Super Hybrid Rice in China

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PJM

Contents

1. Super rice breeding program in China

1.1 Basic information

. China's population: 1.3 billion.

popu. as staple food : 0.8 billion (60%)

rice area: 28. mil ha (4.3 yi mu 2008)

rice yield: 6.3 t/ha (420kg/mu)

HR yield: 7.35t/ha (490kg/mu)

1.2 Super rice breeding program

time: in 1996

enacted by :

China Ministry of Agriculture

applied regions:

all over the planted rice except Yunnan province.

standard:

at 2 locations with 6.7 ha each in 2 running years.

1.3 Yield standard of super rice in China

Phase	Hybrid Rice			Yield increase
	Early season indica	Single season rice	Late season indica	
Present level	7.50	8.25	7.50	0
Phase I 96-- 2000	9.75	10.50	9.75	over 20%
Phase II 01--2005	11.25	12.00	11.25	over 40%
Phase III 11-2015		13.5		

2. Technical approaches for HR breeding

Based on Prof. Yuan Longping

- 2.1 morphological improvement
- 2.2 raising heterosis level
- 2.3 by means of biotechnology

2.1 Morphological Improvement

Plant type of super hybrid rice

- tall erect-leaf canopy
- lower panicle position
- bigger panicle size

IRRI's new plant type

Yuan's super HR plant type

Tall erect-leaf canopy

height of canopy: 1.2 m above

upper 3 leaves: long, erect, narrow, V-shape, thick

long------- to increase leaf area

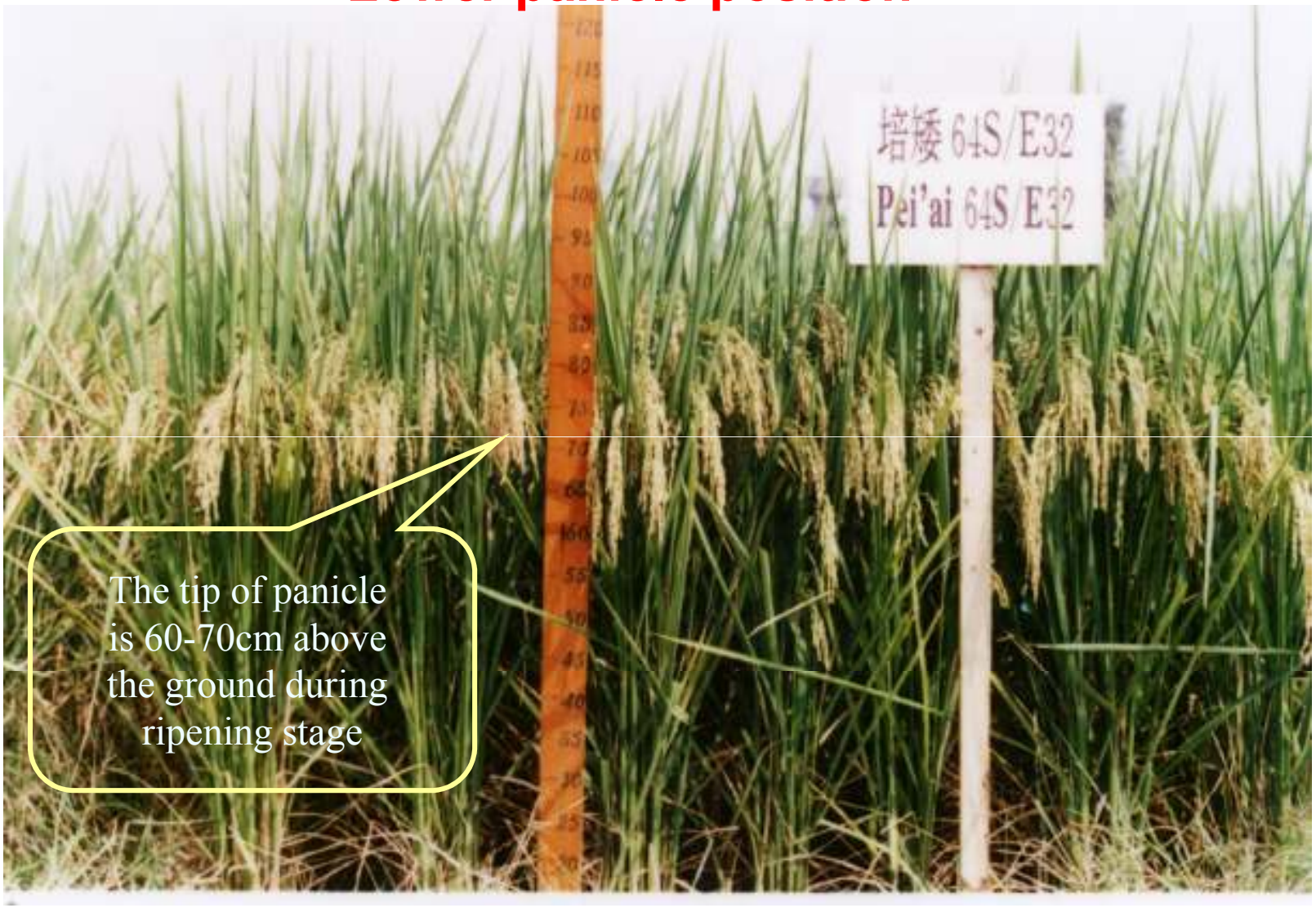
erect------ to intercept solar radiation from both sides

