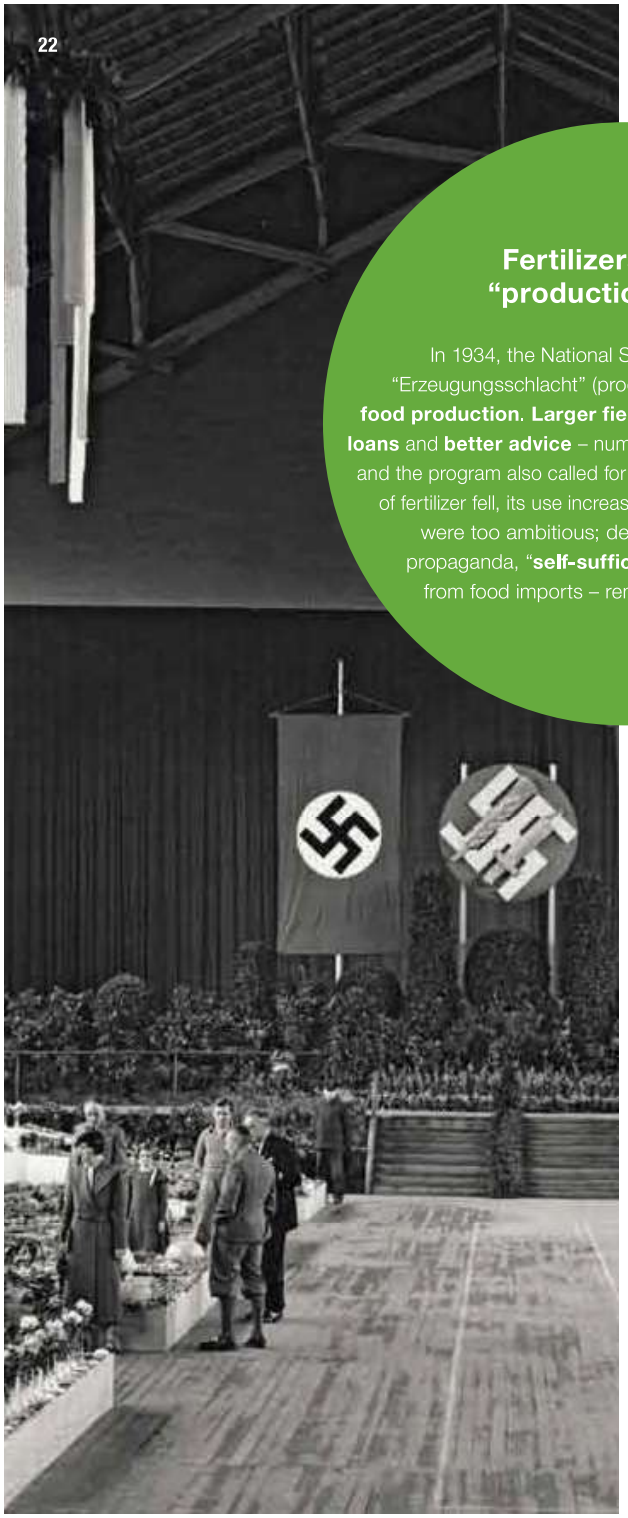
Copper and sulfur
to control insects and fungi?

Were substances such as arsenic and sulfur, which were produced in Ludwigshafen, suitable for crop protection? Since the early 1920s, researchers in Limburgerhof had studied the **insecticidal** and **fungicidal effects** of these substances as well as those containing copper. The search was painstaking; many applications failed to work, "were not suitable as controls" or "caused damage to plants." There was no major breakthrough, but the **groundwork for further research** had been laid.

In the laboratory, researchers studied whether substances exhibited the expected insecticidal or fungicidal effects

Fertilizers for the “production battle”

In 1934, the National Socialists called for an “Erzeugungsschlacht” (production battle) to increase **food production**. **Larger fields under cultivation**, more **loans** and **better advice** – numerous measures were planned, and the program also called for **more fertilizer**. As the prices of fertilizer fell, its use increased. However, the objectives were too ambitious; despite the appeals and propaganda, “**self-sufficiency**” – independence from food imports – remained **unattainable**.



The operations laboratory of the Nitrophoska plant worked on the chemical composition; testing was done in Limburgerhof

In the service of the war economy – increasing yields for self-sufficiency

The focus of research at Limburgerhof was determined by the requirements of National Socialist agricultural policy. Since taking power in 1933, and increasingly since the first four-year plan was launched in 1936, the Nazi regime called for a "production battle." The goal was the greatest possible "self-sufficiency," which also included food production.

