超级杂交稻研究

袁隆平 主编

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内 容 提 要

全书共分 9 章，分别论述了我国超级杂交稻研究的新进展，水稻光温敏核不育系的育性遗传研究及育种策略，水稻亚种间杂种优势利用，超级杂交稻理想株型的形态结构及生理特性，超级杂交稻育种方法和途径，分子技术应用于超级杂交稻育种研究及其所取得的最新进展，超级杂交稻的亲本繁殖及杂交制种高产技术，超级杂交稻的高产栽培理论和技术，以及超级杂交稻先锋组合的试验示范和推广应用等内容。本书论点明确，论述科学、严谨，图文并茂，是国内外第一本全面介绍超级杂交稻研究的学术论著。可供农业科研院所、大专院校以及农技推广、种子生产经营和农业管理部门的相关人员参考。

序

粮食始终是关系到国计民生的头等大事。水稻是我国最主要的粮食作物。据预测，至2030年，我国人口将达到16亿，而耕地面积却在不断减少，因此，提高粮食作物单产，特别是水稻的单产，对于保障我国未来粮食安全具有十分重要的意义。

新中国成立以来，我国水稻单位面积产量出现了两次飞跃：第一次是20世纪60年代的矮秆品种的培育成功与推广，使得单产每公顷提高了1～2 t；第二次是70年代的三系法杂交水稻的培育成功和推广，又使得水稻单产每公顷提高了1～2 t。此后，无论是常规稻还是杂交稻，其产量潜力却一直处于徘徊状态。

为打破水稻单产的徘徊局面，国内外的科研机构和科技人员，都在尝试利用各种手段，进一步提高水稻的产量潜力。首先是日本，于1981年启动了要在15年之内把水稻单产提高50%的超高产水稻育种计划；接着是1989年，国际水稻研究所开展了旨在提高单产20%以上的新株型育种计划，媒体称之为超级稻育种计划。

我国农业部于1996年立项了中国超级稻育种计划，制定了连续两年两个百亩片一季稻的平均单产“2000年达到每公顷10.5 t(第一期)，2005年达到12.0 t(第二期)，2015年达到13.5 t(第三期)的研究目标”。1997年，超级杂交稻育种计划正式启动，并得到了总理基金、国家“863”计划的大力支持，随

后又正式纳入中国超级稻育种计划。

在各级政府的大力支持下，超级杂交稻研究取得了重大成就。先锋组合两优培九于2000年达到了第一期目标；接着培矮88S/0293于2004年比原计划提前一年达到了第二期目标；现在正在开展第三期超级杂交稻的研究。迄今，第一期超级杂交稻已成功地在生产上应用，两优培九已连续几年居籼稻品种播种面积首位，一般每公顷增产1 t左右；第二期超级稻也已开始投入生产应用。

我国之所以能在国际上率先取得水稻超高产育种的突破，主要是在原有利用水稻杂种优势的基础上，实现了两项原始创新：一是提出并研究出了旨在提高群体有效光合效率的超高产株型；二是较为成功地利用了水稻亚种间杂种优势。

《超级杂交稻研究》一书，较为系统地反映了国家杂交水稻工程技术研究中心超级杂交稻课题组的研究成果。在此，我们对长期给予我们大力支持的各级领导和有关单位表示衷心感谢，并谨以此书作为中国超级稻计划立项十周年的献礼！

袁隆平

2006.7 于长沙

Preface

Food is always the first priority to be concerned with the national economy and livelihood of the people. Rice is the most important food crop in China. It is estimated that the population would be as many as 1. 6 billion by 2030 in China. However, the arable land area has been decreasing year after year. Consequently, it is of great importance and significance to ensure the future food security of China by raising continually the unit land area yield of food crops, especially rice.

Two breakthroughs have occurred in rice yield level since the foundation of the People's Republic of China. The first is the successful development of semi-dwarf varieties, which results in a lift of 1～2 tons/ha in yield, in the early 1960s. The second is the invention and successful development of hybrid rice, which raises yield level by another 1～2 tons/ha, in the 1970s. Since then, the yield potential of rice, no matter it is conventional rice or hybrid rice, has been stagnant over years.

To break the deadlock, the scientists in and outside China have been making every effort to further increase rice yield. Firstly, Japan started its super-high-yield breeding project for rice in 1981. Its target is to increase rice yield by

50% within 15 years. Later in 1989, the International Rice Research Institute (IRRI) initiated a New Plant Type breeding program, the so-called super rice breeding program by the mass media, to increase rice yield by 20%.

In China, the Ministry of Agriculture also initiated a super rice program in 1996, in which the yield targets for single cropping rice are 10.5 tons/ha by 2000 (the first generation), 12.0 tons/ha by 2005 (the second generation) and 13.5 tons/ha by 2015 (the third generation), respectively, at two locations with no less than 6.7 ha of land area for each location and for two consecutive years. In 1997, the breeding program on super hybrid rice was started in China and it has been highly concerned and advocated by the Premier Foundation and the State "863" Project. Subsequently, it has been listed into the super rice breeding program of China.

The research on super hybrid rice has achieved marked progresses with the strong supports from the governments at all levels. Liangyou Peijiu, the pioneer super hybrid rice, topped the first target (10.5 tons/ha) in 2000. Then, P88S/0293 materialized the second target (12.0 tons/ha) in 2004, one year ahead of schedule. Now, the research is

focused on the breeding of the third generation super hybrid rice. Up to date, the first generation super hybrid rice has been widely used in commercial production. Liangyou Peijiu has recently become No. 1 in annual planting area among indica rice varieties in China, with a yield increase of around 1 ton/ha on average. The second generation super hybrid rice has also begun to be put into use in farmers' fields.

The great breakthrough achieved on the breeding of super-high-yield rice in China is primarily owe to two virgin innovations we have made: the unique super-high-yield plant type aiming at the increase of population photosynthetic efficiency and the successful utilization of the intersubspecific heterosis.

This book, *Super Hybrid Rice Research*, has systematically introduced the research achievements in super hybrid rice of the China National Hybrid Rice R&D Center. Hereby, we deeply appreciate various levels of governments and related units for their long-term strong supports in super hybrid rice program, and present this book as a gift for the tenth anniversary of the Super Rice Program of China!

Yuan Longping
At Changsha in July, 2006

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