narrow---- to occupy less space, with higher LAI

v-shape-- making leaf blade stiffer, so not prone to droopy

thick------- with higher photosynthetic function and not easy to senescent

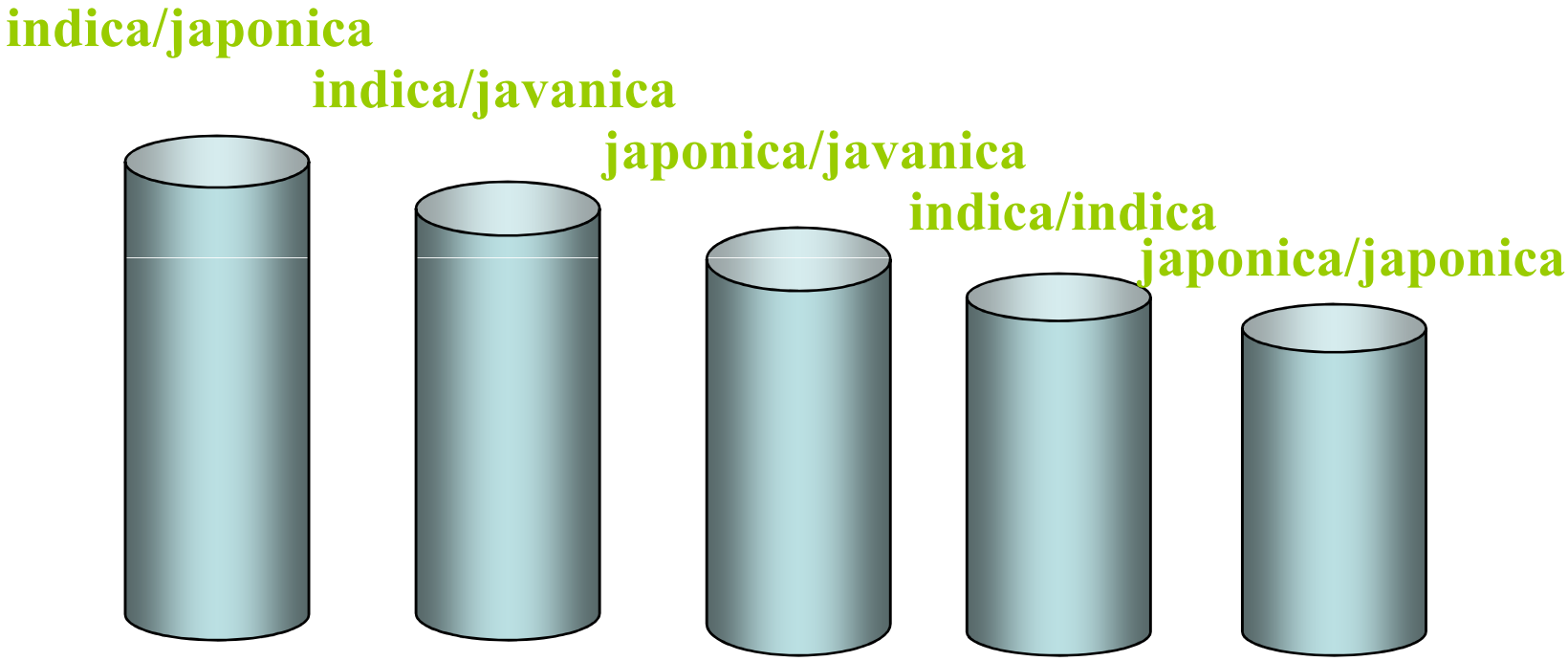
Lower panicle position

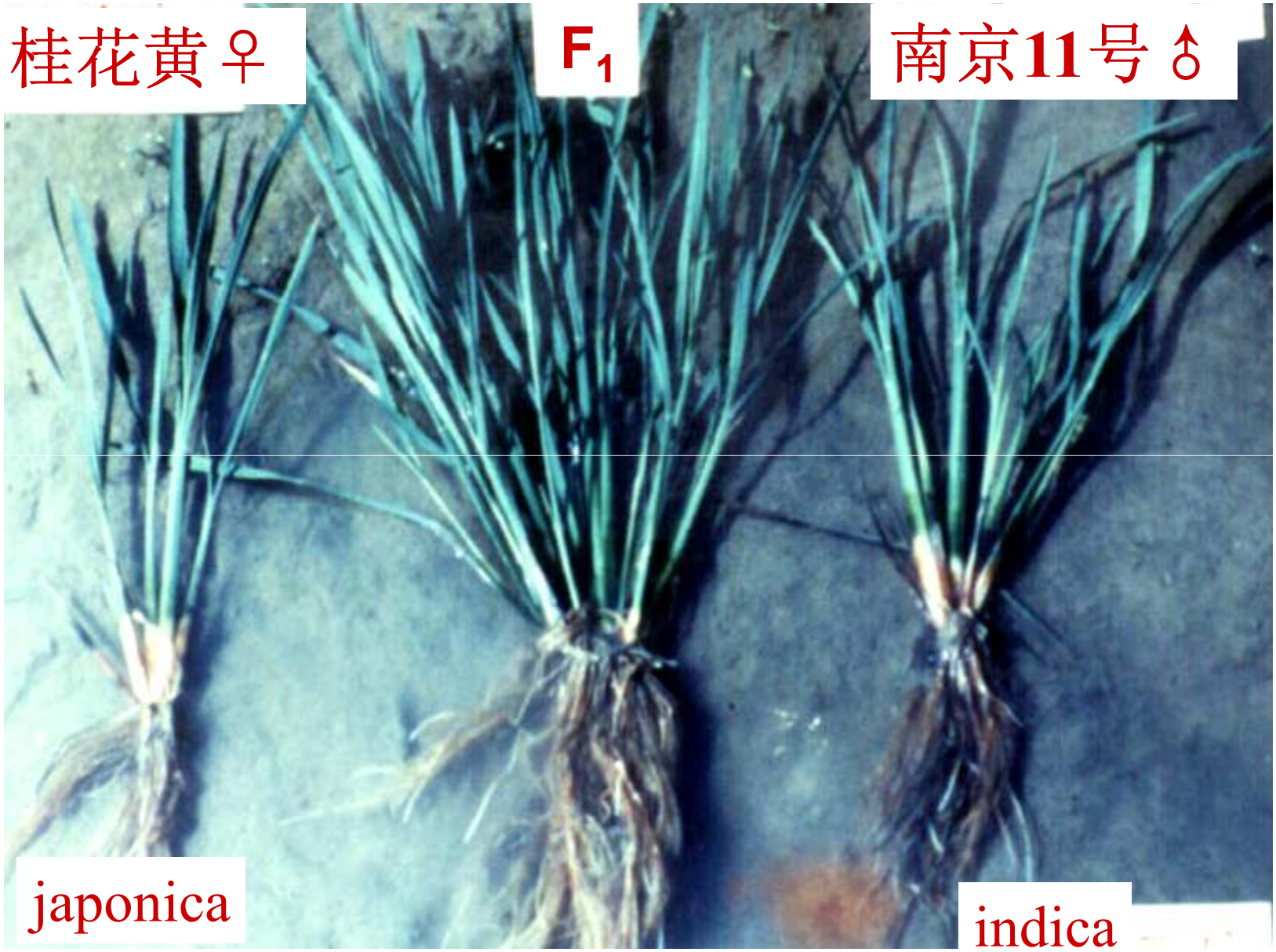


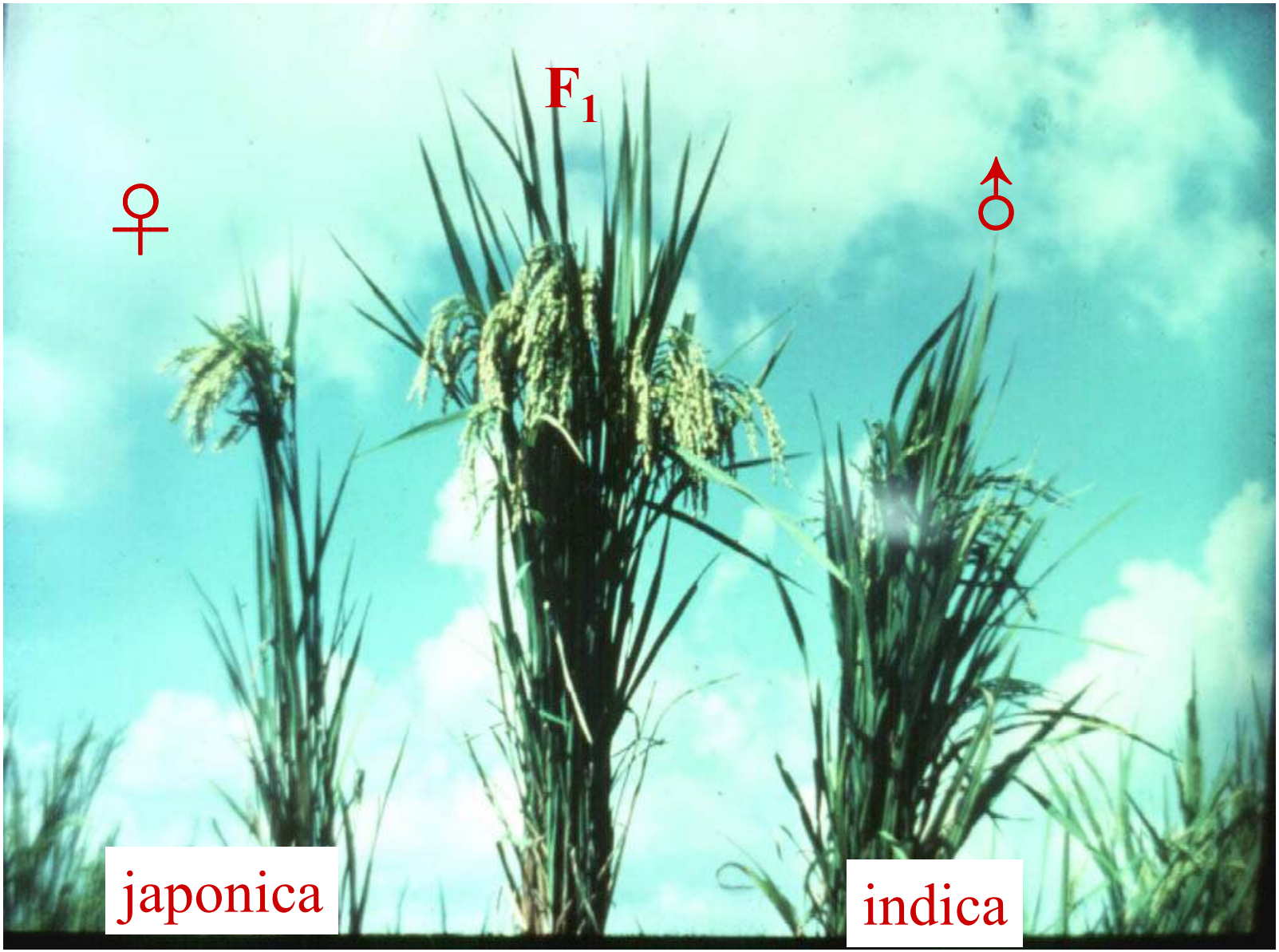
Bigger panicle size

