1914 – 1927

The beginnings – research, development, advisory services

With the introduction of **ammonia synthesis**, BASF lays the **foundation** for the industrial production of **modern fertilizers**. By concentrating on this new technology, the Agricultural Research Station Limburgerhof serves as an inspiration for the future direction of the entire company. The outbreak of the **First World War** soon grounds these high-flying plans but, at the same time, increases demand for yield-boosting fertilizers to ensure the supply of **food for the country**. With its professional advisory services and the new **compound fertilizer Nitrophoska**, the Agricultural Research Station provides the basic building blocks for **forward-looking agriculture**.

History

The **First World War** is triggered by the **assassination** of Archduke **Franz Ferdinand** of Austria, heir to the throne, on June 28, 1914.

On November 25, 1915, **Albert Einstein** presents the general **theory of relativity** to the Prussian Academy of Sciences.

On November 11, 1918, the **Armistice** of Compiègne is signed, bringing an **end** to the **First World War**.

In 1919, following his initial success in silent films, **Charlie Chaplin** and his partners establish the **independent** film company **United Artists**.

The **first public radio broadcast** in Germany happens on December 22, 1920, with the **transmission** of a **Christmas concert**.

Frederick Banting and **John James Rickard Macleod** receive the **Nobel Prize for Medicine** in 1923 for the **discovery of insulin**.

In 1925, shortly before the sound film era begins, the epic film ***Ben Hur*** becomes one of the **biggest box office hits in American silent films**.

In 1927, **Charles Lindbergh** makes the **first** non-stop, **solo transatlantic flight**, from New York to Paris.

In the first field tests, employees spread fertilizer by hand, as was customary in agriculture at the time

The entrance to the Agricultural Research Station in the early years of research in Limburgerhof

Limburgerhof –
the first research station with a new direction

Can nitrogen produced in a factory work as fertilizer on fields? This was the question that triggered the start of research at Limburgerhof, beginning in the spring of 1914. The idea was intriguing, but how to implement it was another question. On the basis of Fritz Haber's findings, BASF chemist Carl Bosch developed a large-scale process to combine atmospheric nitrogen with hydrogen to form ammonia.

But how did this nitrogen work? Could it be used as fertilizer for farmers around the world? The new method raised great hopes. Nitrogen was urgently needed as a plant nutrient because the natural saltpeter deposits in Chile, which were being used at the time, would not be indefinitely available. Synthetically manufactured ammonia could help ensure the supply of food for a growing global population.

Time was running short. Having begun operations in September 1913, the new BASF plant in Oppau, Ludwigshafen, was the first ammonia plant in the world, producing up to 30 metric tons of ammonia a day. Carl Bosch proposed establishing a research station and linking it closely to the laboratories in Oppau.

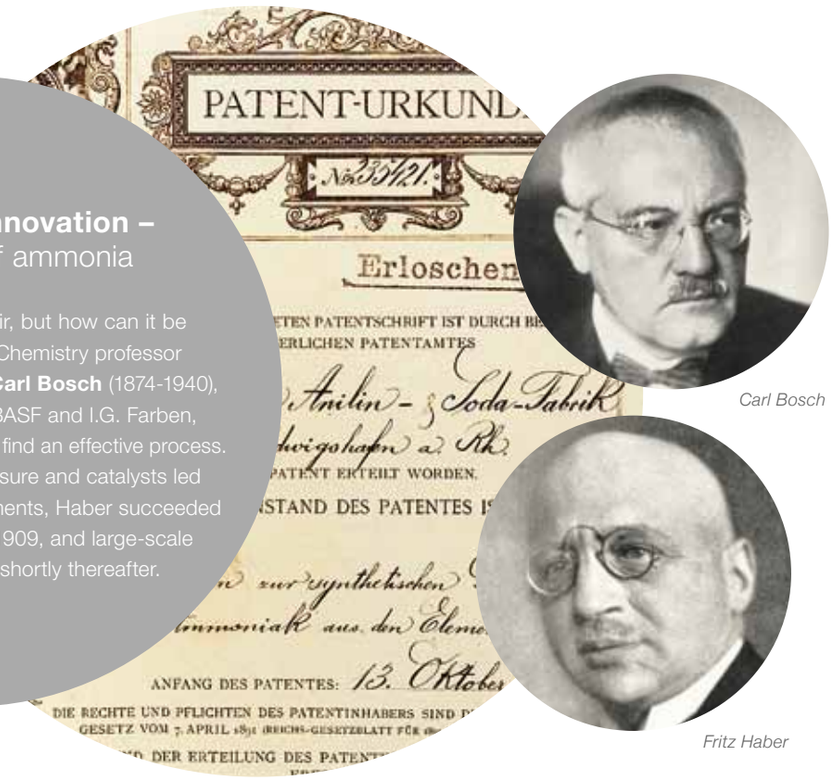
The prospects for synthetic nitrogen fertilizer were outstanding, but the first task was to prove it actually worked. For BASF, much depended on the tests because fertilizer production was supposed to serve as an inspiration for the entire company in the early 20th century.

