

Nanjing Research Institute for Agricultural Mechanization, Ministry of Agriculture and Rural Affairs (NRIAM): Agricultural Product Harvesting and Post-production Processing Engineering Technology Innovation Team

The “Agricultural Product Harvesting and Post-production Processing Engineering Technology Innovation Team” is part of the NRIAM. The team consists of outstanding scientific and technological innovation experts in the domestic agricultural machinery industry. The team is led by chief scientist Professor Zhichao Hu. As a leading field researcher and doctoral supervisor, Professor Hu has been awarded the title of “Jiangsu Province Young and Middle-aged Chief Scientist”, “Top Ten Outstanding Inventors in Jiangsu Province”, “Jiangsu Province’s Outstanding Experts”, “Nanjing Top Ten Technology Stars”, “State Council Special Subsidy Specialist”, “National May First Labor Medalist”.



Prof. Zhichao Hu

He is currently Party Secretary and Deputy Director of the NRIAM; Director of the National Peanut Industry Technical System Mechanization Research Office; Director of the Southern Seed Processing Engineering Technology Center of the Ministry of Agriculture and Rural Affairs; Director of the Academic Committee; team leader of the agricultural machinery science and technology innovation harvesting mechanization group, and leader of the peanut specialty group in the mechanized advancement group of the Ministry of Agriculture and Rural Affairs.

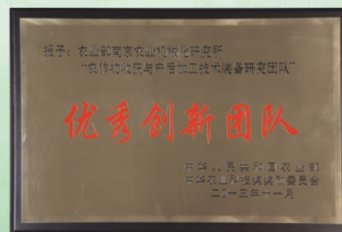


The technological innovation team is primarily engaged in four research areas: (1) key technologies and equipment for mechanized harvesting of submerged fruits; (2) key techniques and equipment for high-quality, smooth, and tillage-free sowing; (3) residual membrane fouling mechanization prevention and control technology equipment; (4) complete sets of seed processing technology and equipment applications.

Currently, the team consists of 32 researchers with Master’s or higher postgraduate qualifications, including three field-based postdoctoral fellows, five research fellows, 12 associate

research fellows, four specialists in mechanical research for the national industrial technology system (including three directors), two State Council Special Subsidy Specialists, two chief experts, one youth chief scientist, one youth and technology leader, and four science and technology leaders from Jiangsu Province.

In recent years, the innovation team has completed 16 national-level, provincial-level and ministerial-level scientific research projects, made a number of major scientific and technological achievements, secured 56 national invention patents, published two monographs and 246 journal papers, and invented more than 20 new agricultural machinery products. Among these accomplishments, two are of leading positions worldwide, with one attaining the advanced international level. The team has been awarded Second Prize for National Technical Invention, as well as three first and seven second prizes at the provincial and ministerial levels. The team has also been awarded the titles of “National Worker Pioneer” and “Chinese Agricultural Science and Technology Outstanding Innovation Team.”



Contact persons: Zhichao Hu, Chief Scientist of Agricultural Product Harvesting and Post-production Processing Engineering Technology Innovation Team, Nanjing Research Institute for Agricultural Mechanization, Ministry of Agriculture and Rural Affairs, Tel: +86-25-84346256, Email: zchu369@163.com; Fengwei Gu, Associate Researcher. Tel: +86-25-84346256, Email: gfwsl@163.com.



Key Technologies and Instruments of Peanut Mechanized Harvesting, NRIAM

China is the world's largest producer and consumer of peanuts. Mechanized harvesting of peanuts in China is challenging, mainly due to the vast areas of peanut cultivation, diverse soil types, multiple peanut species, and adoption of plantation with plastic film. In 2009, peanuts harvested by machine comprised only 18.02% of the total peanut harvest in China. The development of the peanut industry is severely hampered by the low level of mechanized harvesting application. Long-term development of mechanized peanut harvesting technology in China has been slow due to three major technical bottlenecks: (1) High breakage rate and interrupted workflow due to film winding during peanut picking; (2) Large losses of buried peanuts due to serious soil obstruction during excavation and picking; (3) Seedling and film hanging, serious screen blockage, and poor cleanliness during cleaning. These three problems have severely constrained the development of mechanized peanut harvesting technology in China.

After over a decade of research and development, the Agricultural Product Harvesting and Post-production Processing Engineering Technology Innovation Team from the Nanjing Research Institute for Agricultural Mechanization, Ministry of Agriculture and Rural Affairs has made some original technological breakthroughs: (1) Invention of the vertical fruit harvesting technique with soft picking to prevent winding, and horizontal fresh seedling feeding, solving the problems of film winding, low pick-up rate, and high breakage rate during picking and achieving smooth operation; (2) Invention of profile modeling and shovel depth-limiting seedling picking, self-balancing vibration, double-roller vibration, and soil side release techniques, solving the problem of large losses of buried peanuts due to serious soil obstruction during excavation and picking; and (3) Invention of the non-blocking double-air-system all-size selection and cleaning technique, solving the problems of seedling and film hanging, serious screen blockage, and poor cleanliness during combined harvesting, selection, and cleaning. Based on the above new techniques, technological integration and innovation, the team invented a half-feed peanut combine harvester (Fig. 1), as well as three types of peanut segment harvesters (Figs. 2–4). These technical instruments for peanut harvesting have been promoted and applied in more than 20 provinces, such as Henan, Shandong, Hebei, Jiangsu, Hubei, and Liaoning. With a domestic market coverage of approximately



Fig. 1 4HLB-2 half-feed peanut combine harvester



30%, these instruments have become the main and leading products of China's peanut harvesting machinery market, and have been exported to India, Vietnam, and other countries.

The resulting overall technology is of a leading international level, and it has solved the three major technical problems of mechanized peanut harvesting, filled in multiple technological gaps, and promoted the progress and development of peanut harvesting technology in China. It also provides effective references for research and development of harvesting equipment for other submerged crops, such as potatoes and garlic heads. Additionally, since the introduction of this technology, the level of mechanized peanut harvesting in China has been greatly improved; the technology played an important role in promoting the level of mechanized peanut harvesting in China from 18.02% in 2009 to 30.16% in 2015. These achievement relieved the pressure of unemployment in society, promoted development of the peanut industry, and improved the farmers' quality of life. The technological advancements are critical in addressing the urgent need for peanut production in China, leading the industry in innovation, and ensuring domestic oil supplies.

To meet the requirements of large-scale production owing to implementation of the new land policy, the team has continued to innovate, explore, research, and develop peanut mechanized harvesting technologies and equipment, and has successively invented the world's first half-feed quad-row peanut combine harvester (Fig. 5), as well as China's first full-feed eight-row peanut combine harvester (Fig. 6), further promoting and leading the development and technological advancement of mechanized peanut harvesting.



Fig. 5. Half-feed quad-row peanut combine harvester



Fig. 6. Full-feed eight-row peanut combine harvester

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