Grain weight/panicle: around 6 g
Number of panicles: around 250/m^2

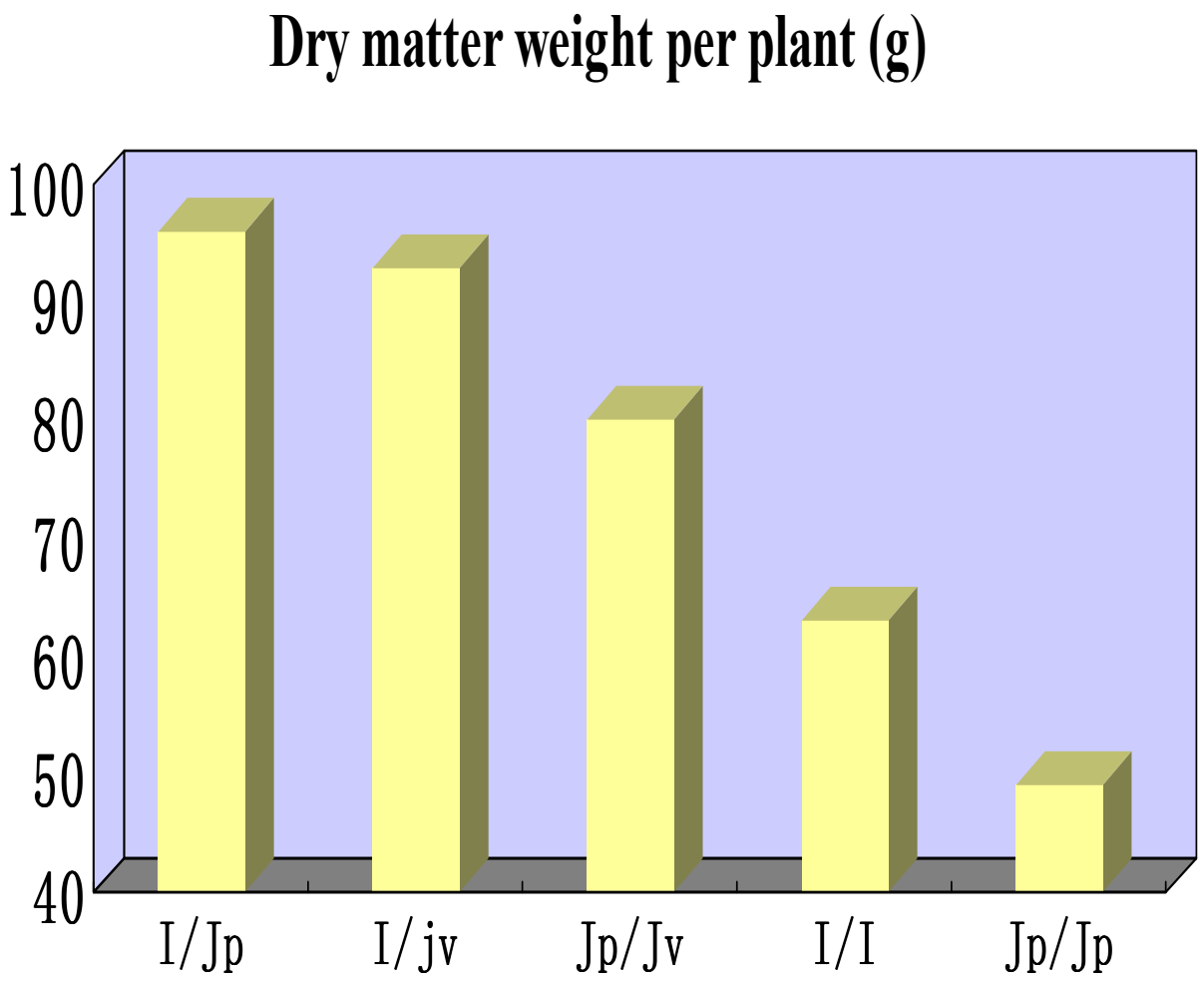
2.2 Raising heterosis level



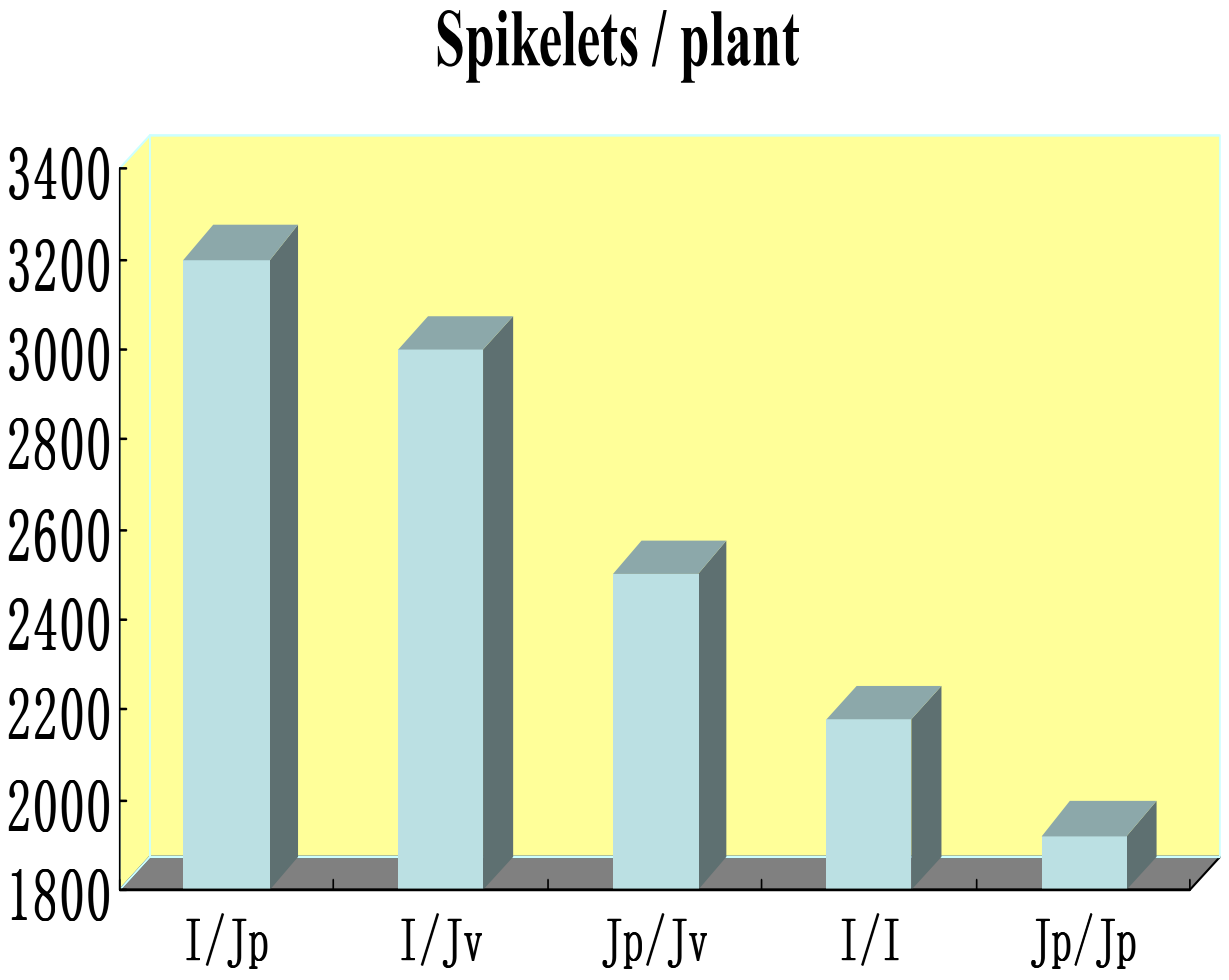

桂花黄♀
F1
南京11号♂
