

# RECOLLECTION

## Remembering the scholar Ding Ying: the father of Chinese rice-farming science

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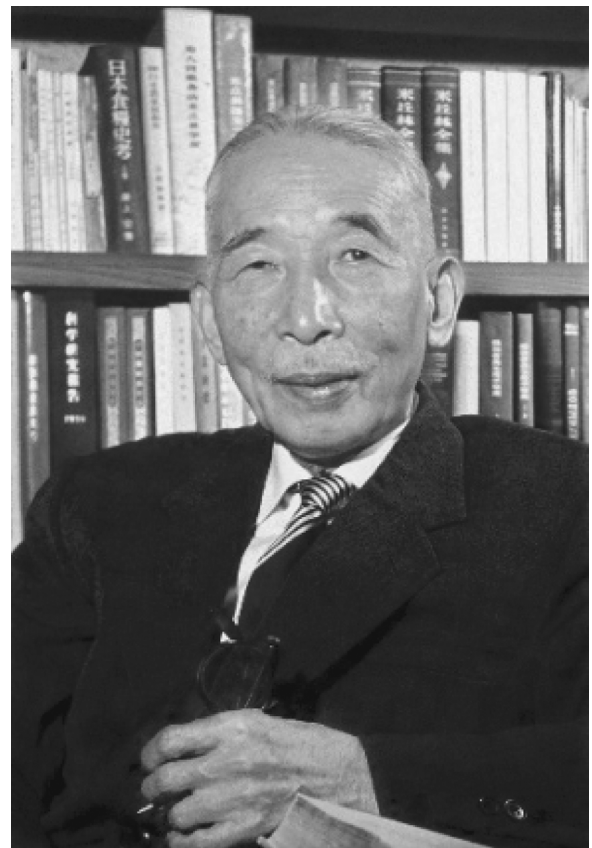
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Ding Ying (November 1888 to October 1964), an agricultural scientist, rice cultivation expert, and member of the Faculty of Chinese Academy of Sciences, dedicated his life to researching the origin, evolution, and classification of rice varieties; regional division of rice cultivation; and breeding and cultivation techniques of rice varieties (Fig. 1). It is Prof. Ding Ying who, for the first time in known history, transferred the wild rice germplasm resistant to harsh environments into cultivated rice varieties. This pathbreaking scientific research led to the successful cultivation of the rice variety “Zhongshan No. 1,” which has been in continuous production for half a century. By establishing the theory of rice variety polymorphism, Prof. Ding lays a theoretical foundation for variety selection, and improved variety breeding, purification, and renovation, which led to his reputation as “the father of China’s rice cultivation research.” In 2009, Prof. Ding Ying was awarded the honorary title of the “Role Model Working for Agriculture, Rural Areas and Farmers” on the 60th Anniversary of the founding of New China.

Throughout his whole life, Ding Ying has been practicing his promise of “striving to feed farmers.” In the words of the late Chinese premier Zhou Enlai, he is “an outstanding agricultural scientist for the Chinese people.” Seeking to gain more precise information about the “temper” of rice (properties of rice), he insisted on working in the paddy field barefooted. He was affectionately reputed by farmers as the “Rice Man.” Through his work in hybrid breeding, the output of rice significantly increased; and through his intensive and diligent study into the origin of rice cultivation, the arbitrary



**Figure 1.** Prof. Ding Ying during the 1950s in his South China Agricultural University Office. From “Brilliant Biography in SCAU Volume 1” by Y. Chen, 2019, Beijing: Science Press.

statement of “the Chinese rice variety originated from India” was clarified as unfounded.

Accepted 13 September 2024.

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## Determined devotion to agricultural sciences and striving for academic pursuit

In 1888, Ding Ying was born in an ordinary farmer's family in Gaozhou County, Guangdong Province. Poor as he was, Ding's father took on debts to ensure Ding Ying's access to education. In 1906, Ding Ying graduated from Gaozhou High School with straight A grades. Also in that year, the Qing government issued a decree for the Constitutional Reform and Modernization, leading to the construction of the Beijing–Zhangjiakou Railway and China's first airplane. Like many other educated Chinese youth at the turn of the 20th century, Ding Ying pondered earnestly the correct path to saving his country. Although he knew how difficult it was to study and work in agriculture at that time, Ding Ying had long been determined to study agriculture as a means to save the country. Considering that there were no specialized agricultural universities at the time, Ding Ying, after careful consideration, applied to study at the Department of Natural Sciences at the Guangdong Advanced Normal College. In 1912, he obtained the opportunity to study in Japan on a government scholarship. In 1914, after completing his preparatory studies at the Tokyo First Advanced College, Ding Ying returned to China; and in September of the same year, he passed the entrance examination for the Fifth High School in Kumamoto to continue his studies. Between 1912 and 1914, Ding Ying went to Japan three times to study agriculture. According to [Qiu Zhuang \(1989\)](#) in *The Soul of Grain-Rice Scientist Ding Ying*, during his study in Tokyo Imperial University (now the University of Tokyo) Ding Ying was the only Chinese student majoring in agriculture. Some “warm-hearted” students tried to talk him out of agricultural study, “Mr. Ding Ying, the study of agriculture means difficult and tiring work and a lifetime of poverty. What promising future could this path bring you? Why not change your major?” However, to everyone's surprise, he just smiled and replied, “Thank you for your suggestions. However, before I came to Japan, I had determined to work for agriculture and farmers. As a young man who has received higher education, I won't change my mind for any reason.”

