Researches for developing *japonica* hybrid rice based on CMS-D1

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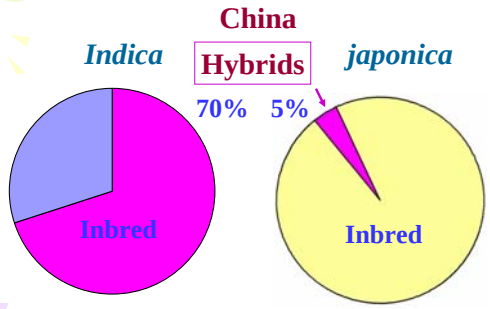
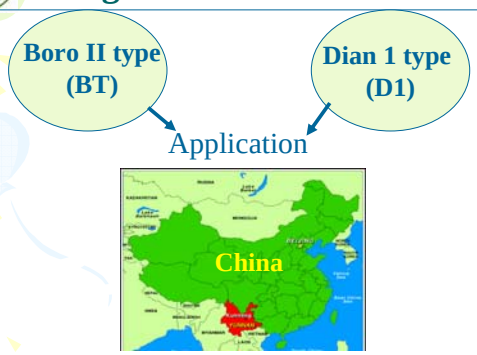
Contents

Background-- Production of HR



Background-- CMS for JHR



Background-- CMS-D1 system

1965 High sterile Plant/Landrace HMY

HMY

1969 HMY A lines

Indica/*japonica*

F_1/*japonica*

Restorer

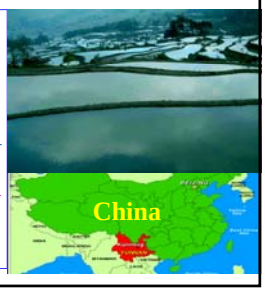
1973 Three lines hybrids

Background-- Yun-Gui plateau

Climate: tropical---temperate ---frigid
Rice: wild, *indica*, *japonica*; irrigated, upland

Indica rice
Altitude: 100 -- 1400 m
Rice area: 4 mha
Hybrids: 70%

Japonica
Altitude: 1400 to 2700 m
Rice area: 6 mha
Hybrids: <10%



Background-- Causes

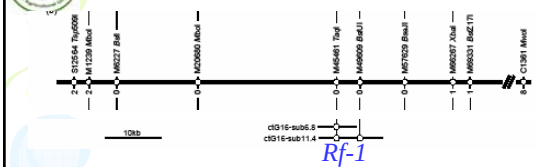
- Lacking of *Rf* genes in *japonica* rice
- Stable sterility of CMS lines
- Poor genetic diversity of *japonica* rice, which results in low hybrid vigor

Researches on CMS-D1

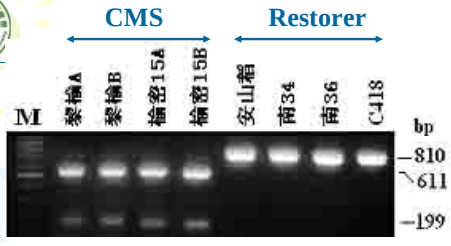
Screening of *Rf* sources by marker

CMS-BT and CMS-D1 sharing same restorer

•DNA markers located within *Rf-1* locus (Komori *et al* 2004)



According to Komori *et al*. 2004



Of 466 traditional cultivars collected from mountainous areas in Yunnan, *Rf* gene was detected only among *indica* cultivars.

