Hybrid rice for food security

- **Chinese scientists bred the world's first rice hybrid in 1974.**
- **Hybrid rice varieties yield about 15 to 20 percent more than even the best of the improved or high-yielding bred varieties do.**
- **Fifteen million ha – about half of China's total rice area – are now under hybrid rice cultivation; national average rice yields have increased from 3.5 to 6.2 tonnes/ha.**
- **Hybrid rice has particularly good potential to improve the food security of poor countries where arable land is scarce, populations are expanding and labour is cheap.**
- **FAO, IRRI, UNDP and ADB all support the improvement of national capacities in hybrid rice development and dissemination. In 2001/02 an estimated total of 800 000 ha of hybrid rice were planted in Asian countries other than China.**

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INTERNATIONAL YEAR OF RICE 2004
rice is life

THE SITUATION

In crop breeding, the use of hybrid vigour in first-generation seeds (or F1) is well known. However, until about 30 years ago, its application in rice was limited because of the self-pollination character of that crop. Then, in 1974, Chinese scientists successfully transferred the male sterility gene from wild rice to create the cytoplasmic genetic male-sterile (CMS) line and hybrid combination. The first generation of hybrid rice varieties are three-lines hybrids and produce yields that are about 15 to 20 percent greater than those of improved or high-yielding varieties of the same growth duration. Developments in hybrid rice technology have resulted in two-lines hybrids with yield advantages of 5 to 10 percent over those of the equivalent three-lines hybrids. In China, the area under hybrid rice production is now about 15 million ha, and accounted for about 50 percent of the total rice area in 1995.

TABLE 1. Areas of hybrid rice cultivation in Asian countries (2001/02)

Country	Area of hybrid rice *(ha)*
Viet Nam	480 000
India	200 000
Philippines	90 000
Bangladesh	20 000
Myanmar	10 000
Indonesia	1 000
Total	**801 000**

Over the last decade, FAO, the International Rice Research Institute (IRRI), the United Nations Development Programme (UNDP) and the Asian Development Bank (ADB) have provided strong and consistent support to improving national capacity in hybrid rice breeding, F1 seed production and research facilities in several countries. In 2001/02, it was estimated that about 800 000 ha of hybrid rice were planted in Bangladesh, India, Indonesia, Myanmar, the Philippines and Viet Nam (Table 1).

WHY HYBRID RICE?

- ***A new opportunity:*** Increasing attention has been given to the development of a new generation of rice varieties, including hybrid rice, new plant types and transgenic rices. At present, hybrid rice technology for large-scale production has a yield advantage of 15 to 20 percent, or more than 1 tonne of paddy per hectare, over the best bred varieties. Successful commercial hybrid rice production has enabled China to diversify agricultural production on millions of hectares of land. Although Chinese rice lands steadily decreased from 36.5 million ha in 1975 to 30.5 million ha in 2000 (0.6 percent per year), the country has been able to feed more than 1 billion people, thanks to the hybrid rice programme raising the national average yield from 3.5 to 6.2 tonnes/ha.
- ***Increasing demand for rice:*** Rice is the most important staple food crop for more than half of the world's population. The increased demand for rice is expected to exceed production in many countries in Asia, Africa and Latin America. World rice production therefore needs to increase, while land, water and labour are all decreasing.
- ***Declining yield growth:*** World rice production has increased continuously since 1961, but at varying rates. The annual growth rate of yields declined from 2.5 percent in the 1960s to about 1.1 percent in the 1990s, owing to the difficulty of sustaining rice productivity growth as yields increase. The Expert Consultation on Technological Evolution and Impact for Sustainable Rice

Production in Asia and the Pacific, held in Bangkok in 1996, reported the stagnation and deceleration of rice yields in many Asian countries.

- ***Rural employment and income generation:*** the labour-intensiveness of F1 seed multiplication and production for the hybrid rice programme has created rural employment opportunities and increased farmers' incomes. Hybrid rice seed production requires about 30 percent more labour (or 100 workdays/ha) than the seed production of improved varieties. In north Viet Nam, F1 seed production needs 400 to 500 workdays/ha.

- ***Hybrid rice for adverse ecologies:*** in some countries, the use of hybrid rice has revealed better heterosis in unfavourable soil and climatic conditions – such as saline soils and uplands – than in favourable irrigated rice conditions. In Egypt, hybrid rice performed well in saline conditions, where it yielded 35 percent more than inbred varieties.

- ***Scarce land, large populations and cheap labour:*** because of its yield advantages, hybrid rice technology is very important for the food security of rice-consuming countries where arable land is becoming scarce, population is steadily increasing and labour is cheap.

FAO'S HYBRID RICE PROGRAMME

In compliance with the International Rice Commission's recommendations, FAO gives high priority to the large-scale adoption of hybrid rice outside China. Over the last ten years, as well as its Regular Programme, the Organization has provided technical cooperation projects to support national rice programmes (Table 2).

TABLE 2. FAO support to national hybrid rice programmes (1992–2002)

Project	Country	Period	Budget (US$)
FAO/TCP/VIE/2251	Viet Nam	May 1992 – Dec. 1993	259 000
FAO/TCP/VIE/6614	Viet Nam	July 1996 – Dec. 1998	296 000
FAO/TCP/MYA/6612	Myanmar	Mar. 1997 – Mar. 1999	221 000
FAO/TCP/BGD/6613	Bangladesh	May 1997 – Apr. 1999	201 000
FAO/TCP/PHI/8821	Philippines	Jan. 1998 – Dec. 2000	275 000
FAO/TCP/INS/8921	Indonesia	Jan. 2000 – Dec. 2001	257 000
FAO/TCP/EGY/8921	Egypt	Sep. 1999 – Dec. 2002	248 000
UNDP/IND/91/008 and IND/98/140	India	1991–2002	6 550 000

Hybrid rice technology has provided farmers with high yields, saved land for agricultural diversification and created rural employment opportunities. Although the technology is still new, many rice-producing countries have expressed their interest in applying it to improve food security. Recent progress in hybrid rice programmes in Viet Nam, India and the Philippines shows that dissemination of this technology requires: i) strong commitment and support from governments and scientists; ii) cooperation among research programmes, seed production sectors and extension delivery services; and iii) international collaboration and coordination (Figure 1).

FIGURE 1. Network of hybrid rice production

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