## Intensive research in rice planting, pursuing truth in a down-to-earth manner

In 1924, Ding Ying returned to China and accepted the job offer in the Guangdong Public Agricultural School (the predecessor of the Agricultural College of the Sun Yat-sen University), where he taught while carrying out experiments. In the 1920s, many Chinese would rather believe in divinities than science, and few had any agricultural knowledge. Therefore, Ding Ying read through ancient agricultural books day and night, and wrote teaching handouts.

Dedicated to classification of rice breeding, Ding Ying proposed the classification system of two subspecies—Jing Rice and Xian Rice, as well as the varieties of cultivated rice. In 1926, Ding Ying found a wild cultivar of rice in a pond at the end of the Rhinoceros Road near the school, and he named it the “rhinoceros tail.” After reading a lot of ancient books, he discovered the book *Shuowen Jiezi*, written by Xu Shen during the Eastern Han Dynasty 2000 years ago, included Chinese characters of “秈” (non-glutinous rice, the predecessor of the character “粳”) and “秣” (long-grained rice) in the title. Based on preliminary research, he published two research papers in 1927 and 1928, entitled “The Origin of Crops in China” and “The Investigation into the Names of Cereal Crops,” respectively, proposing that rice originated in China.

Also in 1928, Japanese agronomist Shigemoto Kato discovered the differences between these two cultivars, and he named the long-grained rice widely cultivated in India as “indica rice” and the non-glutinous rice in Japan as “japonica rice.” Ding Ying was dissatisfied with this naming method, and proposed replacing them with the Chinese pronunciations of “粳” and “粳” as “Xian” and “Jing,” respectively. However, due to the restriction of the International Code of Botanical Nomenclature, the established scientific names could not be changed, and thus Ding Ying's proposal was not accepted. Thirty years later, Ding Ying published a paper titled “The Origin and Evolution of Cultivated Rice in China,” which was a huge hit in academia. With sufficient evidence, this paper corrected the erroneous conclusions that cultivated rice in China came from India, and that China's non-glutinous rice was from Japan. In 2011, DNA analysis again confirmed that rice originated in China. And in 2018, the Chinese names of “粳” and “粳” were restored in papers published in *Nature*.

Ding Ying studied different properties of rice cultivars grown in different regions and classified six major rice cultivation regions in China. Since 1927, Ding Ying has established six rice experimental sites by selling part of his ancestral property and setting aside part of his salary to rent land, hire workers, and selling green seedlings to sponsor his follow-up experiments. In the 1930s, it was popular in rice breeding to select good cultivars under superior water and fertilizer conditions, and fine cultivation management. However, he did not blindly follow the American fashion and instead believed that the local cultivars cultivated by Chinese farmers in the long-term production practice were the precious wealth of the motherland. Ding Ying instead transformed and utilized some of their features, as he believed this was the most pragmatic and effective way to either improve the existing cultivars or selectively breed new ones.

He first selected excellent individual plants from fine farm cultivars around the country, identified the local planting custom, and adopted the cultivation method

in the original areas during the selective breeding process. He paid special attention not only to the high yield but also to the phenotypic expression of the cultivars to select the best ones which can be promoted in the original production areas. Over more than 10 years, Ding Ying successfully developed more than 100 excellent cultivars, such as the typhoon-resistant “Tianjidu No. 7,” the fertilizer-saving “Heidu No. 4,” the drought-tolerant “Zhuzhan No. 1,” and the “Baigunuo No. 16” praised as “700-jin cultivar” by farmers given that it can realize the yield of 350 kg per mu.

In 1936, Ding Ying developed the world's first “thousands-of-ears” cultivar of rice with their heavy golden rice ears looking like scattered sorghum, based on a hybrid rice of a Guangdong farm cultivar of “Zaoyinshan” and the Indian wild rice with its largest ear carrying more than 1400 grains. This was a breakthrough in the academic research of rice. But he soon suspended this research as he found that the performance of seeds was not stable, and the backward farming method at that time could not satisfy the research conditions needed in rice production. Aiming to solve practical problems in production, Ding Ying decided to focus his efforts on the research of pragmatic issues in rice breeding to ensure people's basic living needs.

