

can produce their own hybrid seed using 8-10 d time isolation and no distance isolation.

In the self-sustaining seed production system, about 5% of the area of a rice farm is used for producing the next season's hybrid rice seed; the rest is used for growing grain. The seed production plot is planted so that it flowers 8-10 d after the main crop flowers to reduce contamination from pollen of commercial hybrids or inbred varieties. Locating the plot in the corner of the farm lessens the chance of contamination from the neighboring farm.

The R (restorer) line is planted in a 3-m-wide strip around the seed production plot, covering about half of it. The actual F₁ seed production plot is

planted with A (maintainer):R lines in a 10-3 row ratio (see figure). The R line strip provides sufficient pollen load to minimize contamination from other pollen sources. Recommended seed production practices, including flag leaf clipping, GA₃ application, and supplementary pollination, are followed to achieve high outcrossing of the A line and thus a high seed yield of A x R hybrid.

Seeds produced at IRRI using this system gave uniform hybrid crops during 1992 dry and wet seasons comparable with ones raised from seeds produced in isolated seed production plots. Seed yield in the A x R area was 50-70 g/m² for the hybrid and 100-150 g/m² for the R line. Yield from the R line border rows was about 5 t/ha.

Half of a 500-m² hybrid rice seed production plot is allocated to plant A and R lines and half to pure R line. This plot will yield 12.5-17.5 kg hybrid seed (enough to plant 1 ha), and about 125 kg R line seed, which can be used as grain. As management improves, hybrid seed yields can be increased to 100-125 g/m²; thus the 500-m² hybrid seed production plot can be reduced to 350-400 m². Farmers need to buy only 400 g of A line seed in this system. Although they can use their own R line seed, we advise them to buy 1 kg fresh R line seed every season to ensure seed purity. Public or private sector seed companies can produce foundation seed for A and R lines. ■

Two-line hybrid rice in China

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Chinese scientists have been working to develop two-line hybrid rice to increase yield and simplify the seed production

Table 2. Promising two-line hybrid rice being tested.

Hybrid	Type	Province in which developed
K9 S/03	Indica	Guang Xi
Pei Ai 64 S/ Xiang Zao Xian 1	Indica	Hunan
Pei Ai 64 S/ Te Qing 2	Indica	Hunan
W6154 S/ Te Qing 2	Indica	Hunan
W6154 S/312	Indica	Hunan
An Nong S-1/312	Indica	Hunan
Heng Nong S-1/ Ming Hui 63	Indica	Hunan
N8 S/Xiang 26	Indica	Hunan
545 S/402	Indica	Hunan
W6111 S/ Te Qing 2	Indica	Hubei
5088 S/1514	Japonica	Hubei
5088 S/R9-1	Japonica	Hubei
5460 S/R9-1	Indica	Fujian
W6154 S/ Vary Lava 1312	Indica	Fujian
7001 S/ Lun Hui 422	Japonica	An Hui

Table 1. PGMS and TGMS lines developed in China.

Line	Type	Province in which developed
7001 S	Japonica PGMS	An Hui
5088 S	Japonica PGMS	Hubei
5047 S	Japonica PGMS	Hubei
K9 S	Indica TGMS	Guang Xi
K14 S	Indica TGMS	Guang Xi
5460 S	Indica TGMS	Fujian
8902 S	Indica TGMS	Hubei
W6111 S	Indica TGMS	Hubei
Pei Ai 64 S	Indica TGMS	Hunan
An Nong S-1	Indica TGMS	Hunan
545 S	Indica TGMS	Hunan
N8 S	Indica TGMS	Hunan
Heng Nong S-1	Indica TGMS	Hunan

process. Some photoperiod-sensitive genic male sterile (PGMS) lines, thermo-sensitive genic male sterile (TGMS) lines, and two-line hybrids have been successfully developed (Tables 1 and 2). Japonica mutant Nong Ken 58 S and indica mutants An Nong S-1 and Heng Nong S-1 are the major sources of these PGMS and TGMS lines.

Some of the promising two-line hybrids have been tested in on-farm and demonstration trials. They were cultivated on 100,000 ha in China during 1991-93. About 2 million ha are expected to be planted to the two-line hybrids by 1995. ■

Heterosis and combining ability evaluation of cytoplasmic male sterile (A) lines and restorer (R) lines

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The general combining ability (GCA) of four A lines and five R lines and the specific combining ability (SCA), heterosis, heterobeltiosis, and standard heterosis of 20 F₁ hybrids were studied in a line x tester mating design. The 31 treatments of 20 F₁s, 4 lines, 5 testers, and 2 traditional varieties (RD23 and