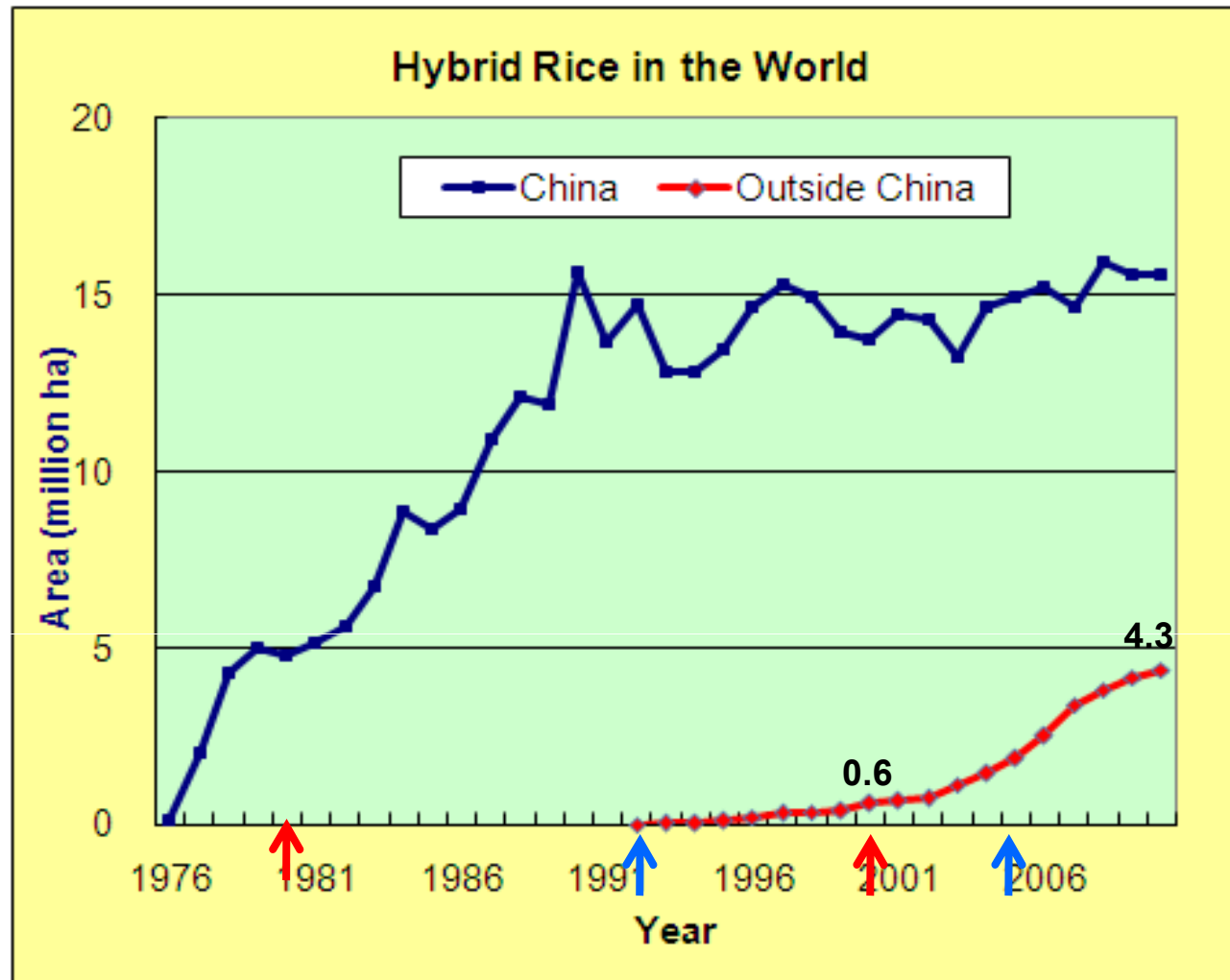


Hybrid Rice R&D Program at IRRI

Fangming Xie

IRRI

Dec. 12-13, 2011, Sanya, China



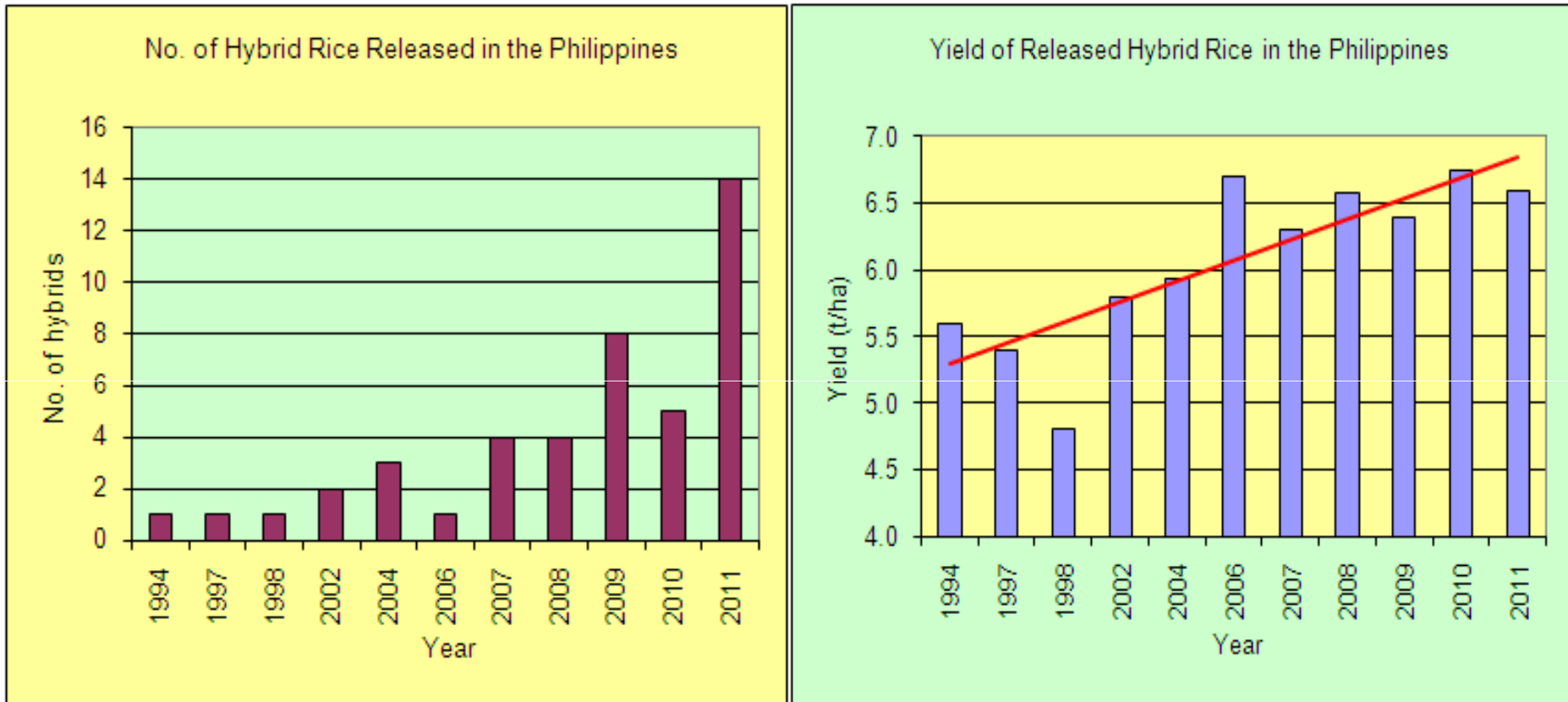
Hybrid rice R&D **outside** China started in the later of 70's & earlier of 80's, but no significant commercial production until 2000's:

- (1) a gap of 20 yrs (1980-2000) between research & production (>0.5 million ha)
- (2) a gap of 15 yrs (1991-2005) from the 1st hybrid release to 2 million ha (China in 1 yr)

Hybrid Rice Status in Major Hybrid Rice Countries (2009)

Country	China	Bangladesh	India	Indonesia	Philippines	Viet Nam	USA	Myanmar
Total Rice Area (million ha)	29.9	11.4	41.9	12.9	4.5	7.4	1.3	8.0
% of Hybrid Rice In Total Rice Area	52.1	7.0	3.9	5.0	4.4	10.1	15.9	1.0

Hybrid Rice Released for Commercial Production in the Philippines

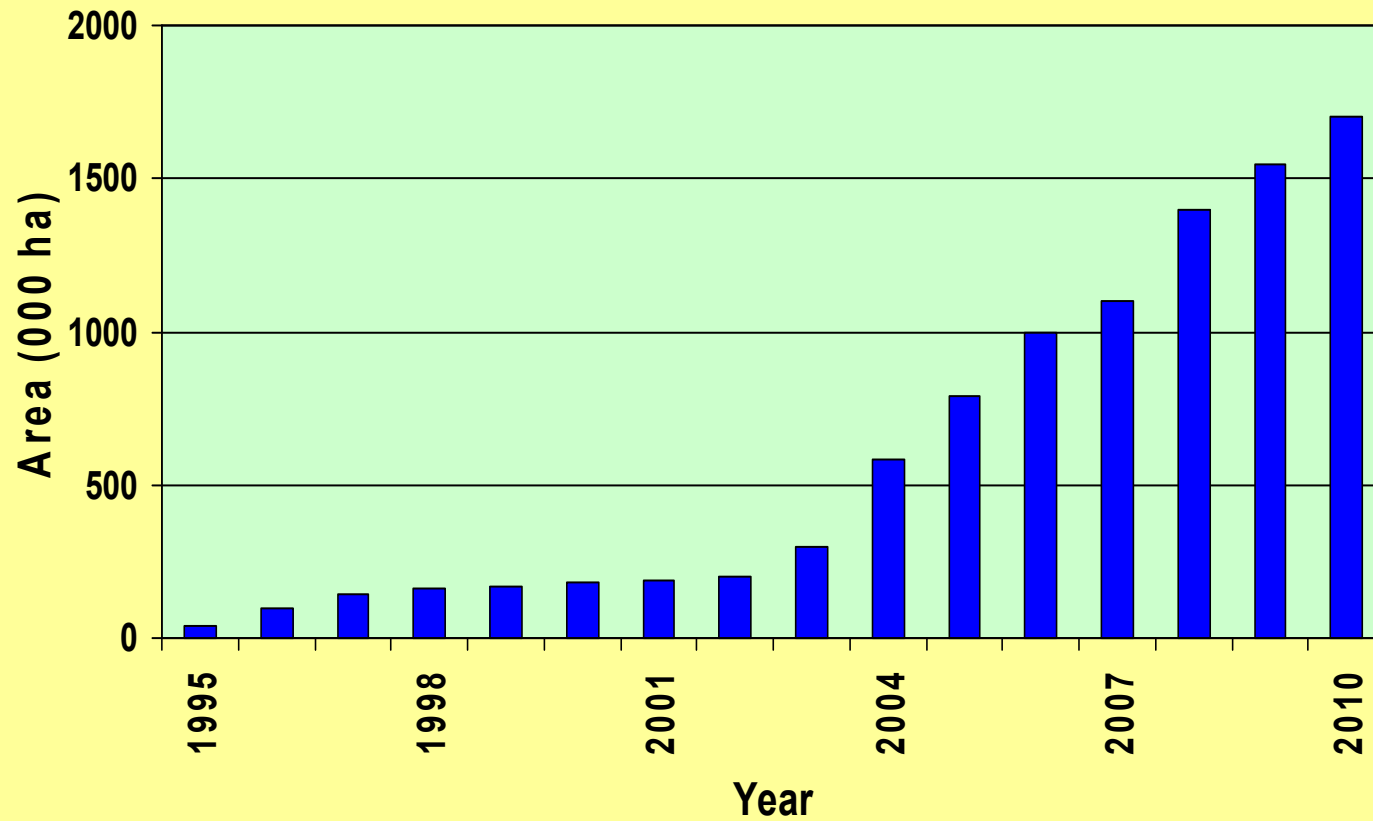


More hybrids released recently

Hybrid yield increased (6.6 t/ha currently)