In 1938, Ding Ying successfully developed the best cultivar from dozens of cultivars crossed with the “rhinoceros tail.” He was excited to name it after the Sun Yat-sen University as “Zhongshan No. 1.” It was the world's first successful case of transferring genes by overcoming viruses and harsh environment to cultivate rice. This cultivar has been popularized and grown in Guangdong and Guangxi for 50 years. Zou Lu, the first president of Sun Yat-sen University, wrote a poem to praise this research, “Several decades of efforts at rice planting, rewarded with achievements known in South China. ‘Zhongshanbai’ well-received among farmers, high reputation of Ding Ying spread in rural areas.”

Ding Ying strived to promote the improved cultivars through various means. He established the “demonstration land” at experimental sites, asked students to take good cultivars back to their hometowns for trial planting, signed output contracts with farmers, and even promoted the mechanism of “seed exchange” where farmers exchanged ordinary rice cultivars with farms for better ones. In Guangdong and Guangxi, many farmers adopted his improved seeds, generally increasing production by 5%–25%. Therefore, Ding Ying became a famous “Rice Man” in the coastal southern region of China.

### Master of knowledge and action; lifelong bond with earth

With the sound of gunfire looming ahead in Guangzhou in 1938, the leadership of Sun Yat-sen University decided to

move the university westward to Chengjiang, in Yunnan province. As soon as he settled down in Chengjiang, Ding Ying started his survey investigating local farmers' practical farming experience, which laid a solid foundation for the completion of the book “Investigation of Rice Cultivation Methods in Chengjiang.”

In 1942, Ding Ying published the paper “Truly Scientific View of Agriculture,” in which he applied a critical eye to those who look down on farmers and traditional farming while intending to replace domestic empirical farming with foreign farming methods. He believed that agronomy should be classified as an applied science and there would be no sense for its existence if it could not be applied to any specific area in the physical world. In pure natural sciences, the secret of species transformation is not studied, the connections between natural and biotic conditions are not discovered, and the complicated rural economy is not discussed. However, all of these above issues need to be analyzed through real and conventional empirical farming methods by agriculturists engaged in applied sciences.

Due to customary field trials year after year, Ding Ying developed a habit of “patrolling the field.” He would roll up his trousers and work in fields with farmers and students (Fig. 2). During one investigation, on seeing a small plot of withered rice plants, Ding Ying was immediately about to squat and take off his shoes to go into the fields. Considering his age, his assistant hurried to the field and dug the whole plant to show him. But he said, “You'd better step on the soil, touch the rice root, and feel the tenderness and air permeability of soil texture on your own, before you estimate the degree of salinity. Practical work on one's own will often bring different results from those of indirect observation.”

The former Minister of Agriculture Mr. He Kang spoke highly of Ding Ying: “He has been adhering to the combination of scientific research, production and teaching, the cooperation between laboratories, experiment stations, and rural bases, and the integration of experiment, demonstration, and promotion (Fig. 3). He attaches great importance to traditional farming methods, farmers' experience, and scientific experiments, paving a new way for the research of agricultural sciences.”

### Rigorous scholarship and wholehearted devotion

In terms of scholarly research, Ding Ying insists that one should be responsible for science and production when publishing papers. When writing an article, he insists on doing proofreading on his own despite its triviality. By doing so, he believes he can find out the mistakes probably made by typists, and more importantly, this provides him a self-corrective opportunity, as one small error may ruin all the effort undertaken.



**Figure 2.** Ding Ying (third from left) and his student Lu Yonggen (third from right) together observing rice growth in the field. From "Brilliant Biography in SCAU Volume 1", by Y. Chen, 2019, Beijing: Science Press.



**Figure 3.** In 1963, Ding Ying guided scholars in the darkroom of the rice ecological building testing the critical light length for growing rice varieties. From "The 120th Anniversary of Ding Ying's Birthday," South China Agricultural University, 2008.

"The Historical Origin and Development of Rice Cultivation Methods in China" published in 1926 carries considerable weight. Having asked experts in history, philology, anthropology, and taxonomy for advice, he

proposed the innovative method of systematic classification of rice in this article after careful observation and verification. It took him 31 years to complete this paper, which was not finalized until 1957.

