A leader in the field

Reaping the benefits of HZAU's agricultural expertise

Biology is a key strength of Huazhong Agricultural University (HZAU) and the bedrock of its development plan. By building a training base for emerging life science talent and attracting world-class biological scientists, HZAU seeks to integrate traditional agricultural methods with modern biological science and become a leader in agricultural biology innovation.

Having launched its microbiology programme in the 1940s, HZAU consolidated its ambition between 1987 and 1993 by setting up a biotechnology centre to build a pipeline for application of its research, and establishing master's and doctoral programmes in molecular biology. Now the university's roadmap covers everything from molecules and cells to individual crops and animals. It is geared to embrace theoretical and applied innovations. The programme has also established a complete biological training system covering the path from undergraduate to doctoral studies.

Focusing on major staples, including rice, corn and soy, as well as essential agricultural microorganisms, HZAU researchers stand apart in research on crop functional genomics, heterosis and male sterility, crop-associated microbes and diseases, and the interactions between microbes, crops, pests and the agricultural environment. A group of HZAU experts have set up an advanced technology platform for functional rice and corn genomics research. Studies to identify the molecular mechanisms behind the hybrid sterility between *indica* and *japonica*, two subspecies of cultivated rice, have strengthened the hybrid, improving rice yield.

The theory and practice of 'green super rice', proposed by HZAU researcher, Zhang Qifa, demonstrates a new sustainable crop breeding model, bringing a shift in aim and approach.

HZAU researchers have also made breakthroughs in the prevention and treatment of crop diseases and pests by using beneficial microorganisms; the treatment of animal waste; microbial fuels; biological remediation of soil contaminated by heavy metals, and the biological treatment of water with excess minerals and nutrients.

These achievements in biological sciences have led to 700-plus papers in journals listed in the Science Citation Index (SCI), including high-impact titles, two national natural science awards, and 135 awarded patents between 2012 and 2016. With 510 projects in the field within five years, research budgets have amounted to 713 million RMB.

HZAU biology is also making a mark in the global academic community, hosting conferences on plant biology, microbiology and integrated biology. It launched the international rice functional genomics conference.

It has also established joint laboratories and training programmes with renowned research institutions and universities, such as the Donald Danforth Plant Science Center and the University of Arizona in the United States, and the University of Birmingham in the United Kingdom.

There are plans to increase the societal impact of HZAU's work by developing new technologies to address major agricultural development problems in China and around the world. ■

HZAU researchers use the latest genetic and genomic tools to breed productive crops.

ADVERTISEMENT FEATURE

The master of oil crop breeding

Fu Tingdong is a shining star in rapeseed breeding. The 80-year-old HZAU professor, a member of the Chinese Academy of Engineering, can often still be found in rapeseed fields, studying his hybrids which provide food for many.

Fu is head of the National Engineering Research Center of Rapeseed. He did his undergraduate and graduate studies at HZAU and has been devoted to oil crop studies ever since. In 1975 he developed a self-incompatible line of *Brassica napus* and its hybrids, a first in China, and a major breakthrough in oil crops.

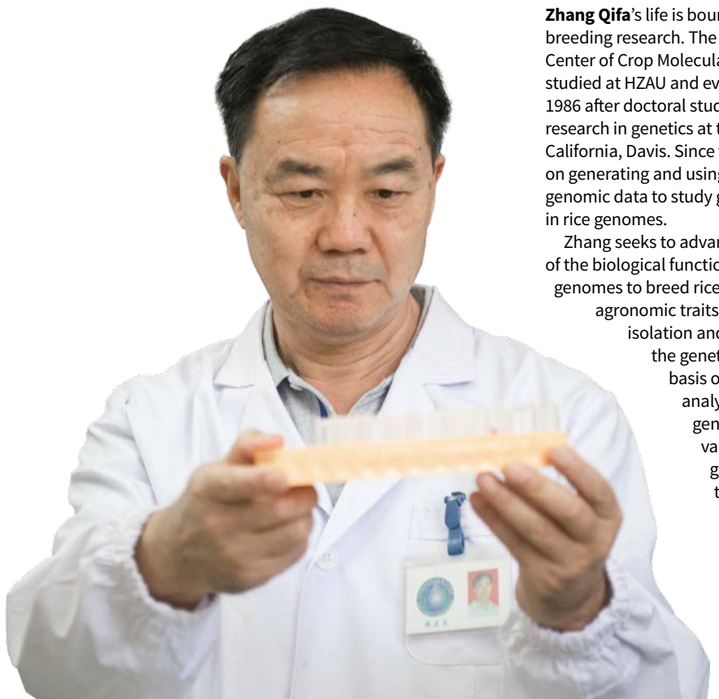
Fu came to fame for his discovery of the Polima (Pol) cytoplasmic male sterility (CMS) system. While CMS is a maternally inherited failure to produce functional pollen, it presents a tool for producing hybrid seed in rapeseed. Fu's Pol CMS system is recognized as the first to have practical value for rapeseed hybrid breeding, and is widely used in China and abroad. It was estimated that in 2001, 61% of the rapeseed cultivated in the United States were Pol CMS hybrids. In China now, Pol CMS hybrids account for 60% of planted rapeseed hybrids.

Fu's breeding strategy harnesses hybrid strength to develop double-low (low erucic acid and low glucosinolates) rapeseed, leading to the development of high-yield hybrids with improved traits. He bred 15 rapeseed hybrids, including Huaza 62, which are planted in more than 200 million mu (13.3 million hectares) of farmland each year.

Fu is a recipient of the Eminent Scientist Award, the highest honour in rapeseed research from the International Consultative Group of Research on Rapeseed (GCIRC). He also won the Agricultural Science Award from The World Academy of Sciences (TWAS), and many other domestic and international honours.

Fu's latest work focuses on succession cropping of fodder rapeseed after rice or wheat. His technology is being tested and promoted across China, providing a potential avenue for the development of livestock husbandry. ■

The brain behind the super grain



Zhang Qifa's life is bound to crop genetics and breeding research. The head of the National Center of Crop Molecular Breeding, Zhang studied at HZAU and eventually returned in 1986 after doctoral study and postdoctoral research in genetics at the University of California, Davis. Since then, he has focussed on generating and using the wealth of genomic data to study genes and interactions in rice genomes.

Zhang seeks to advance understanding of the biological function of rice genes and genomes to breed rice with improved agronomic traits. His work on the isolation and cloning of key genes, the genetic and molecular basis of heterosis, and his analysis and mining of genetic resources of crop varieties have led to genomic technologies that improve crop performance.

Zhang proposed the idea of 'Green Super Rice', aimed at producing high and stable yields of nutritious rice using less land, water and much fewer pesticides and fertilizers. His strategy is to first identify genes for desired traits through functional genomic study and then incorporate them into breeding lines using genomic selection, and cross lines with similar genetic backgrounds to develop rice combining preferred genetic traits.

Zhang has been leading the efforts in national projects on rice functional genomics research and to develop green super rice. The projects have now identified hundreds of genes for beneficial traits, leading to high-yielding varieties with enhanced disease, pest, and stress resistances. These varieties are now widely cultivated in China's rice growing areas.

Zhang, a member of the Chinese Academy of Sciences, the US National Academy of Sciences and TWAS, has received many awards, including the award from the International Crop Science Society and the National Natural Science Award. As China's pioneer in the functional genomics studies of rice, he is guiding the development of green super rice. ■

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