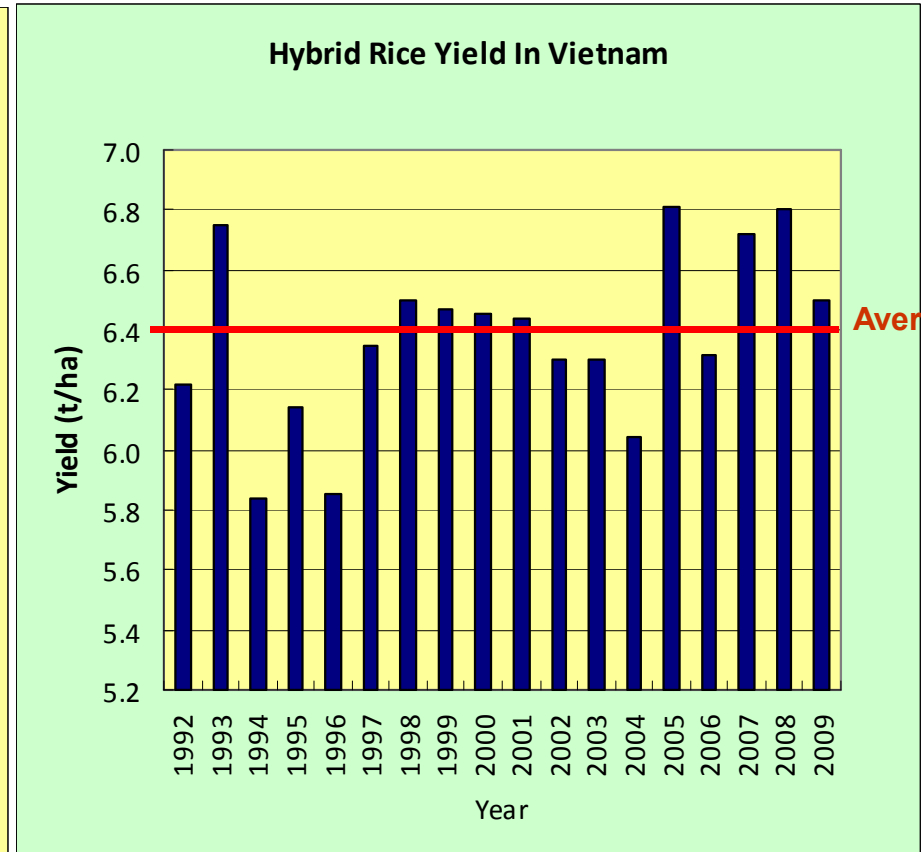
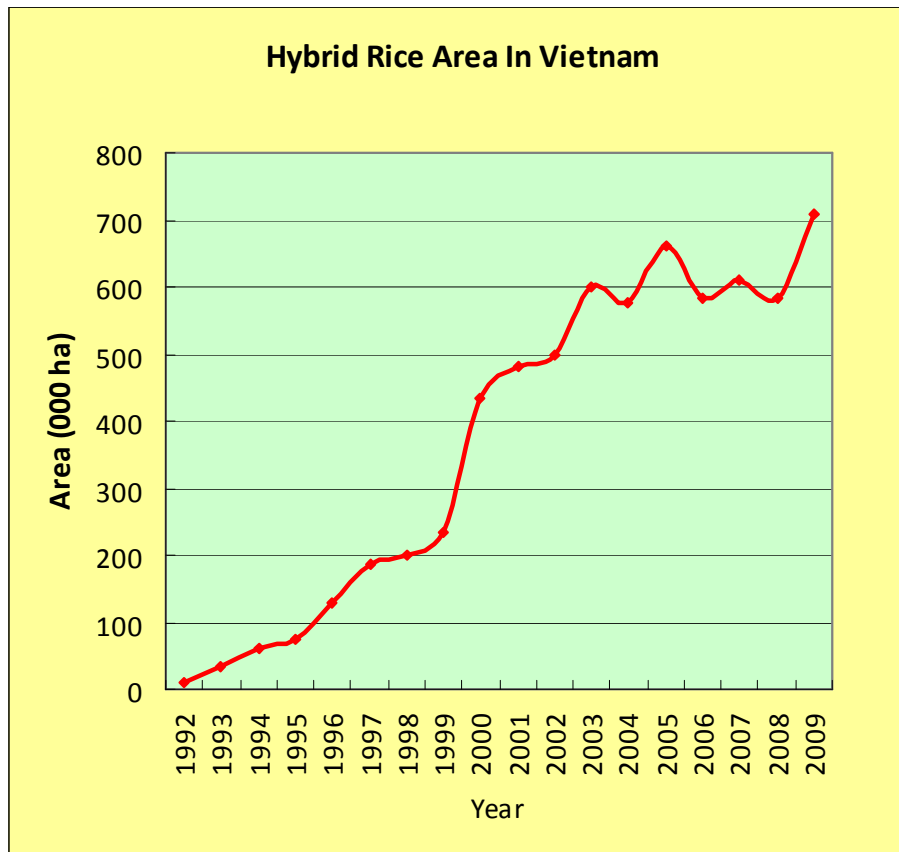
Since 1994, **44** hybrids released for commercial production in the Philippines, **11** from IRRI

Hybrid Rice Area in India











Hybrid Rice Area in Total Rice Area = 3.86% (2009)

Hybrid Rice Production in Vietnam



Hybrid Rice Area in Total Rice Area = 10.1% (2009)

Trend of Hybrid Rice Development

	Public		Private	
	China	Outside China	China	Outside China
R & D				
Commercialization				

Private and public sectors for Hybrid Rice

- **Advantages of private companies**
 - Product-oriented R & D pipelines
 - Large scale of seed production & processing
 - Marketing
- **Advantages of public sector & IRRI**
 - Technology research & innovation
 - Diverse germplasm & long term breeding
 - Collaboration, network & capacity building
 - Public interest

Hybrid Rice Development Consortium **(HRDC)**

- **Complementary Advantages**
 - Enhance steady stream of innovation & research outputs
 - Improve product accessibility & commercial use
 - Involvement of **private sector** in ensuring sustainable growth of hybrid rice
- **Established by IRRI in 2008, w/ 38 public & private organizations**

