celerate the development of a generally affluent society in the reservoir region. We should give priority to the re-establishment and protection of the ecological environment; ensure the effective protection of this national strategic fresh-water resource pool; and strengthen our observation and treatment of impounding influences, making use of advantages while striving to avoid disadvantages. We should also enhance our integrated management, optimize our regulation, and improve our ability in and level of scientific management for the Three Gorges Project. In this way, we can ensure the long and safe running of the dam and sustain its comprehensive benefits; drive economic and social development in the Three Gorges region, enabling the development of a harmonious society; improve the ability of the Three Gorges Project to serve the national economy and nation-wide social development; and thus provide improved benefits to the people.

Development of Super Hybrid Rice for Food Security in China

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By Longping Yuan

The current population in China is over 1.3 billion and will reach 1.4 billion soon. Meanwhile, China's arable land is decreasing year by year. Facing such a severe situation of population-growth pressure plus cropland reduction, it is obvious that the only way to solve the food shortage problem is to greatly enhance the yield level of food crops per unit of land area through advances in science and technology. Thus, we are currently carrying out three yield-increasing projects.

1 Project No. 1: Developing a super high-yielding hybrid rice variety (16 t·hm^{-2})

The development of higher and higher crop yields is an eternal pursuit. Rice is the number one grain crop in both China and the world. In order to substantially increase rice yield, Japan took the lead in initiating a super high-yielding rice breeding program that was targeted to raise rice yield to 12 t·hm^{-2} within 15 years. However, this target has not yet been realized, after 34 years. Next, the International Rice Research Institute (IRRI) launched a program to develop super rice in 1989, which was later altered into a new plant-type breeding program, with the target of developing a super rice yielding 12–12.5 t·hm^{-2} by 2000. However, this target was not reached either. Evidently, it is extremely difficult to develop a super rice yielding 12 t·hm^{-2}.

In order to meet the food demand required by the Chinese people in the 21st century, a super rice breeding program was set up by the Ministry of Agriculture and the Ministry of Science and Technology in 1996 and 1997, respectively. This program was divided into four phases. The yield targets are listed below (based on an average yield at a location with 6.7 hm^2 or 100 mu, where 1 mu = 1/15 hm^2):

Phase I: 1996–2000 10.5 t·hm^{-2} or 700 kg·mu^{-1}
Phase II: 2001–2005 12 t·hm^{-2} or 800 kg·mu^{-1}
Phase III: 2006–2015 13.5 t·hm^{-2} or 900 kg·mu^{-1}
Phase IV: 2016–2020 15 t·hm^{-2} or 1000 kg·mu^{-1}

Through morphological improvement plus the utilization of inter-subspecific heterosis, as well as the unceasing efforts and collaborative work of our research team, all of the yield targets to date have been fulfilled one by one, either on schedule or ahead of schedule. The representative variety of Phase I, named *Liang-you-pei-jiu*, was co-developed by the Jiangsu Academy of Agriculture Sciences and the Hunan Hybrid Rice Research Center. This variety was released to large-scale commercial production in the first few years of the 21st century, with a highest annual planting area of nearly 10 million mu and an average yield of 550 kg·mu^{-1}. The representative variety of Phase II, *Y Liangyou 1*, was planted over 8 million mu in 2014, with an average yield of around 600 kg·mu^{-1}; and the representative variety of Phase III, *Y Liangyou 2*, yielded 926.6 kg·mu^{-1} at a 100 mu demonstration location in Longhui County, Hunan Province, in 2012. The latter variety began to be commercialized in 2013, and the planting area reached 1 million mu in 2014, with a higher yield of 650 kg·mu^{-1}. The representative variety of Phase IV, *Y Liangyou 900*, yielded over 1000 kg·mu^{-1} at four locations covering 100 mu each, and yielded 1026.7 kg·mu^{-1}(15.4 t·hm^{-2}) in Xupu County, the highest yield of rice in the world to date. It is predicted that

Figure 1. The *Super 1000* variety in the trial field in Sanya, Hainan.

China National Hybrid Rice R&D Center, Changsha 410125, Hunan

variety can produce a further yield increase of 50 kg·mu^{-1} in large-scale commercialization.

Theoretically, rice still has a huge yield potential to be tapped. Currently, we are struggling to breed hybrid rice varieties with a target yield of 16 t·hm^{-2}. A very promising variety, *Super 1000*, has recently been bred successfully with this target yield. On April 9, 2015, a field workshop was held in Sanya, Hainan Province. More than 300 rice experts and personnel from the seed industry witnessed and were excited by the excellent performance of this variety. Dr. Ish Kumar, a renowned Indian rice breeder, was in fact too excited to leave the demonstration field; when asked what he felt, he replied, "More than excited!" At present, this variety is at the ripening stage. Anyone who is interested in (or has doubts about) super rice is welcome to investigate the variety at Sanya. Your opinions and suggestions will be appreciated. After all, "seeing is believing."