There were fewer reservations about the new mineral fertilizers than there had been in the 19th century, but the concerns had by no means been completely eliminated. Farmers only bought and used fertilizers that proved effective in the fields. Since there were few facilities for practical agricultural research at the time, BASF built its own. A site for the Agricultural Research Station was quickly found: Limburgerhof, located only about 10 kilometers south of Ludwigshafen. BASF had acquired some buildings and 225 hectares of arable land there in 1899 to build housing for workers and additional production facilities. The uniformly sandy soil with few nutrients of its own and a low water-retention capacity, along with the moderate and rather dry climate, offered perfect conditions for field tests. The spacious site offered plenty of room for research and farm buildings.

Five employees started working there in the spring of 1914. They initiated the first trials with various plants, testing ammonium sulfate and sodium nitrate that was produced in-house. They wanted to find out whether these fertilizers were as effective as standard nitrogen fertilizers, which at the time included everything from manure to coking ammonia, a by-product of coal use. While the small team continued its research, laboratory and office space was built. It was an impressive sight: In the glass-roofed greenhouse, tracks were laid down on which 24 trolleys holding up to 600 containers could be moved from the greenhouse to the outdoors as needed. Testing was carried out on a field of approximately two hectares. The first buildings were completed on May 1, 1914, and the initial tests showed promising results.

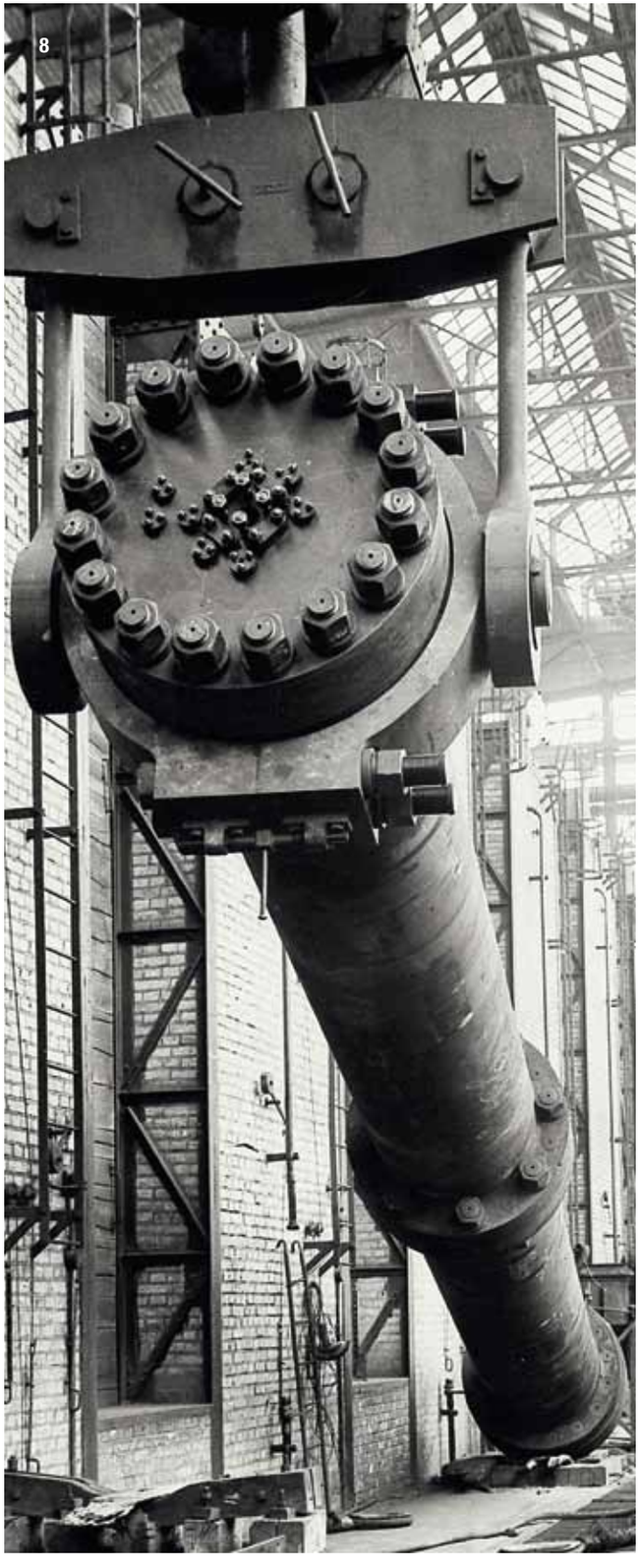
Fundamental innovation – the synthesis of ammonia