japonica
indica


F1
♀
♂
japonica
indica

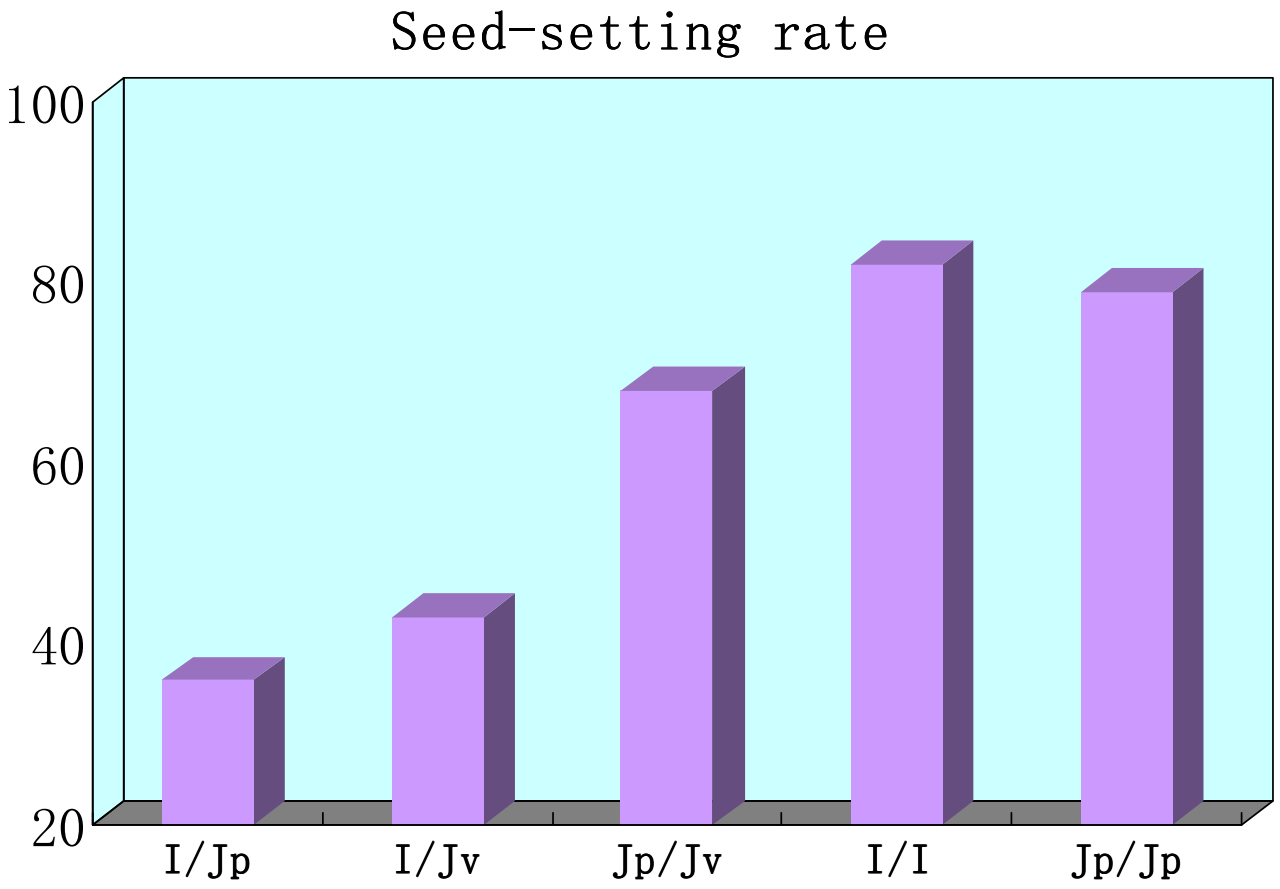
Heterosis in different rice hybrids



Heterosis in different rice hybrids

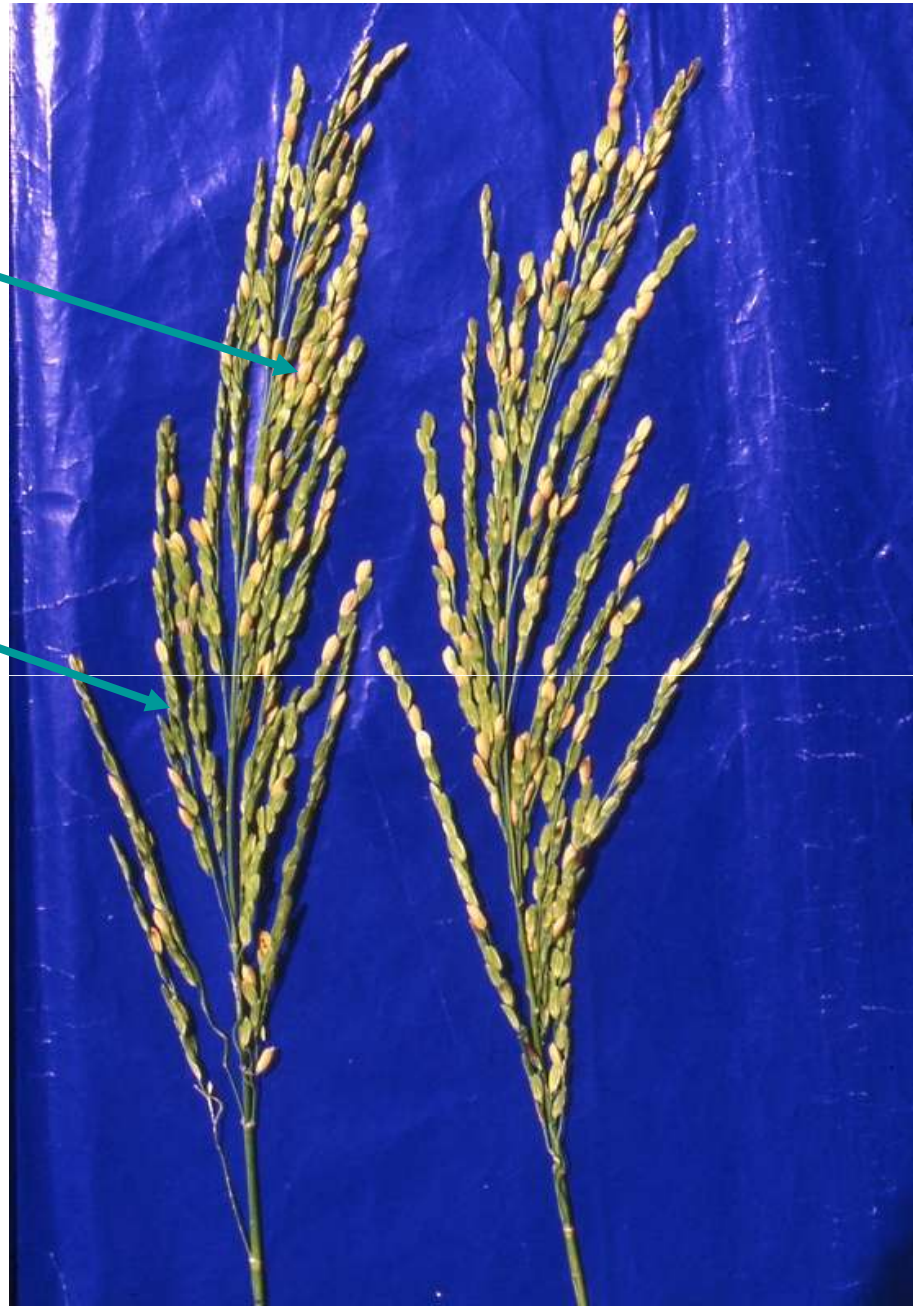