HRDC Objectives

- **Support research for parent and hybrid development**
 - Hybrid rice research (heterosis & other traits);
 - Develop hybrids & parents and share w/ partners
- **Provide information on the performance of hybrids & develop best management practices**
- **Support information sharing, public awareness & capacity building**

2011 HRDC Organization

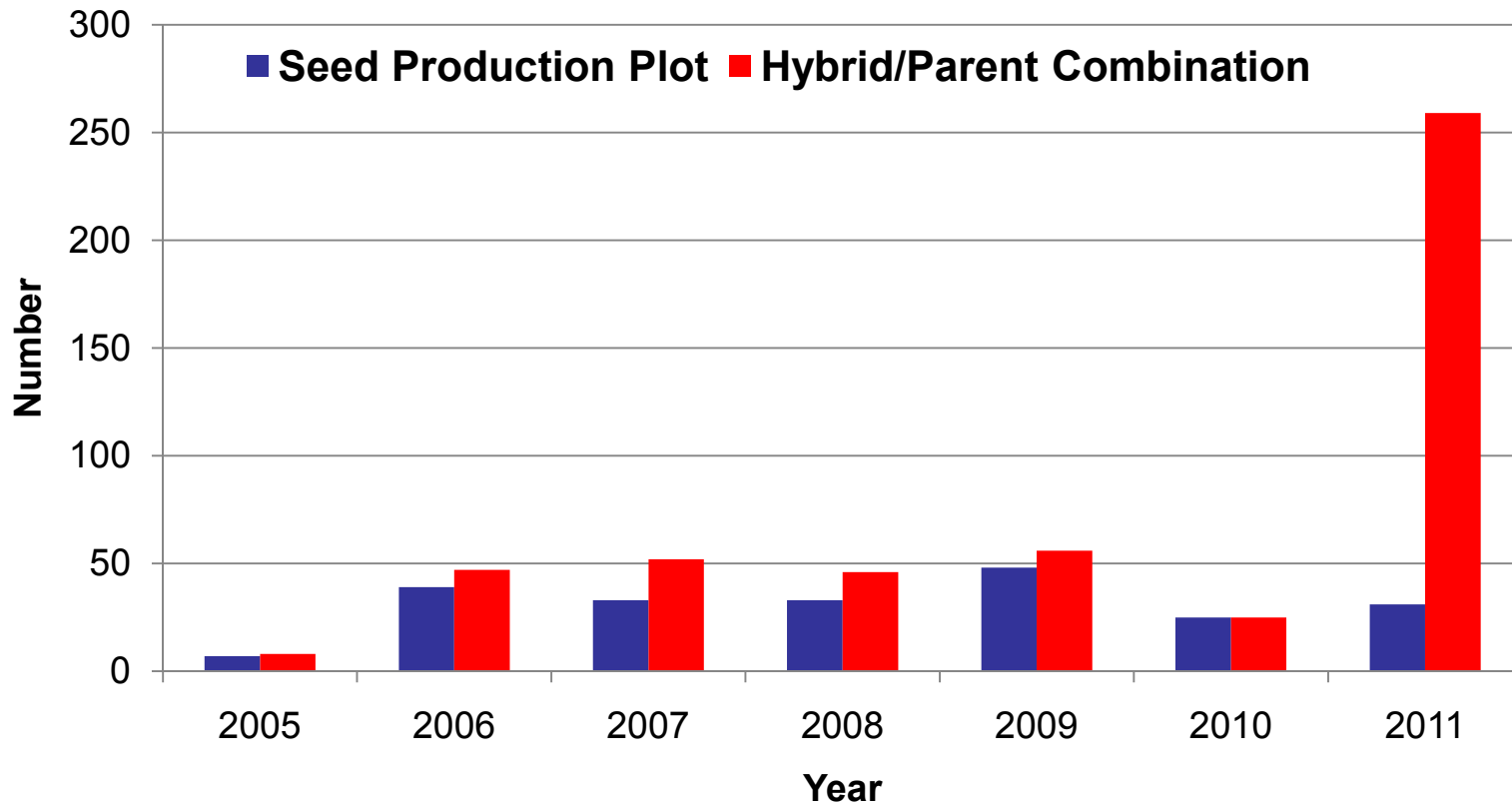
Country *	Private	Public	Country	Private	Public
Bangladesh	1	2	Iran		2
Belgium	1		Malaysia	1	2
Benin		1	Mali		1
China	1	6	Myanmar		1
Colombia	1	1	Pakistan		1
Costa Rica		1	Philippines		1
Dominican Republic		1	Singapore	1	
Egypt		1	Sri Lanka		1
Germany	1		Thailand		1
India	17	3	USA	2	2
Indonesia	1	1	Vietnam		1
Total: Private = 27 , Public = 30					

* The country is the member registered country in HRDC

Hybrid Rice Breeding Materials

Materials	2010	2011
New Crosses for breeding	182	252
New Hybrids Tested	2886	2249
F2 Population	72	127
AxB Pairs	1203	950
Breeding Lines > F2	8743	8324
<i>Total Breeding Lines</i>	<i>13,086</i>	<i>11,902</i>
Stage IV (AYT) Hybrids Tested	200	220

Parent and Hybrid Seed Production



Seed Production Plot = small scale of seed production
Hybrid combination = hybrids > Stage 1

