

# Crop Cultivation and Physiology Innovation Team of the Chinese Academy of Agricultural Sciences

The Crop Cultivation and Physiology Innovation Team of the Chinese Academy of Agricultural Sciences is a research group focused on crop physiology and ecology and associated with the Ministry of Agriculture and Rural Affairs. Based on the needs of industry and the direction of technological developments, the research mainly focuses on the innovations and integration of basic theories as well as the application of key technologies of corn cultivation and physiology. The team has chaired a number of projects such as the National Key Research and Development Program, the National Natural Science Foundation of China and the "973" program during the "13th Five-year Plan". More than 40 experimental sites are located in the main corn-producing area of China. Outstanding improvements have been made in theoretical innovation, technology research, agronomist training, and science promotion and popularization.

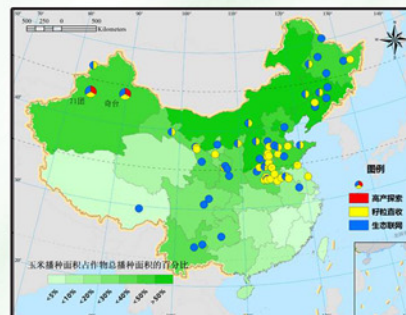
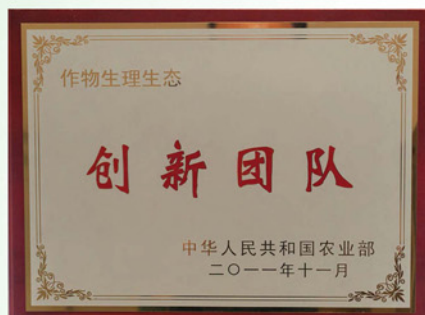


Figure 1 Crop Cultivation and Physiology Innovation team of the Ministry of Agriculture and Rural Affairs of China and experimental stations

Prof. Shaokun Li is currently the Director of Crop Cultivation and Farming Center and is also the Chief Expert of the Crop Cultivation and Physiology Innovation Team of Chinese Academy of Agricultural Sciences, the Chief Scientific Popularizing Expert of National Crop Science, the Group Leader of the National Corn Cultivation, the Chief Expert of Corn Science and Technology in the Ministry of Agriculture and Rural Affairs, and the Expert of Corn Cultivation in the Modern Agricultural Industry Technology System. He has published more than 240 academic papers in prestigious domestic and foreign journals, including more than 80 SCI papers. In addition, he has published 12 scientific and technological books and 30 technical posters, formulated 26 technical regulations and standards, applied for 23 patents including 13 invention patents, and obtained 27 software copyrights. He also won the honorary titles of the first round of Outstanding Agricultural Scientific Research Talents of the Ministry of Agriculture, National Outstanding Scientific and Technological Workers and was rewarded the special allowance of the State Council. In 2017, he was awarded the 1st session "Scientific Innovation and Advancement Award" medal.



Figure 2 Chief scientist Li Shaokun was awarded the National Innovation Competition Medal in 2017

Figure 3 Shaokun Li guided the field experiment and introduced advanced cultivation technologies to agronomists in the field

The innovation team has been continuously exploring the corn yield potential since 2004 through theoretical research on the characteristics of hybrid varieties, ideal canopy structure and regulatory approaches, density tolerance and competition among varieties of dense planting and high-yield conditions. The team proposed breakthrough approaches to achieve high yield by dense planting, increase dry matter production at post-flowering and high-quality population regulation and then built a theoretical basis for dense planting and high-yield cultivation of corn. A dense planting and high-yield technology system suitable for modern corn production was developed with regional practices, selection of dense-tolerant varieties, determination of suitable planting density and sowing date, precision seeding, high-quality canopy regulation technology, water and fertilizer management, and suitable harvest time. This team broke the national high yield record six times, in 2009, 2011, 2012, 2013, 2017 and 2020, respectively. The yield record of 1517.11 kg/666.7 m<sup>2</sup> was obtained in 2017, providing a grain yield breakthrough of "one and a half tons" per mu in a single season. In 2020, a new record of 1663.25 kg/666.7 m<sup>2</sup> was obtained, improving the corn yield potential by 560 kg/666.7 m<sup>2</sup>. The application of this technology has repeatedly provided high-yield records across China and major producing provinces, and the high-yield approaches and vital technologies of corn have been verified.