Heterosis in different rice hybrids



Filled seed

Empty seed



Indica/Japonica F1

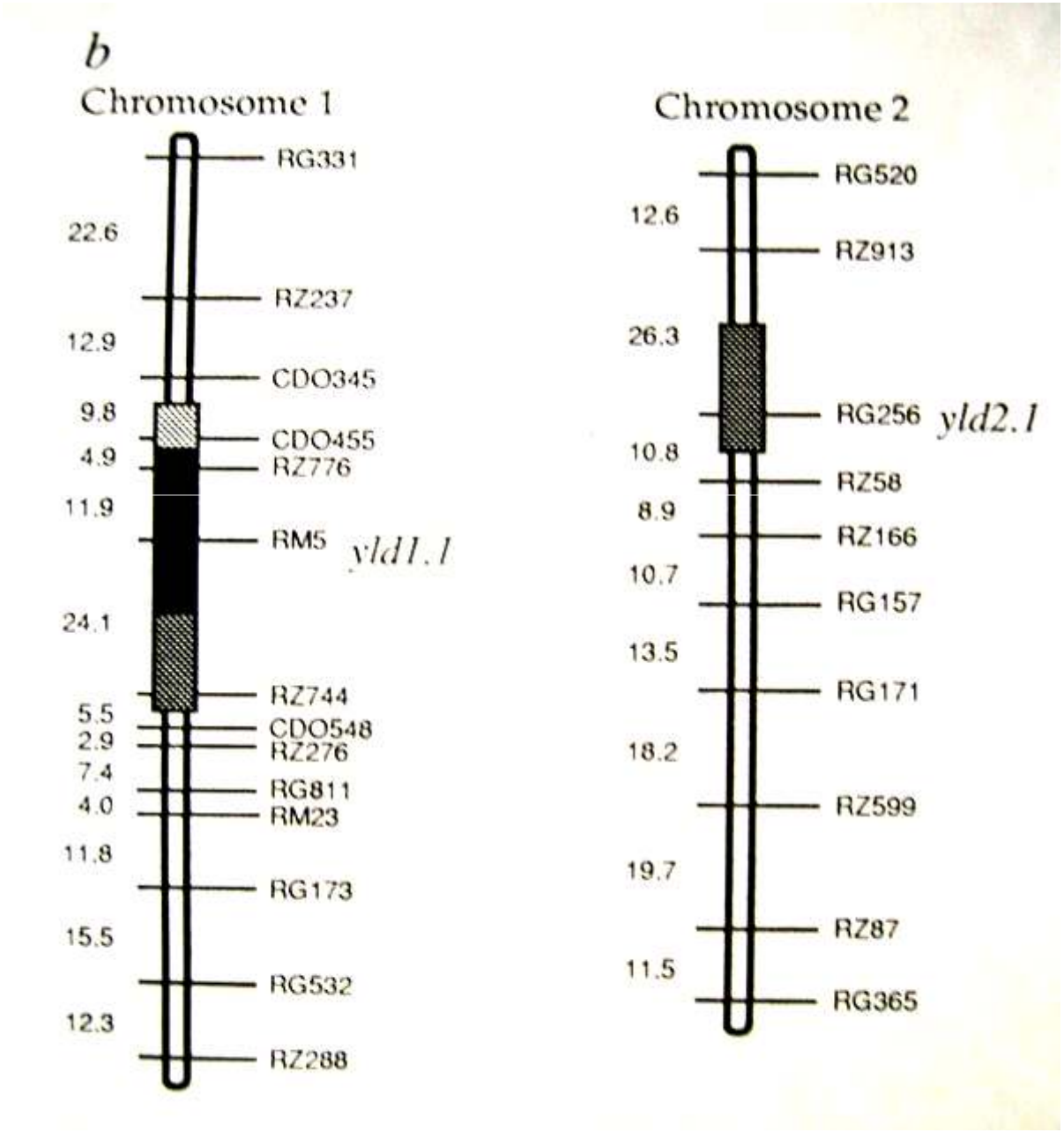
Yield potential of an indica/japonica hybrid