Nitrogen is present in the air, but how can it be combined with hydrogen? Chemistry professor **Fritz Haber** (1868-1934) and **Carl Bosch** (1874-1940), a chemist and later CEO of BASF and I.G. Farben, conducted extensive research to find an effective process. High temperatures, high pressure and catalysts led to success. After many experiments, Haber succeeded in synthesizing ammonia in 1909, and large-scale implementation followed shortly thereafter.



Carl Bosch

Fritz Haber



The main laboratory, pictured here in 1922, and the research station worked closely together from the start (image on the right)

High-pressure reactors made of heavy-gauge steel were used for the large-scale synthesis of ammonia in the ammonia plant (image on the left)

Uncertain times of war – research for explosives and nutrition

After a promising start, the company's plans were thwarted by the outbreak of the First World War. Half of all BASF employees were drafted for military service, the Oppau plant decommissioned parts of its production and the future of Limburgerhof hung in the balance.

The rules of the war economy prevailed. State organizations such as the War Raw Materials Department and Kriegschemikalien AG restricted corporate freedom, and raw materials themselves were also scarce. BASF, like many companies, encountered difficulties in maintaining its operations. But the German army urgently needed the products made by the chemical industry. For example, there were shortages of nitrogen and nitric acid, which were obtained from ammonia and used in the production of explosives. BASF saw an opportunity here: Using the Haber-Bosch process, the company could produce ammonia in large quantities. It lacked the necessary facilities for the production of nitric acid, but once established, these facilities could also be used for the production of nitrogen fertilizer, at the latest after the war.

Against this background, in September 1914, Carl Bosch made his “saltpeter promise” to the War Department after long negotiations. BASF would provide large amounts of nitric acid and, in return, receive government support to build large-scale oxidation plants to process the ammonia into nitric acid.

Meanwhile, the Research Station Limburgerhof continued to focus on fertilizer research. With the expansion of the greenhouse in 1915, there was now room for 1,500 containers. The laboratory was also substantially enlarged and the area available for field tests totaled about 10 hectares. The nitrogen fertilizer tests extended to different soil types and all major crops, including fruits, vegetables and tobacco, in addition to the standard types of cereal grains. The team then began to experiment with combinations of various plant nutrients. Testing with a combination of nitrogen and potassium began in 1916, and the combination of nitrogen and phosphorus followed in 1917. And so just a few years after the development of ammonia synthesis, BASF made a crucial step forward by creating the first fertilizers to contain all the essential nutrients.

The work in Limburgerhof was not limited to chemical research and field tests; even during the war, research continued to focus on agricultural practices. Since 1917, BASF had farmed the previously leased Limburgerhof property with close to 150 hectares of arable land and its own livestock.

The company then purchased the nearby Rehhütte and Kohlhof operations and brought them under its management. The resulting extensive agricultural operations provided a good complement to the research station. While the scientists produced solid findings in chemistry and plant physiology, practical experience was gained in agriculture and animal husbandry. In order to systematically develop agriculture as a business area, BASF gathered its forces in 1918, the last year of the war, and founded an agricultural department, to which Limburgerhof now belonged.

