주제-03

Situation and Challenges of Rice Production and Breeding in China

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China is one of the biggest country of rice production, and also a large country of rice consumption, more than 50% of Chinese population rely on rice as the staple food. With the increasing of population and the opening of world grain market, People's demand for rice will continue to grow. Therefore, it is necessary to emphasis the important role of rice production and breeding in agriculture sustainable development, which have important strategic significance to solve the contradictory between food supply and demand in China and even the world, and ensure national food security.

1. Rice production

China's superiority rice cultivation regions are mainly distributed in the Yangtze River Basin, the southeast coast areas and the northeast region. In 2018, the rice cultivation area in China was 30.189 million hm^2, accounted for 25.79% of the total grain crops. With the demand of rice consumers for high-quality *Japonica* rice increasing, the cultivation area of *Japonica* rice tends to increase year by year, which accounted for about 32% of the total rice area. In 2018, the hybrid rice total cultivation area was 14.33 million hm^2, the conventional rice total cultivation area was 14.93 million hm^2, the area of hybrid rice accounted for 48.97% of the total rice area. The cultivation area of hybrid rice has grad ····· ually decreased, and the cultivation area of conventional rice has gradually increased in the past ten years, which was mainly due to the increase of *Japonica* rice cultivation area and direct-seedling cultivation rice area in China. Two-line hybrid rice cultivation area has been gradually increased, its accounted for the proportion of hybrid rice area increased to 22.5% in 2010 and 34.4% in 2014 from 0.92% in 1996. Rice yield per unit area and total yield increased year by year, the rice total yield reached 212.13 million ton in 2018, accounting for 32.24% of total grain output, increased by 12.89% compared to 2000; rice yield per unit area was 7020.0 kg/hm^2, increased by 11.94% compared to 2000. The continuous increase of rice yield per unit area and total yield have played an important role in the development of China's society and economic stability.

2. Rice breeding

During the 1950s and 1960s, China has successfully bred dwarf rice varieties including Aijiaonante, Guangchangai, Taizhongzailai 1 and so on, which were solved the reduction of rice yield caused by lodging and promoted the rice yield increased by 30%-50%, and realized food self-sufficiency. In 1964, China took the lead role in rice heterosis utilization research. In 1973, the male sterility of wild rice resources was used and achieved the "three lines matching" in China, which were applied in production and promoted the rice yield per unit area increased by more than 20% compared to dwarf varieties, known as "the Second Green Revolution" of rice production. China's hybrid rice is a major achievement in the history of agricultural development in the world, it has made an important contribution to the development of rice industry in China and even all over the world. However, in the middle of 1980s, China's rice breeding was in the climbing stage, rice yield per unit area failed to make progress in more than ten years. In order to achieve the breakthrough in rice breeding, Chinese government started the project of super-high-yield rice breeding in 1996, and established the breeding goal in three periods, which the average of yield per unit of single cropping rice every five-years could achieve 10.5 t/hm^2, 12.0 t/hm^2 and 13.5 t/hm^2 in 2000, 2005 and 2010 respectively. In the breeding of northern *Japonica* rice, many super rice varieties of northern *Japonica* rice such as Shennong 265, Shennong 606, Jijing 88, Jijing 83, Longjing 21, Longjing 31 and so on had been successfully bred through the methods of sub-species hybridization and geographically distant hybridization, taking multiple cross and backcross, combining the new plant type and strong heterosis, optimizing the combination of traits, aggregating favorable genes. In the breeding of hybrid rice, many super hybrid rice combinations including Liangyoupeijiu, Fengliangyou 1, Yangliangyou 6, Y liangyou 1, Shenliangyou 5814, Y liangyou 900 and so on had been successfully bred by the methods of two-line hybrid, taking the advantage of wide compatibility materials and PTGMS materials, combining the improvement of morphological and heterosis level, which exceeded the expected target of super high yield breeding plan in 2000, 2004 and 2011 respectively. In the 2010-2014, the average of national rice yield per unit area (6.74 t/hm^2) increased by 6.42% compared to 2000-2004 (6.20 t/hm^2); in the 2010-2014, the average of northeast *Japonica* rice yield per unit area (7.56 t/hm^2) increased by 12.62% compared to 2000-2004 (6.60 t/hm^2).

3. Prospect

Up to now, significant achievements of rice breeding and production have been made in China, however, which are still facing serious challenges to national food security and ecological security. The genetic basis of parental materials used in breeding is narrow at present, which is one of the biggest "bottleneck" in the sustainable development of rice breeding and production. Nowadays in order to improve rice yield, expanding the genetic basis of parent materials in grain quality, disease resistance and abiotic tolerance is a top priority. In the future, we should actively explore elite germplasms of rice landraces and wild rice carried with beneficial genes which could be applied for rice breeding to broaden the genetic base of breeding materials. At the same time, in order to meet the demand of Chinese rice farmers and consumers for rice varieties, we should combine the conventional breeding technique with molecular breeding technology, meanwhile improve the grain quality and comprehensive resistance of rice improved varieties, including the resistance to disease, insect, and the resistance to abiotic stress as well as the ecological environmental adaptability.