Combination	Plant height (cm)	Number of spikelets /panicle	Number of spikelets /plant	Seed setting rate %	Actual yield (kg/ha)
Chengte232(japonica) ×26Zhaizao(indica)	**120**	**269.4**	**1779.4**	**54.0**	**8250**
Weiyou35 (indica/indica)	**89**	**102.6**	**800.3**	**92.9**	**8625**
Increase %	**34.8**	**162.8**	**122.4**	**-41.9**	**-4.3**

2.3. By means of biotechnology

2.3.1 Utilization of favorable genes from wild rice

Two yield enhancing QTLs were identified




9311
611
MH63

CK:

430 g/100 panicles

J23A/Q-611:

580 g/100 panicles

J23A/Q611

2.3.2 Using genomic DNA from barnyard grass to create new source of rice

Total DNA of barnyard grass introduced into R207 by Spike-stalk injection

Fragments of DNA from barnyard grass confirmed to be introduced into R207 by molecular analysis

New elite R-lines have been developed

Barnyard grass

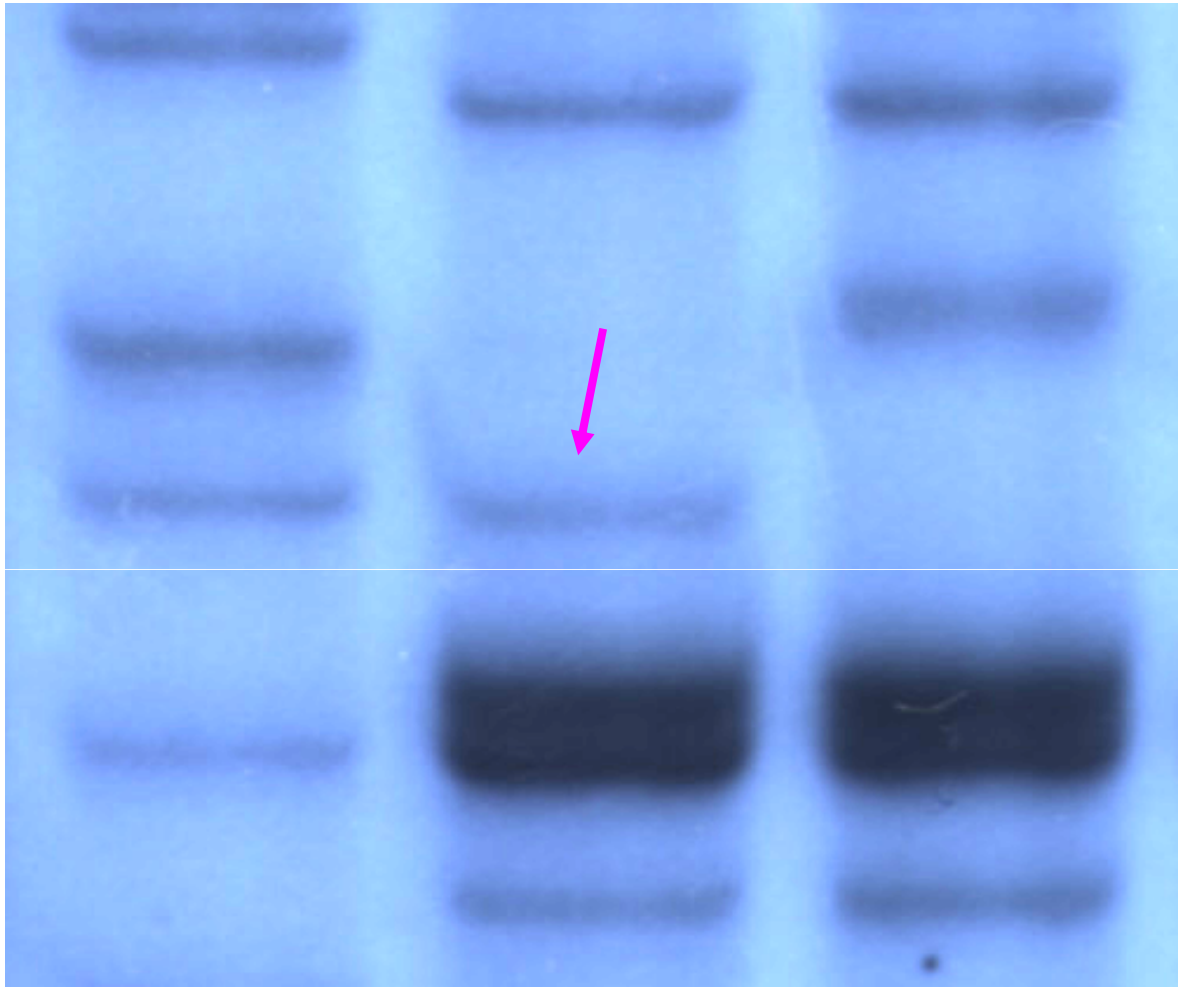
Echinochloa crusgalli


R207
GDS/RB207-1
RB207-1

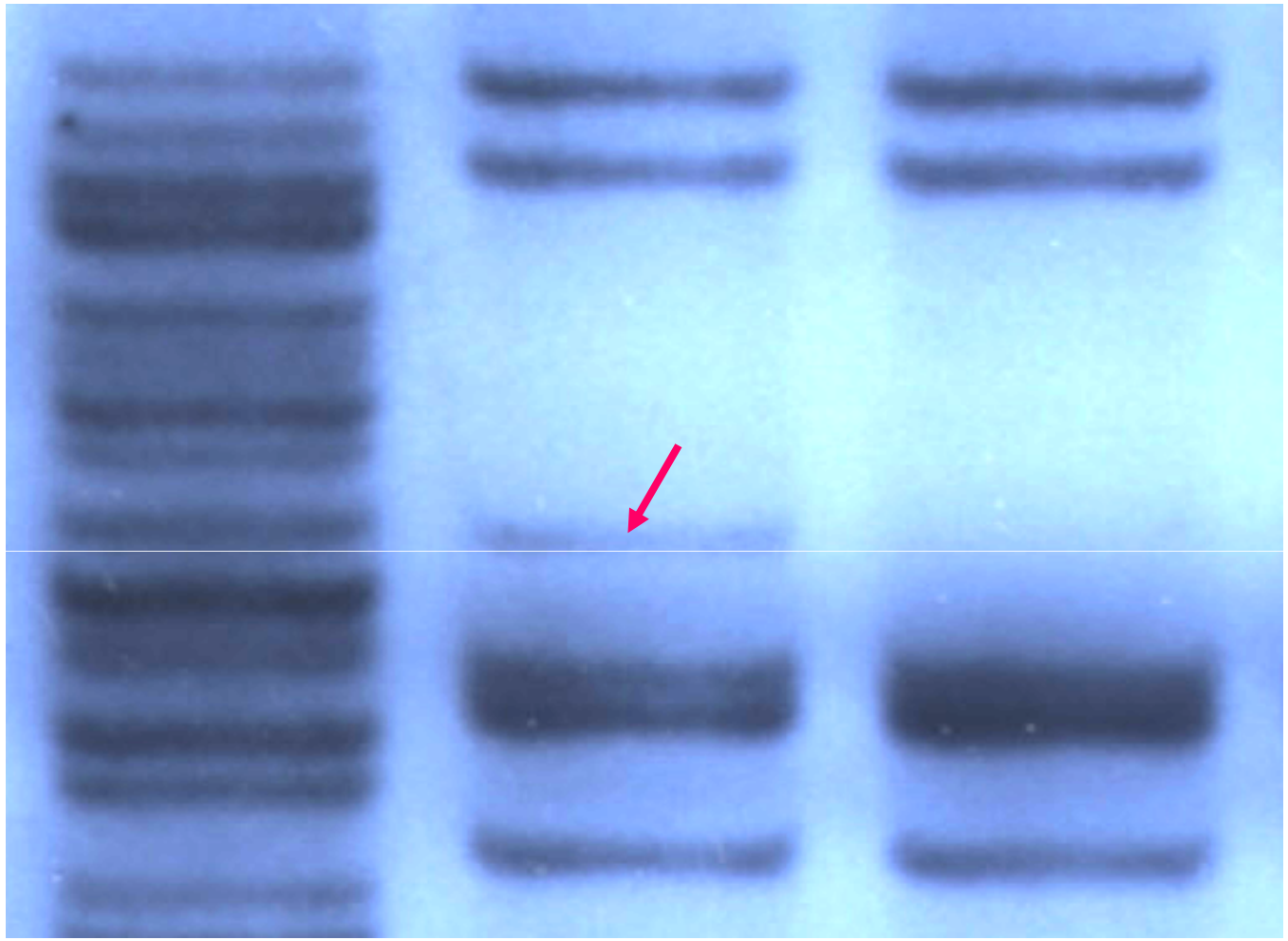

R207
RB207-1
GDS/RB207-1


GDS/RB207-1
Panicles/m2: 225
Spikelets/Pan.: 256
1000-grain weight: 32g
Seed-setting rate: 85%
Yield estimated: 15.7t/ha

GDS/RB207



B. grass RB207 R207



B. grass RB207 R207

2.3.3 Transferring C_4 gene from maize into super hybrid rice

C_4 genes from maize have been cloned and are being transferred into super hybrid rice. The yield potential of C_4 super hybrid rice can be further increased by a big margin theoretically.

3. Progress of Phase I

Time: 1996-2000

Target: 10.5t/ha

Hybrids: P64S/9311,
P64S/E 32


P64S/9311

P64S/9311