Genotyping of CMS revertants

Confusing about fertile plants found in CMS populations

Generation of CMS populations

Bulking pollination

individual pollination

FPs in the CMS populations

	CMS	Size	FP	Ratio%
Individual	LyA	17,000	10	0.0588
	Ym15A	36,530	19	0.052
	Hx42A	11,000	8	0.0727
	Total	*64,503*	*37*	*0.057*
bulking	LyA	81,540	77	0.0944
	Ym15A	93,450	101	0.108
	Total	*174,990*	*178*	0.1017

Genotyping

FPs

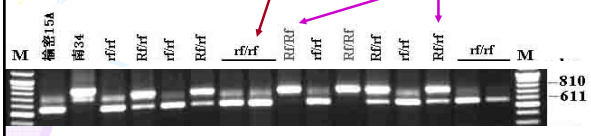
Fertile pollens → >95% and < >50%

A / FP → F_1 → sterile and Fertile

By M49609*Bst*UI

S_0

S_1

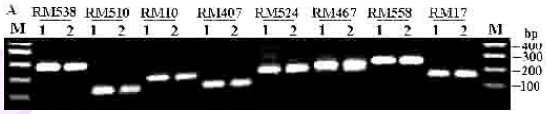


Frequency of the revertants

CMS line	*rf/rf*	RV	Ratio %
LyA	9	1	0.059
Ym15A	12	7	0.0192
Hx42A	6	2	0.0182
Total	*27*	*10*	*0.0155*
LyA	40	37	0.0454
Ym15A	75	26	0.0278
Total	*115*	*63*	*0.0360*

Difference between CMS and RV

G	Durat Day	Hight (cm)	Leaf (L/W)	Leaf angl	Panicle (cm)	Seedset (%)	Grain (L/W)
S_2	143	66.8±5.5	25.0±2.2	11.6±1.7	19.6±1.1	76.9±6.6	2.1±0.
S_3	143	67.5±4.9	25.1±1.7	11.6±1.6	19.8±1.0	78.0±7.6	2.2±0.1
F_2	145	66.8±4.6	25.7±1.8	11.7±1.5	19.7±1.1	76.7±9.2	2.1±0.1
B	142	67.0±4.7	25.4±1.7	11.7±1.4	19.5±0.9	78.1±7.7	2.2±0.1



Stability of CMS-D1 lines

CMS lines at three locations

Location	Altitude	Tem(℃)
Kunming	1900	19.7
Mengzi	1250	22.8
Yuanjiang	400	28.3

CMS lines had more stained abortive pollens, and less typical or spherical abortive pollens at altitude area.

Alti	Lines	Stained	Spher.	Typical
1900	96	84.92	8.74	6.33
1250	53	88.65	7.13	4.20

Fertility of CMS-D1 at the locations

Place	Seed-set
Kunming	0/108
Mengzi	4/108
Yuanjiang	4/108

Development of Japindica lines

Reasons

- Poor genetic diversity of *japonica* rice
- Few combination possessing strong vigor

Aims:

High yielding, resistant, good quality

Development of Japindica lines

Methods

Wide and multi-crossing between *japonica* and *indica* or wild rice. Combining the characteristics from *indica* or wild rice and cold tolerance into a line

Results

Japindica lines, possessing genetic background and characteristics of *japonica* and *indica* or wild rice, are available. Which increased the possibility of development of *japonica* hybrid rice with hybrid vigor

Possibility of high yielding, resistant, good quality

"Dianza31" and "Dianza32" have super-rice yielding potential. Harvested grains were annually ranged from 12.808 to 14.4 t ha^{-1} during 2004-2007 at Baoshan in Yunnan.

The yielding was over the standard of the super rice in China.

Genetic divergence of DZ31

- **CMS maintainer:**

***Indica* 1 and *japonica* 4**

- **Restorer:**

***Indica* 2 and *japonica* 5**

Good grain quality

The HVs have 12 out of 13 evaluating items reach the excellent rice grain quality in GB/T 17891-1999, ranked in the Excellent Grain Quality Varieties in in Yunnan.

Resistance to blast disease

Path	Y34	Y88	TH77	TH74	Y69	9206	88A	IW
31-A	S	S	S	S	S	S	S	S
DZ31	R	R	R	R	R	R	R	R
Rline	R	R	R	R	R	R	R	R
32-A	S	S	S	S	S	S	S	S
DZ32	R	R	R	R	S	R	S	R