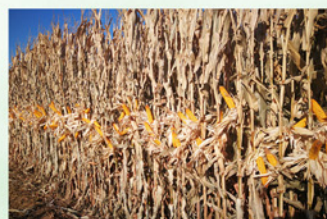


Figure 4 Precision mechanized seeding, growth and development of dense-planting corn in the field (Qitai, Xinjiang).

Figure 5 High yield records of 1517.11 kg/666.7 m<sup>2</sup> in 2017 and 1663.25 kg/666.7 m<sup>2</sup> in 2020

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Large-scale, intensive, mechanized, and high-quality production will surely become the mainstream method of corn production in China in the future, and the Crop Cultivation and Physiology Innovation Team has been the first to perform research on and application of vital technologies for mechanical corn harvesting in China since 2010. The obstacles to mechanical corn harvesting have been clarified through tens of thousands of samples from experimental demonstration bases across more than 20 major corn production provinces, and the basic principles of selecting early-maturing and fast-dehydrating varieties, shortening the growth period and dense planting have been established. The technological system of mechanical grain harvesting that is suitable for corn production needs in China was constructed by an evaluation and selection approach, guiding breeding direction, and selecting varieties that are suitable for different ecological conditions, thereby achieving high-quality mechanical grain harvesting. Vital technologies such as selecting suitable mechanical grain harvesting varieties, dense planting and lodging resistant cultivation, standardized row spacing planting and appropriate harvesting dates were developed. In 2017, a record of 1229.8 kg/666.7 m<sup>2</sup> (total of 700 hm<sup>2</sup>) was achieved, with a net profit of 1110 yuan/666.7 m<sup>2</sup>, in 71 Regiment in Xinjiang with a large-scale and standardized full mechanization approach, realizing the synergy of high yield and high efficiency and establishing a successful case for the transformation of corn production to increase efficiency and develop modern corn production.



Figure 6 Field observation, demonstration activity and key technologies of mechanical corn grain harvesting

In recent years, the "Research and Application of Dense Planting and High-Yield Full Mechanization Green Production Technology of Corn" and "No-tillage Planting Technology of Corn" developed by the team have been selected as the main national corn technology for many consecutive years. The "Dense Planting and High-Yield Full Mechanization Green Production Technology of Corn" was rated as one of the year's top ten "China Agricultural New Rural Technologies", thus improving the competitiveness of corn industries and establishing a modern corn production technology. The "Research and Application of High-Yield and High-Efficiency Production Theory and Technical System of Corn" and "Corn Field Planting Handbooks and Wall-charts" completed by the team won the 2nd prize in "The State Scientific and Technological Progress Award" in 2011 and 2015, respectively. In 2019, the Crop Cultivation and Physiology Innovation Team of the Chinese Academy of Agricultural Sciences won the "Innovation Team Award of Shen-nong China Agricultural Science and Technology Award". The "Research and Application of Dense Planting and High-Yield Full Mechanization Green Production Technology of Corn" developed by the team won the "Agricultural Technological Extension and Corporation Award of Harvest on Agriculture, Animal Husbandry, and Fishery Award" from the Ministry of Agriculture and Rural Affairs (MARA). The "Research and Application of the Key Techniques of Mechanical Grain Harvesting for Corn Planting in Northwest Irrigation Region" won the 1st prize for "Science and Technology Progress in the Xinjiang Uygur Autonomous Region". The "Research and Application of the Key Technology of Mechanical Grain Harvesting of Summer Corn in Huang-Huai-Hai Plain" won the 2nd prize for "Scientific and Technological Achievements Award of Harvest on Agriculture, Animal Husbandry, and Fishery Award" from MARA, and the "Research and Application of the Key Technology of Mechanical Grain Harvesting for Corn" won the "Crop Science Award of the Chinese Crop Society".



Figure 7 Certificate of the "Shen-nong China Agricultural Science and Technology Award"



Figure 8 Certificates of "National Prizes for Progress in Science and Technology" in 2011 and 2015

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