2 Project No. 2: "Planting three to produce four" bumper harvesting project

In this project, the goal is to plant super hybrid rice over three mu, and thus obtain a yield equivalent to that from four mu, based on the average yield of the past five years. This project has been mainly implemented in medium- and low-yielding rice fields. In 2007, Hunan took the lead in carrying out this project. Of the 20 counties participating in the project, 18 achieved the goal by obtaining a rice yield that was 33% higher than the average yield of the past five years (2002–2006). In 2014, up to 52 counties participated in the project, with a total planting area of 11.46 million mu. The total planting area has reached 43.353 million mu in the 8 years since the implementation of the project, with an increased paddy of 4.733 billion kg. The planting area is planned to be extended to 15 million mu by 2017, and to produce as much rice grain as was produced from 20 million mu, based on the average yield of the past five years from 2002–2006. This increase is equivalent to the effect of planting an extra 5 million mu of rice fields, and harvesting 2 billion kg more grain annually. (The average yield over five years from 2002 to 2006 is about 400 kg·mu^{-1}.) Many participants from Sichuan, Guizhou, Anhui, Guanggong, Guangxi, Zhejiang, and Henan have asked for involvement in the project; the project has already been initiated in Guangdong, Guizhou, Guangxi, Sichuan, and Anhui, and good results have been obtained. I suggest that this project be integrated into the national program, with the aim of extending the planting area of super hybrid rice to 60 million mu in the next five years. This would produce a yield of grain equivalent to that produced from 80 million mu at the current yielding level—the same effect as obtaining an additional 20 million mu of rice fields. Based on a yielding level of 400 kg·mu^{-1}, the annual increased paddy of 8 billion kg would be sufficient to meet the food demand of the entire population of a mega city like Beijing or Shanghai for a whole year.

3 Project No. 3: "Feeding one person on 0.3 mu (200 m^2) of cropland" high-yielding project

This project, also known as the "Three-One" project, focuses on the food requirements for an individual. A yearly yield of 360 kg of grain, produced from 0.3 mu, can meet the food demand of one person per year. In 2014, this project was initiated in high-yielding areas of 16 counties in Hunan under three models:

Model 1: Double cropping super hybrid rice, with early hybrid rice yielding 550 kg·mu^{-1} and late hybrid rice yielding 650 kg·mu^{-1} on average;

Model 2: Potato plus single-cropping super hybrid rice, with potato yielding 2000 kg·mu^{-1} (equivalent to a rice yield of 500 kg·mu^{-1}) and single-cropping super hybrid rice yielding 700 kg·mu^{-1}; and

Model 3: Spring corn plus single-cropping super hybrid rice, with corn yielding 500 kg·mu^{-1} and single-cropping super hybrid rice yielding 700 kg·mu^{-1}.

In 2014, the yield target was met in Xiangtan County and Lilin County, both of which had adopted Model 1. Taking the Yuhu district of Xiangtan County as an example, early hybrid rice yielded 584.5 kg·mu^{-1} and late hybrid rice yielded 662.5 kg·mu^{-1} at a demonstrative location covering 310 mu. In Shimen County, Longshan County, and Yongshun County, all of which had adopted Model 2, the yielding level remained at more than 1200 kg·mu^{-1} of paddy year-round. With hard work being done, and under the support of relevant departments, the planting area is projected to be extended to 11 million mu by 2020, taking up 19% of the arable land in Hunan; the grain produced from such an area will meet the food demand of half the population of Hunan. It is advisable for this project to be carried out in districts, cities, or provinces where the ecological conditions are similar to or better than those in Hunan.

4 Raising grain yield by raising biomass

Grain yield is calculated as follows:

$$\text{Grain yield} = \text{Harvest index} \times \text{Biomass} \quad (1)$$

At present, the harvest index is very high (above 0.5), leaving very limited room for improvement. Thus, further increases in rice yield will mainly rely on increasing the biomass. From the perspective of morphology, raising plant height is an effective and feasible way to increase biomass. As many developments do, rice variety improvement has developed in a spiral trend. For example, rice plant height has been developed from dwarf, to semi-dwarf, to semi-tall, tall, and super tall. Primitive rice varieties were tall plant types with heights as high as 1.7 m to 1.8 m. These varieties produced more straw and less grain, and yielded only 250 kg·mu^{-1} with a harvest index of only 0.3. The dwarf-type varieties were invented in the early 1960s, with a plant height of about 70 cm and a harvest index that was improved to 0.5; these varieties had a yield potential that was increased to 400 kg·mu^{-1}. At present, the major commercialized varieties belong to the semi-dwarf type, with a plant height of 90 cm to 100 cm. While the harvest index remains above 0.5, the taller the plant, the higher the biomass; therefore, rice yield has increased, with a yield potential of 600 kg·mu^{-1}. Our latest super hybrid rice yields about 1000 kg·mu^{-1} with a plant height of 1.2 m. In order to obtain a further increase in yield, even taller plants may be developed.

Development in science and technology is endless. We anticipate the successful development of a super hybrid rice yielding 16 t·hm^{-2} by next year.