Ding Ying often said, “Science research is objective work. Scientists should openly listen to opposing opinions without being burdened by preconceived assumptions or prejudices.” As a scholar of the Morgan school, Bao Wenkui came up with a bold idea of cultivating the latest-maturing Guangdong rice cultivar in the southernmost place Yaxian (today’s Sanya) in Hainan province. This may turn it into early rice with a shortened period of growth due to different light conditions. The theory was greeted by extensive doubts from other scientists including Ding Ying. As a man of deeds rather than words, Ding Ying soon went to Yaxian to conduct relevant experiments. Bao’s theory was proved correct by the result of experimentation a year later. As soon as he returned to Beijing, Ding Ying talked with Bao and fully affirmed his assumption. And this became a far-spread story at that time in the agricultural research community. Ding Ying believes that regardless of schools, facts conform to the truth only if they stand the test of practice.

According to Qiu Zhuang in *The Soul of Grain-Rice Scientist Ding Ying*, Wang Lianzheng, the former president of the Chinese Academy of Agricultural Sciences (CAAS), spoke of Ding Ying as follows: “Being a steady worker, he is strict in scientific studies, plunges into practical work, and seeks truth from facts. He is unassuming and sees to everything himself. When it comes to academics, he often talks the talk and walks the walk with humility, seriousness, and adherence to truth.”

### Professional demeanor and lasting influence

Reviving Chinese agriculture and cultivating agricultural talents are Ding Ying’s lifelong pursuits. He often said “Learn more about farming, love agriculture and make appropriate contributions” to encourage colleagues and students. From the late 1930s to early 1940s, Ding Ying had been working in Sun Yat-sen University even when the university had to be relocated three times. In 1940 (during its second move to northern Guangdong), Ding Ying was promoted to Dean of the College of Agriculture. He was like a magnet attracting a group of top Chinese experts to teach at the Sun Yat-sen University, which significantly facilitated the talent pool in the College of Agriculture. Prof. Ding not only attached great importance to talents but also the cultivation of talents. A large number of well-known agricultural researchers, including Prof. Huang Yaoxiang, Prof. Lu Yonggen, and Prof. Wu Zhuonian, were all students of Prof. Ding Ying.

In 1952, South China Agricultural College (today’s SCAU) was founded through the merger of the Agricultural Colleges of Sun Yat-sen University, the Agricultural College of Lingnan University, and part

of Department of Animal Husbandry and Veterinary Medicine and Department of Disease and Insect Pest, College of Agriculture, Guangxi University. That same year, Ding Ying was elected as the first and founding president of the university. In 1957, he was recommended to be the first president of CAAS. In 1963, the first ecological rice lab supported by these three colleges under his suggestion was established in China. He personally presided over the ambitious research project “A Study of the Sensitivity of Rice Strains for Temperature and Photo Period.” This ambitious research was conducted in 10 pilot areas of eight provinces within 3 years, with 157 representative strains selected as research samples.

There is a famous saying from Ding Ying, “A sincere scientist should also be a sincere laborer.” When people talk about Ding Ying, they often say, “Prof. Ding is honest, simple, amiable, and treats others as equals.” When planting rice seedlings with farmers, Ding Ying always said, “Barefoot! Hurray!”

He went on a field trip in Yunnan province in 1960 when he could only make it on foot because the mountain road was too narrow for cars to pass. Everyone warned him of the dangerous path going to the village, but he insisted on going there and it took him a day to arrive at the village. He said with a smile, “Never have I walked so long in a day. But my word is my bond. This is the least of virtues.” On that year, he was already 72.

When he was over 70, his health began to spiral downwards. In 1960 he suffered decreased vision in his right eye, so he had to read books and newspapers with the help of a magnifying glass. Working 12 hours in a day was his normal routine then. In the year prior to his departure, he went to all the forefronts of production, for instance, Shanxi, Shaanxi, and Xinjiang. Wherever he went, all he did was ask, observe, and write. He often pressed his right hand against his distending painful liver and staggered along the fields. When taking part in a symposium, he pressed his stomach while taking notes and answering questions patiently with clenched teeth. A 75-year-old senior as he was in 1963, Ding Ying still insisted in stepping into the paddy field to observe the influence of snow water irrigation on the growth of rice roots, during his investigation in China’s northwestern rice cultivation region. However, as long as he finished this trip, he gradually lacked in physical strength and became more and more vulnerable.

In the 28th day before he passed away, when Ding Ying was investigating rice planting growth in saline soils in Linyi, Shandong, acute symptoms appeared accompanied by a sharp pain in his liver, making it difficult to eat. The sharp pains were accompanied by a lingering high fever. He was sent to a hospital in Beijing and after a week he was diagnosed with advanced liver cancer. He passed away at the age of 76.

In the Chinese imagination, Ding Ying resembles characteristics of the rice fields he cultivated by himself. He is not afraid of cold or drought, instead remains extremely resilient and highly productive. He stands upright but looks down at the earth, lowering his head just like every full rice grain does.

### Conflict of interest

None declared.

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