The mixed fertilizer plants in Oppau began to produce various nitrogen compounds and fertilizers in 1913

Postcard from the 1920s with an advertising rhyme for fertilizer

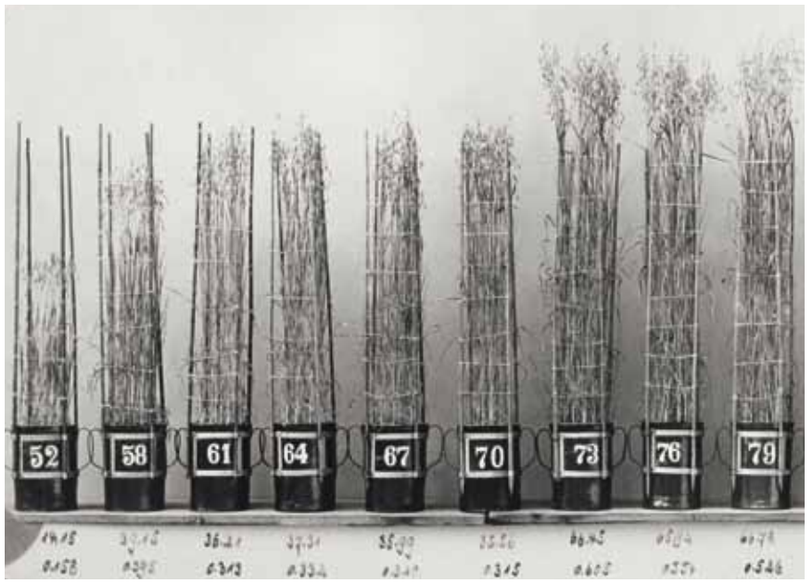
Advisory services – the foundation for a prosperous future

After the war, the demand for fertilizers was especially large. Soils were leached, agricultural yields had fallen because Chilean saltpeter could not be imported during the war, and ammonia from coking plants and factories had been used for explosives.

As a result of the famine experienced during the "turnip winter" in 1917, the government assumed responsibility for the food supply. The question was how to accomplish this. Significant grain-growing regions in the eastern part of the German Empire had been lost, while small and medium-sized farms ranging in size from 5 to 20 hectares made up around a third of the total area under cultivation. These farms often not only lacked money for machinery and fertilizer but also expertise. BASF's agricultural department thus began offering its advisory services to provide the necessary know-how.

Starting in 1919, advisory centers were set up in cities across Germany, including Breslau, Kiel, Münster, Munich, Kassel, Dresden, Cologne, Hanover and Stettin. The company soon began establishing similar offices abroad. The discussions with farmers at these centers always returned to the same questions: Were the synthetic fertilizers really effective? And would using them pay off? The advisors were able to dispel these doubts. Experiments conducted in Limburgerhof had shown that fertilization increased yields and quality. And the advisors used test results to show that the investment in fertilizers was worthwhile. State agencies supported this program by strongly encouraging farmers to use more mineral fertilizers. "If this does not happen, we will experience a famine," the Prussian Prime Minister and Agriculture Minister Otto Braun wrote in November 1920.

Many farmers had developed their knowledge about soils and fertilizers through experience. In Limburgerhof they knew that the adage that the dumbest farmer harvests the largest potatoes had long since ceased to apply. However, there was still some uncertainty about using the new fertilizers. What fertilizers should be used and in which mixing ratios for specific crops and soils? The advisors from BASF used their practical and technical knowledge to convince the farmers. They worked closely with the farmers to create fertilization plans and, when needed, also advised on other operational issues. The advisory centers soon earned an excellent reputation, due in part to the fact that they did not sell the fertilizer. Sales were handled by Stickstoff-Syndikat, a Berlin-based sales organization founded by German nitrogen producers in 1919.