IRRI Hybrids Released Commercially in the Philippines from 1994

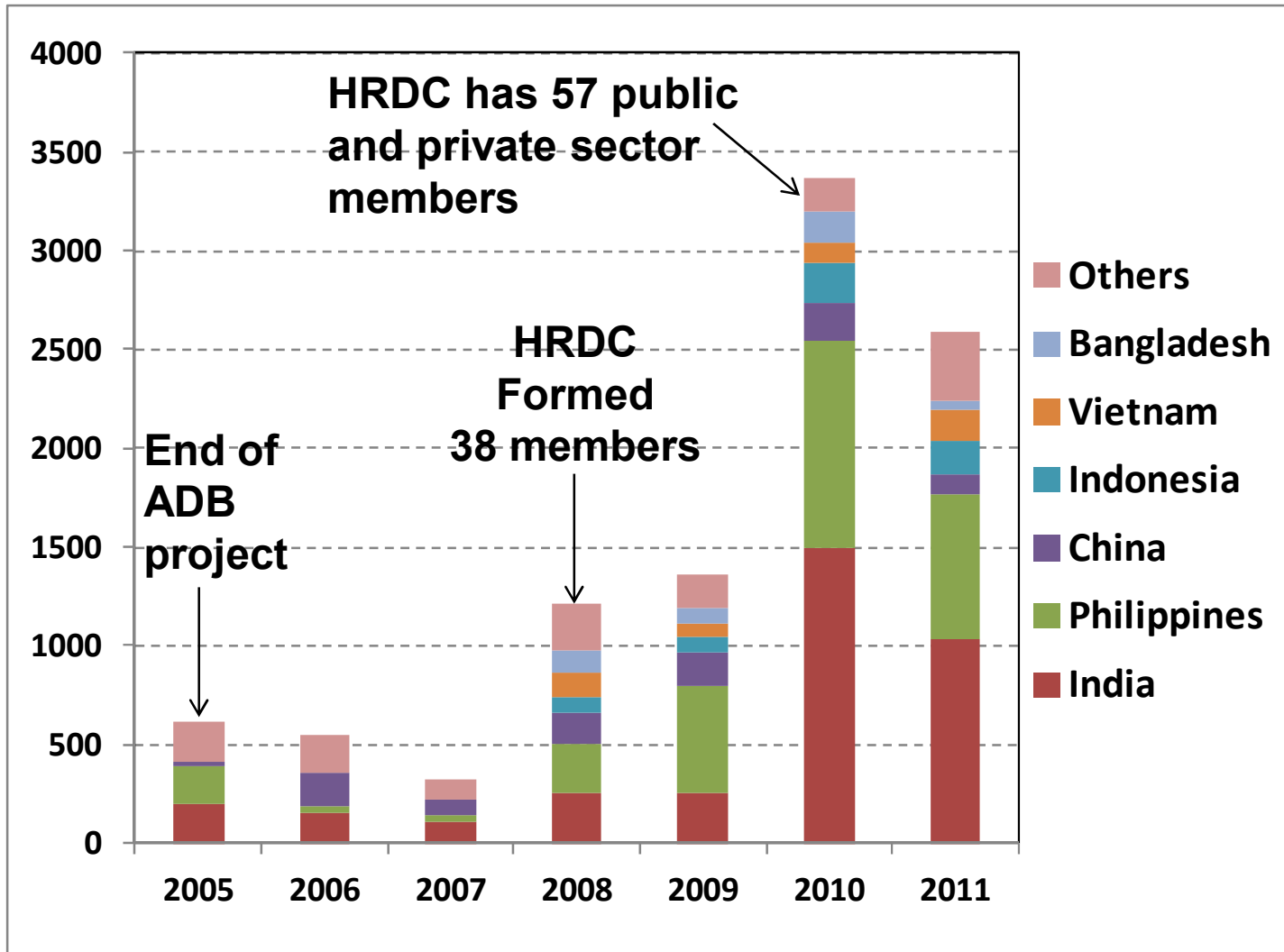
IRRI Code	Hybrid Name	Year
IR81949H	Mestizo 32	2011
IR80637H	Mestiso 31	2011
IR84714H	Mestizo 30	2011
IR82372H	Mestizo 26	2010
IR82363H	Mestizo 25	2010
IR83199H	Mestizo 21	2009
IR78386H	Mestizo 7	2006
IR75217H	Mestizo 3	2002
IR75207H	Mestizo 2	2002
IR68284H	Mestizo 1	1997
IR64616H	Magat	1994

Yield (kg/ha) of IRRI hybrids tested since 2008 & compared with IR75217H

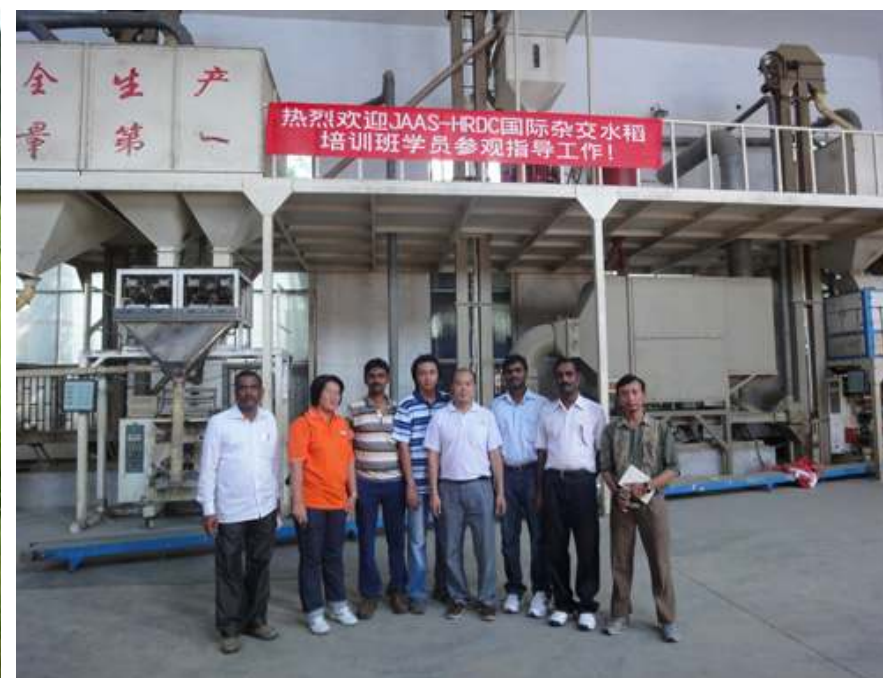
DS	Data Point	Yield	% > CK	WS	Data Point	Yield	% > CK
IR82385H	1	7700	8.0	IR82385H	7	7350	14.8
IR85471H	7	7653	7.4	IR82396H	9	7101	11.0
IR82366H	2	7593	6.5	IR79118H	1	6950	8.6
IR81958H	17	7444	4.4	IR82392H	1	6736	5.3
IR83202H	4	7345	3.0	IR85471H	9	6720	5.0
IR86169H	3	7264	1.9	IR85469H	1	6717	5.0
IR81955H	8	7228	1.4	IR83201H	18	6685	4.5
IR82386H	25	7205	1.1	IR84711H	11	6649	3.9
IR85465H	2	7150	0.3	IR81959H	1	6610	3.3
IR84713H	2	7148	0.3	IR82362H	1	6576	2.8
IR75217H	35	7128		IR83199H	24	6557	2.5
				IR81958H	16	6473	1.1
				IR81972H	1	6442	0.7
				IR75217H	42	6400	