The theory was that Germany should produce its own food in order to save foreign currency reserves and to be able to provide food to the German people during the planned war of conquest. In fact, in many areas, the program remained nothing more than a call to action, as defense activities took precedence over agriculture, and the goal of self-sufficiency was unattainable. Mineral fertilizers were, however, exempt from sales tax, so their prices fell sharply. This convinced many farmers to finally use straight nitrogen fertilizers, Nitrophoska and other fertilizers. The consumption of mineral fertilizers doubled in Germany between 1932/33 and 1937/38. There was no longer any question about the benefits, especially with nitrogen. Consumption reached a peak of 718,000 metric tons in the 1938/39 financial year.

The agricultural department, which included the administration of the Limburgerhof property and 21 advisory centers in addition to the research station, experienced a boom and by 1939 had about 400 employees. In addition to 10 academics carrying out the scientific work, the research station had 28 administrative employees and nearly 120 workers in the greenhouses and fields. Research activities received funding from the state, and the results were published by the Research Service ("Forschungsdienst") of the National Socialist institution for the agricultural sciences. As with the I.G. Farben Group as a whole, Limburgerhof was also integrated into the National Socialist system. In a publication celebrating its 25th anniversary in 1939, the research station emphasized its role "in the great labor front of German agricultural science." The research station recognized its duty to "aid the work of German farmers which is so vital for our people."

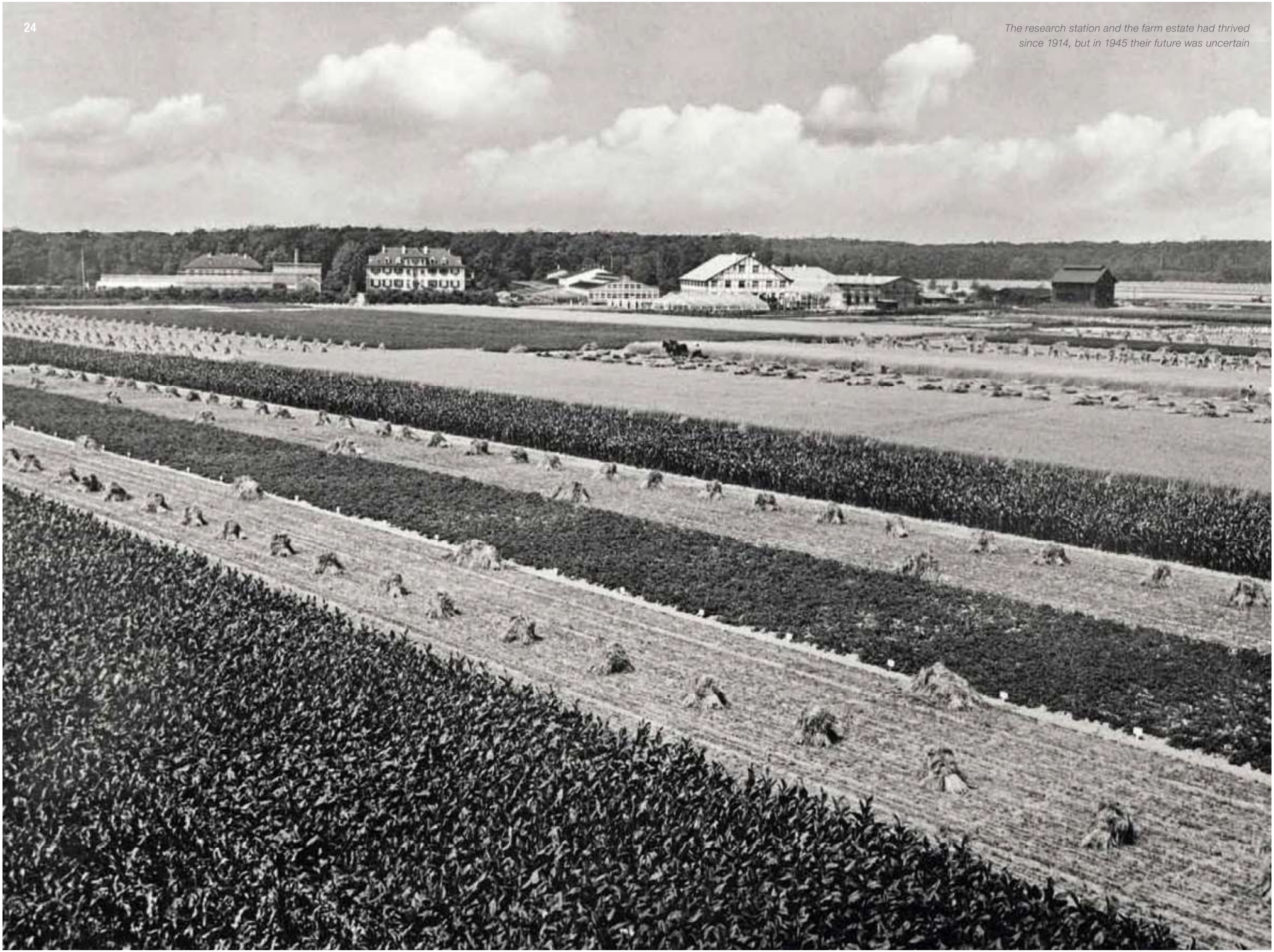
The beginning of the Second World War on September 1, 1939, posed threats to production similar to those in the First World War because nitrogen was needed not only for fertilizer but also for explosives. But the Nazi regime also considered the food supply important. Carl Krauch, an executive at I.G. Farben and an administrator in the implementation of the Nazis' four-year plan, announced in 1940 that the company would continue to supply German farmers with nitrogen, "this nutrient so vital to crops." Around 150 employees continued their work at the research station, initially without major restrictions. Women replaced the 60 workers who had been drafted into military service. Between 1940 and 1944, at least 33 prisoners of war and civilian forced laborers were used. In addition to Poles, there were also Ukrainians and Russian prisoners of war.