Oat plants in a nitrogen fertilizer trial with Limburgerhof soil, 1919. N-fertilizer: pot 52: 0 g N; pots 58-70: 0.2 g N; pots 73-79: 0.5 g N

In addition to advisory services, advertising played a key role in raising awareness about BASF fertilizers. Postcards lauded nitrogen fertilizers using impressive images and catchy slogans. Demonstrations in Limburgerhof proved the superiority of mineral fertilizers and were attended by a growing number of visitors from the early 1920s onwards. The agriculture department also made use of modern media. A two-part film produced by Ufa (Universum Film AG) in 1921 showed how to use fertilizer and how to maximize its effectiveness. This was followed by about 30 more films that put the work of Limburgerhof on the big screen. Other topics were incorporated into the research programs – ranging from the nutritional physiology of plants, to the humus status of the soil, to bacteriological and enzymatic matters. BASF built new laboratory and farm buildings in Limburgerhof to handle the heavier research workload. The staff at the research station looked to the future with confidence, and rightly so, because purchasing power in agriculture grew until the mid-1920s and fertilizer sales rose.

The targeted use of the new fertilizers measurably increased agricultural yields after the First World War

In ruins and ashes – the disaster in Oppau

One of the worst disasters in industrial history devastated BASF in 1921. On the morning of September 21, a fertilizer silo exploded in Oppau. A total of **561 people died** and large sections of the **factories** and nearby **residential buildings** were **destroyed** or damaged. “The very substance intended to provide food and life to millions of our countrymen has suddenly become a cruel enemy,” said Carl Bosch at the memorial service.

Nitrophoska milestone –
the world's first fertilizer with a complete variety of nutrients

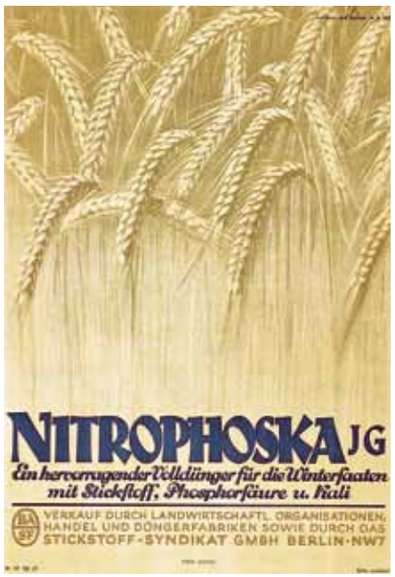
The business with individual nutrients in fertilizers was strong and experiments with combinations had been conducted. What was missing was a fertilizer that combined the three main nutrients: nitrogen, phosphate and potassium. But in what proportions did the individual substances work best? And what was the optimal combination?

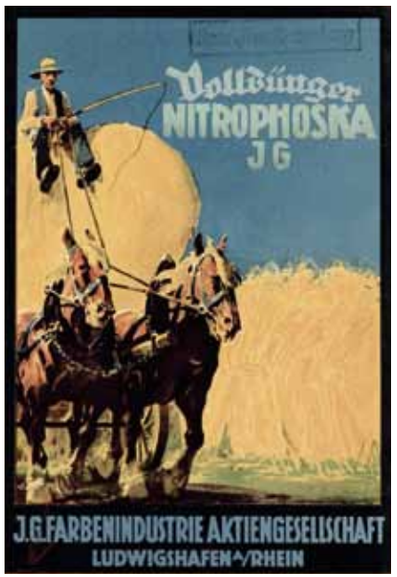
In 1924, Limburgerhof began testing compound fertilizers, in some cases supplemented with calcium. A major series of experiments studied the effects of various nutrient combinations on the main crops in different soils. The result of this research in 1926 was Nitrophoska, named after the three main components nitrogen, phosphate and potassium (in German, potassium is called "Kalium").

The Agricultural Research Station achieved a major breakthrough in just two years with Nitrophoska. The fertilizer was homogeneous, meaning that the individual nutrients were chemically bound rather than mechanically mixed, with each grain of fertilizer containing the various components in the same ratio.

Nitrophoska was immediately received with enthusiastic support when it came on the market in 1927. The new combination of nitrogen, phosphate and potassium was more stable, and the nutrient content greater than that of conventional mixtures. Nitrophoska met farmers' demands for an affordable and easy-to-use fertilizer.