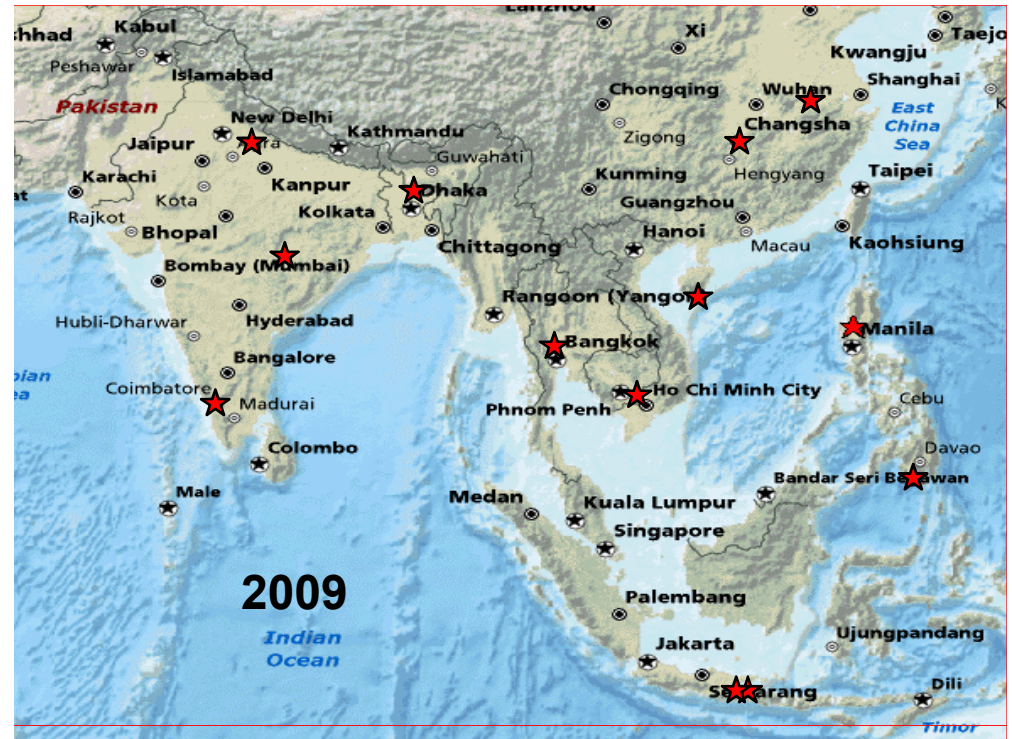
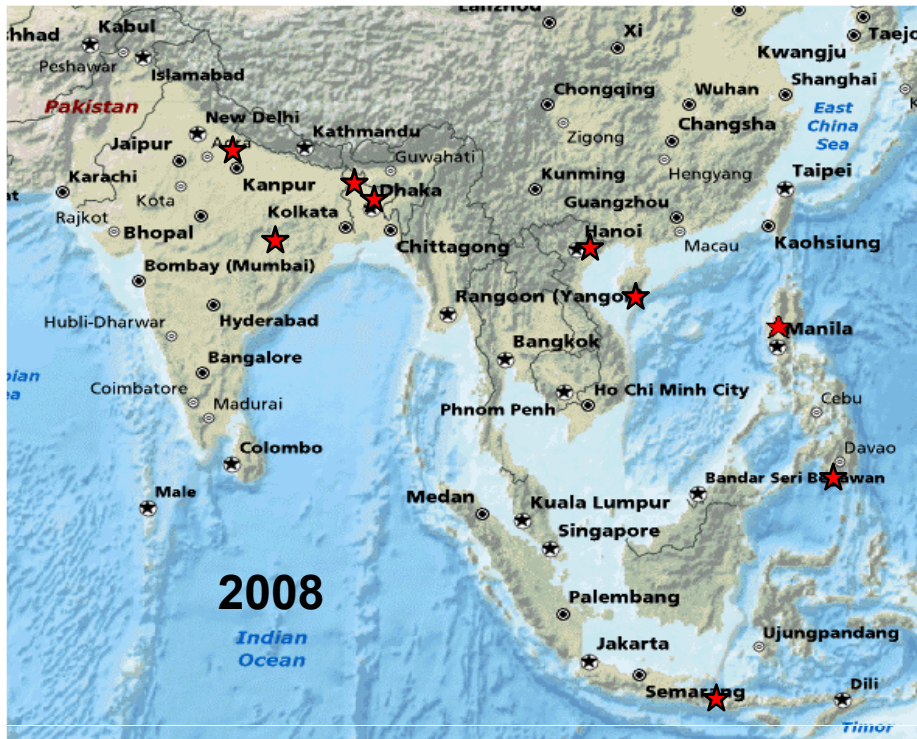
More hybrids, better than hybrid CK, in the pipeline

IRRI hybrid rice germplasm shared with partners



JAAS-HRDC Hybrid Rice Training, 2010 (7). 2011 (14)