Since the research station promised immediate benefits for German agriculture, its work was allowed to continue. However, the focus changed. The work was exclusively application-oriented and increasingly aimed at improving harvest yields and quality; less emphasis was placed on basic research on micronutrients and soil issues.

Towards the end of the war, concerns about the future grew. What would become of the research station after the war? Would it be assigned new tasks or would it be closed as part of I.G. Farben? In March 1945, American troops initially took over the plant in Ludwigshafen, before French soldiers arrived in July 1945.

It was still unclear whether the occupiers would weaken the factories or continue to operate them. In Limburgerhof, rumors were already circulating that the research station was to be closed or transformed into an independent agricultural institute.

Promotional posters for Nitrophoska from the late 1930s. The designs targeted "Heimstättensiedler" (homestead settlers)



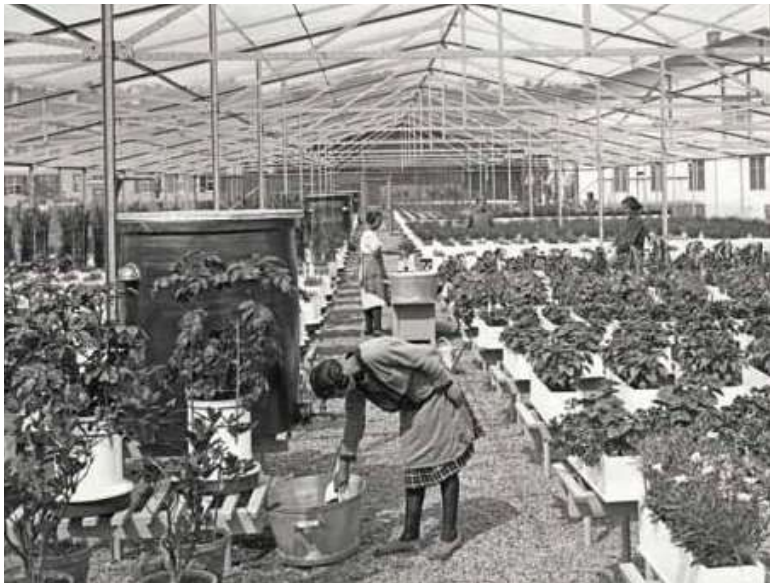
The research station and the farm estate had thrived since 1914, but in 1945 their future was uncertain