Thirteen years after being founded, Limburgerhof had more than met its objective of proving the effectiveness of synthetic nitrogen fertilizer. Nitrophoska was the first product to be developed in different varieties, and it became the starting point for BASF's success in fertilizer production.





Early advertising posters and brochures for the new compound fertilizer

Gottfried Schüle knows Limburgerhof like the back of his hand. His family has deep roots here, and he grew up near the research station. He gained his first professional experience at the Rehhütte Farm Estate in a career that eventually took him from Limburgerhof into the wide world.

Gottfried Schüle's family has had a passion for agriculture for generations. His father Richard grew up on the family vegetable farm in Hassloch, not far from Limburgerhof. Richard studied international agriculture in Weihenstephan and wrote his doctoral thesis on specialty crops. He brought this expertise to Limburgerhof, where he worked from 1955 to 1988, spending a total of 33 years at BASF. He successfully achieved his professional dream – to grow and learn in a large international company.

Josef Ertl on his visit to the Research Station Limburgerhof

Father Richard and son Gottfried Schüle, in the early 1960s (image on the left)

From Limburgerhof into the wide world – like father, like son

Richard Schüle's first stop was in the sales department, including technical advisory services in Germany. He gathered valuable experience in his daily contact with farmers and later, as a product manager for fungicides, he put this experience to use in the global development of new crop protection products for grains. His passion for everything related to agriculture was also evident in his later position as head of the public relations department in Limburgerhof. He not only managed to bring Josef Ertl – then Minister for Food, Agriculture and Forestry – to the research station on a public visit, but later he also hosted Ertl's successor, Ignaz Kiechle, at Limburgerhof for an informational tour.

"My father experienced the radical changes in German agriculture first-hand – the increasing mechanization and the use of the first chemical crop protection products," Gottfried Schüle recalls. "I also had a close-up view of what was happening at Limburgerhof and later had a similar experience in China." As the youngest of five children, he often brought his father's lunchbox to him at work, and he always felt very welcome at the research station. After graduating from high school, he completed an apprenticeship at the Rehhütte Farm Estate before studying agriculture in Kassel/Witzenhausen. Like his father before him, he was also fascinated by the agricultural structures of distant lands, so he focused his studies on tropical and subtropical agriculture. And, naturally, he began his professional career in Limburgerhof in 1985.

Just a year later, Gottfried Schüle was sent to Taiwan to learn Chinese. Shortly thereafter, he was delegated to Hong Kong to set up BASF's Crop Protection business in China. The first steps were difficult, and laying the foundation in China required his total commitment. "Travel was generally hard and required a lot of permits. I was often traveling for a week or more before getting to my destination," he recalls. Local communication also presented a real challenge to everyone involved. Schüle describes the communications methods used at the time: "Our handwritten correspondence often took days to arrive. So we used the now nearly forgotten telex and a numerical code – similar to Morse code – to laboriously translate the texts into Chinese. We didn't get a fax machine until the 1990s."

His stations in China included working in the province of Heilongjiang, the breadbasket of China with its huge state farms, in the northeast of the vast country. Like his father's efforts in Germany in the 1950s and 60s, Gottfried Schüle carried out groundbreaking work here from 1987 to 1990. He advanced the modernization of agriculture with the introduction of new crop protection products, such as growth regulators. "There was nobody else there to make the decisions; you had to do it yourself," says Schüle about his uncertain but exciting times in China. He finished off his time in Asia with a posting to Hong Kong from 1995 to 1997. Here he witnessed Britain's handover of Hong Kong to China. "It was an unforgettable highlight for me to be able to experience this historic event live," remembers Schüle fondly.

Accompanied by his wife Claudia, he had numerous other foreign postings in Latin America from 1995 onward, before the Schüle family returned to Limburgerhof in 2003. The research station has now changed considerably from the one he remembers from his youth. "It's less like a family today, but the global nature of the business has made it much more cosmopolitan and multicultural," a feature that he himself has contributed to. The couple's two children, Marius and Eva, have grown up bilingual, speaking German and Spanish, and they already have a sense of cultural differences and distinctions. Gottfried Schüle always encourages young people to gain professional experience in foreign countries. "When you're abroad, you can go your own way, and BASF has always offered the ideal platform for an international career."

Gottfried Schüle: from Limburgerhof into the wide world