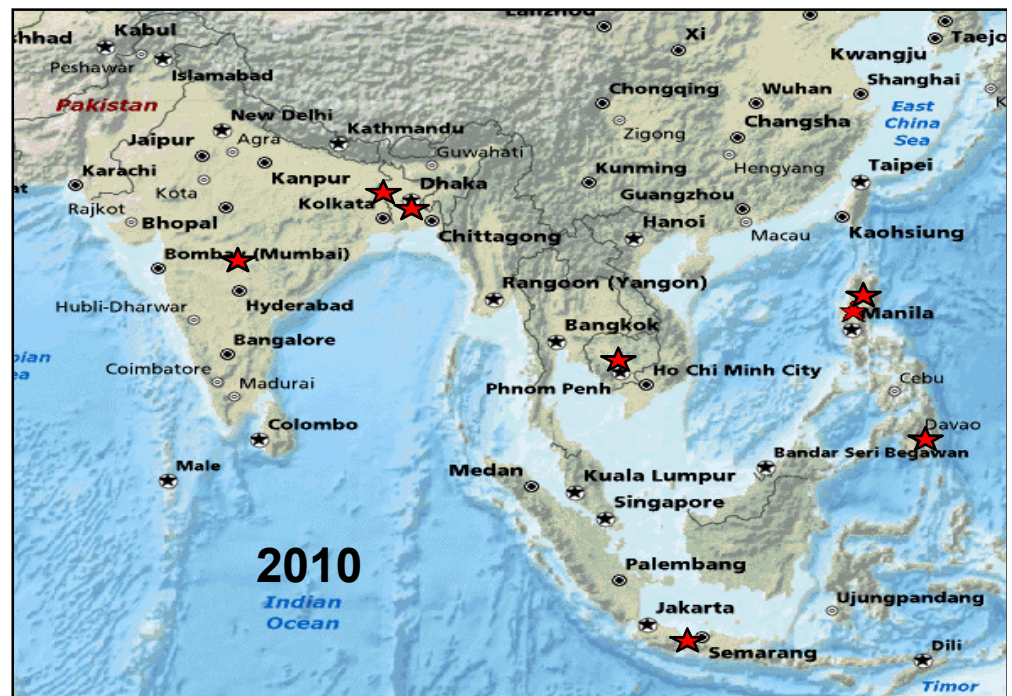
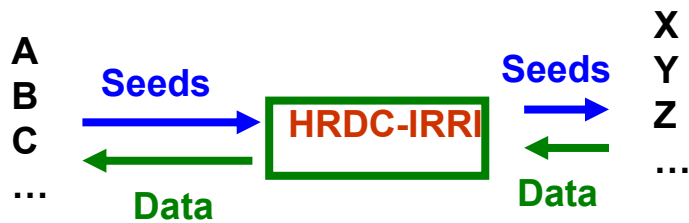


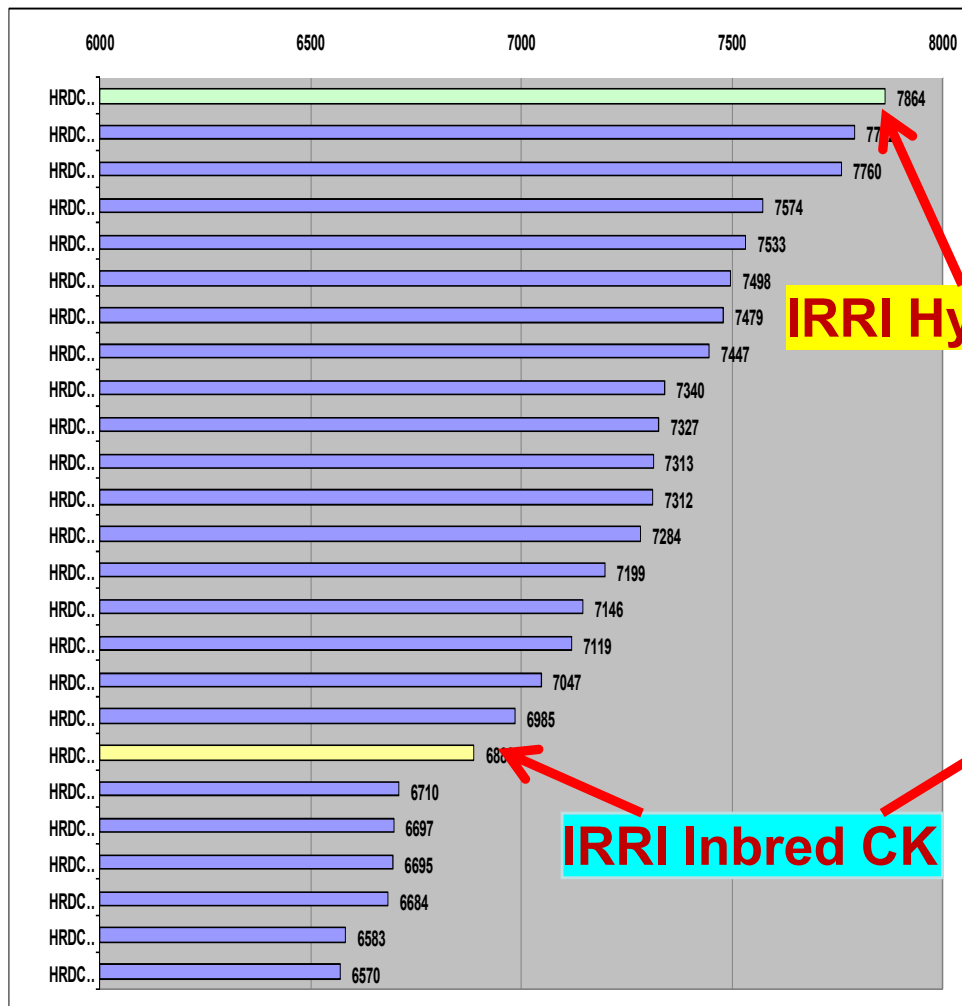


Multiple Replicated Yield Trials (MRYT)