P64S/E32

4. Progress of Phase II

Time: 2001-2005

Target: 12 t/ha

Hybrids: Liang you 293

Y liangyou 1

Y liangyou 7

T you 640

Liang you 0389

II you hang 1

两优293

Y两优1号

5.Progress of Phase III

Time: 2011-2015

Target: 13.5 t/ha

Hybrid: Y liang you 2
Guang zhan 63S/R1128

Progress of the project

2008: 12.72 t/ha (848 kg/mu)

2009: 12.84 t/ha (856 kg/mu)

2010: 13.17 t/ha (878kg/mu)

2011: 13.899 t/ha was obtained


农用氢

2011: 13.899 t/ha was obtained

Location: Longhui county, Hunan

Altitude: 375 m

Area: 7.20 ha (108 mu)

Hybrid: Y liang you 2

Yield components

Yield : 13.899 t/ha (926.6kg/mu)

Effective panicles:	3.023 m/ha (=20.15 w/m)
Spikelets/panicle :	230.1
Filled grains/panicle:	210.3
Seed setting rate:	91.39%
1000-grain weight:	25.66 g

Growth stages

Sowing date: April 14, 17
Transplanting date: May 12-17
Initiating heading date: July 28
Full heading date: Aug. 8
Ripening date: Sept.18

Growth duration: 156-158 days

6. Result from planting super varieties

6.1 Yield standard of super rice variety

(1) + 8% over the Check in provincial varieties' trail with 1 year high-yielding demonstration.

(2) yield: 11.7t/ha for single rice (780 kg/mu) with 6.67 ha at same area at 2 years.

6.2 Number of super rice varieties

2005-2011: 83 （92个-9个退出）

hybrids: 54 （58个-4个退出）
inbreds: 29 （34个-5个退出）

6.3 Area of super rice varieties

2005: 2.558 mil. ha (3837 wan mu)
2007: 5.333 mil. ha (8000wan mu)
2008: 5.561 mil. ha (8342 wan mu,19.2%)
2009: 6.070 mil. ha (9100 wan mu)
2010: 6.733 mil. ha (1.01 yi mu)


22/11/2007
Thanks