Between hope and fear – the future of the research station

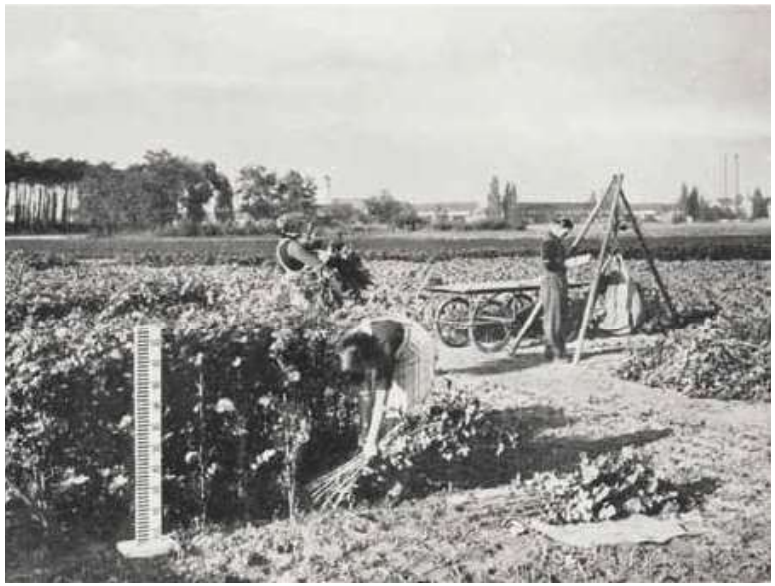
Managers at the research station took the initiative to keep the operation in Limburgerhof running. One thing was certain: The development of fertilizers had reached its limits.

In order to achieve higher yields in Germany, more effective crop protection was needed, especially for weed control. This was evident to every farmer and agricultural scientist: The grain fields of Germany were full of weeds after the war. Limburgerhof had stayed in close contact with farmers through its advisory centers and knew their expectations. But how could products for commercial sale be created? Every possible idea was considered, even some fairly absurd ones. For example, one could test the countless chemical compounds whose formulas sat in the filing cabinets of the I.G. Farben chemical plants, and suitable substances for crop protection would surely be found eventually. But a workable solution was much closer.

In 1946, an article entitled “Kobolde im Garten” in a popular magazine mentioned the substance 2,4-D (2,4-dichlorophenoxyacetic acid). It had been used in England and the United States as a herbicide, but it was later withdrawn due to numerous complaints. The principle behind the substance was very well known in Limburgerhof. Its properties acted selectively, boosting the growth of some plants and damaging others. This was the key to the effective control of weeds. Researchers in Limburgerhof risked everything on this one product and began experiments with this substance in the fall of 1946. The first task was to determine the optimal dosage and its spectrum of action. A free greenhouse at the research station was quickly found, but the substance itself presented difficulties. The laboratory could produce small amounts, but for large trials it needed considerably greater quantities. The necessary phenol component was particularly scarce and could only be obtained through barter. In addition, in fall and winter 1946, there were no test plants for the various cereal weeds and their cultivation proved “extremely difficult,” as employees later recalled. In this situation, the network of advisory centers proved its value. They provided threshing waste containing the seeds of the weeds, and they selected around 100 farmers who each received 100 grams of the substance, an instruction manual and a questionnaire. The response was overwhelming: The farmers were impressed by the herbicidal effects and the scientists confirmed their experiences with a wide range of experimental results.



Greenhouses – built for fertilizer research – were used for herbicide testing immediately after the war



Harvesting fodder mustard in the nursery garden

The beginnings of modern crop protection:
the application of U 46 with a horse-drawn spreader

“Weed-free fields” – the breakthrough in crop protection

After all the successful tests, it was hoped that production and distribution could start right away. The only thing missing at this point was an official approval, which was very difficult to obtain in the chaos of the post-war years.

The Central Institute for Biological Agriculture and Forestry in Braunschweig, a forerunner of the Federal Biological Research Center for Agriculture and Forestry, established in 1950, offered only a provisional permit and it seemed that the long path to an official application would be too much of a burden. Dr. Herbert Stummeyer, the director of crop protection testing, immediately traveled to Braunschweig. Since he had no actual research findings, he presented the questionnaires returned by the farmers. The practical responses of the farmers won over the director of the chemical inspection authority. Because there was not enough time to decide on a name, the working name of U 46 was retained (an abbreviation of the year 1946 and “Unkrautmittel,” the German word for herbicide). Official registration was finally granted at the very end of 1947. A leaflet for the new herbicide had already been printed and the registration certificate was quickly added. Sales of U 46 began in the late 1940s.

With U 46, the Agricultural Research Station now had a second pillar in addition to fertilizer: chemical crop protection products. U 46 was just as big of a breakthrough for Limburgerhof as Nitrophoska. The research station probably survived the uncertain post-war period only because it managed to bring this product to market. For farmers, the product was a dream come true. The tedious and not particularly effective mechanical control of weeds could soon be a thing of the past. Instead, weeds would be controlled chemically. “A spray in May rids a thousand fields of weeds,” promised an advertising slogan. The herbicide U 46 was a milestone on the way to a more intensive approach to agriculture.

Weed control: BASF’s first important crop protection product revolutionized agriculture

You wouldn't think so from looking at her, but Brigitte Johannes has 75 years of BASF experience – of course that figure includes the more than 40-year career of her husband Helmut. She worked at BASF from 1975 to 2009 – a total of nearly 35 years. She is proud that her son Alexander has followed in her footsteps in the Crop Protection division and is continuing the BASF family tradition.

In early 1975, Brigitte Johannes – just like her husband before her – started working at BASF, as a secretary in the newly established Environmental Protection – Air Emissions Monitoring department. She gained her first professional experience in this forward-looking department and then, in 1976, she switched to Special Transactions in sales, from which the Eastern Europe regional department was created in 1980. After 10 years working in various assistant roles, 1984 brought a new challenge for her – her son Alexander was born in August of that year. The latest addition to the family was "molded" early on because his parents' jobs and their BASF colleagues were often the topic of conversation at dinner.

The mother looks back, her son ahead: Brigitte and Alexander Johannes on their time in Limburgerhof

Growing up with BASF: Alexander and his parents on his first day of school (top left image)

Alexander Johannes now works on web-based solutions for farmers and agricultural experts around the world (lower left image)

Generational change in Limburgerhof – a BASF family

Brigitte Johannes returned to work soon after the birth of her son. This was not a given at the time because the demand for part-time jobs was far higher than the supply. Brigitte Johannes' application was no. 1,600 in the entire company. But she was given a chance to work half-days in the Eastern Europe regional department, a unit that was primarily responsible for the agricultural sector.

The many changes also reflected the upheavals that the countries of Eastern Europe were going through at the time. Brigitte Johannes remembers some uncertain and probably even risky business experiences during the Cold War, and in the period immediately thereafter. The foundational work of Brigitte Johannes' department proved to be key in developing the Eastern European market, with its large farms, into one of the most successful agricultural markets for BASF worldwide.

Another fundamental change Brigitte Johannes experienced came with the technological advances in her office. "At first we worked with steno pads, telex and 'golf-ball' typewriters. Letters to the Board at that time were often edited for days until they were error-free," she remembers with a shake of her head.

New electronic media sped up work significantly but had other pitfalls. She recalls an anecdote, one of many, from her days in the office: "A colleague from Kazakhstan always worked very fast. She was supposed to write an email for her boss that was going out to a large distribution list, and he was supposed to approve it before it went out. Just as she was hitting the 'send' button, he came to the door, wanting to make some changes. She was horrified and ran behind her desk, pulling all the plugs, hoping to stop the email before it went out. That story still makes us laugh." She always enjoyed dealing with international colleagues. "I made a lot of friends and some colleagues have become like members of my own family."

If colleagues have become part of the family, it is no surprise the family itself produces new colleagues. Her son Alexander developed an early interest in his mother's department: "Alexander always asked a lot of questions and was very eager to find out what his parents did at BASF. When he turned four, I brought him into the office now and then." This was obviously a formative experience for little Alexander, who would later join BASF as a young adult. Even before starting his business studies in Mannheim, where he received his degree in the spring of 2005, he gained experience as an intern in BASF's HR department. During an internship abroad with BASF in Prague in 2007 and his subsequent thesis on marketing in Limburgerhof in 2010, the student decided that he would eventually like to start his career at BASF in the Crop Protection division. After graduating, he submitted just three applications – all for jobs at BASF. The very first one was successful. A year after his mother left the Agricultural Center Limburgerhof in September 2009, Alexander Johannes continued his family's history at BASF in Global Sustainability & Product Stewardship.

Like his mother, he also appreciates the close relationship he has with his colleagues. The Johannes family has connections with many colleagues that go beyond work. In 2013, Alexander Johannes celebrated his wedding with his family – including, of course, many of his colleagues at BASF.

The agriculture business has certainly evolved, but office work has also dramatically changed over the past few decades