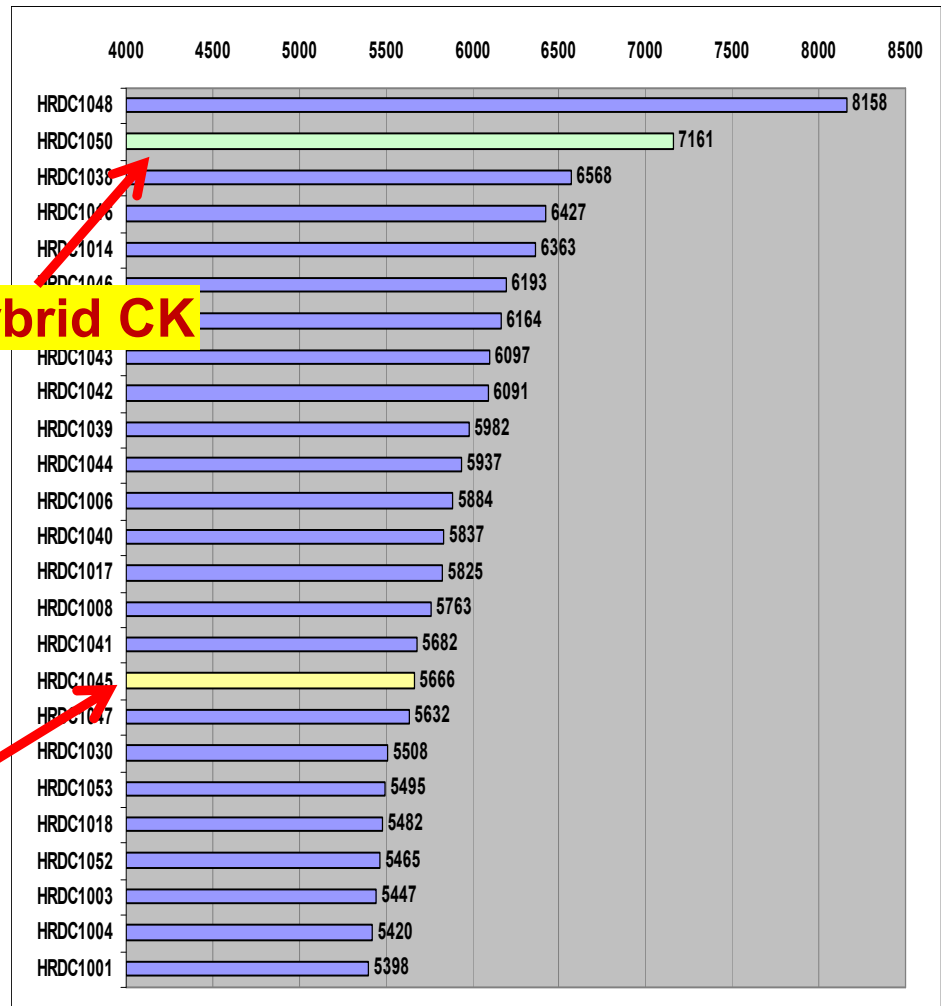
HRDC Member

MRYT Location





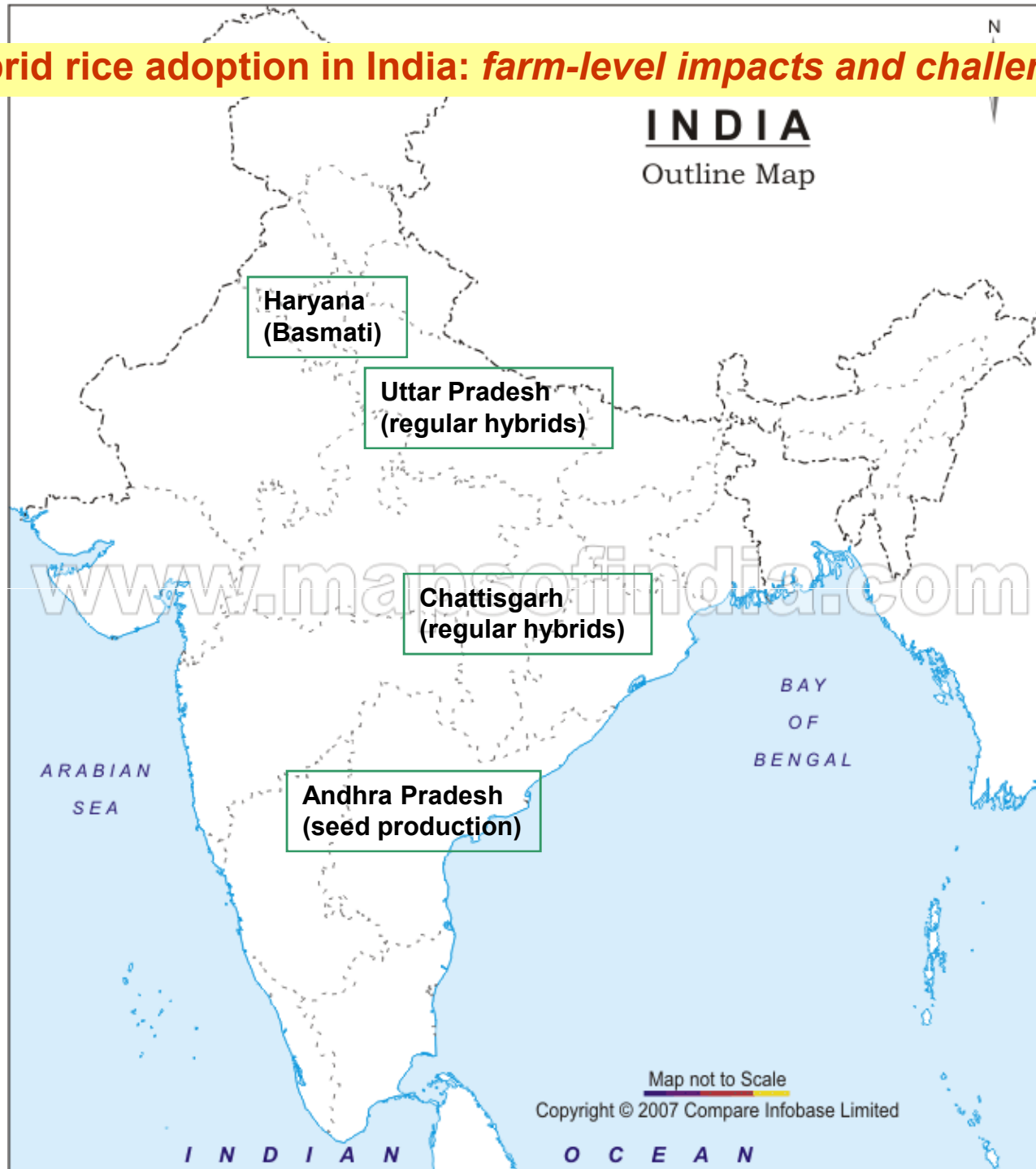
2010DS



2010WS

MRYT Yield Comparison

Hybrid rice adoption in India: *farm-level impacts and challenges*



Hybrid rice adoption in India: *farm-level impacts and challenges*

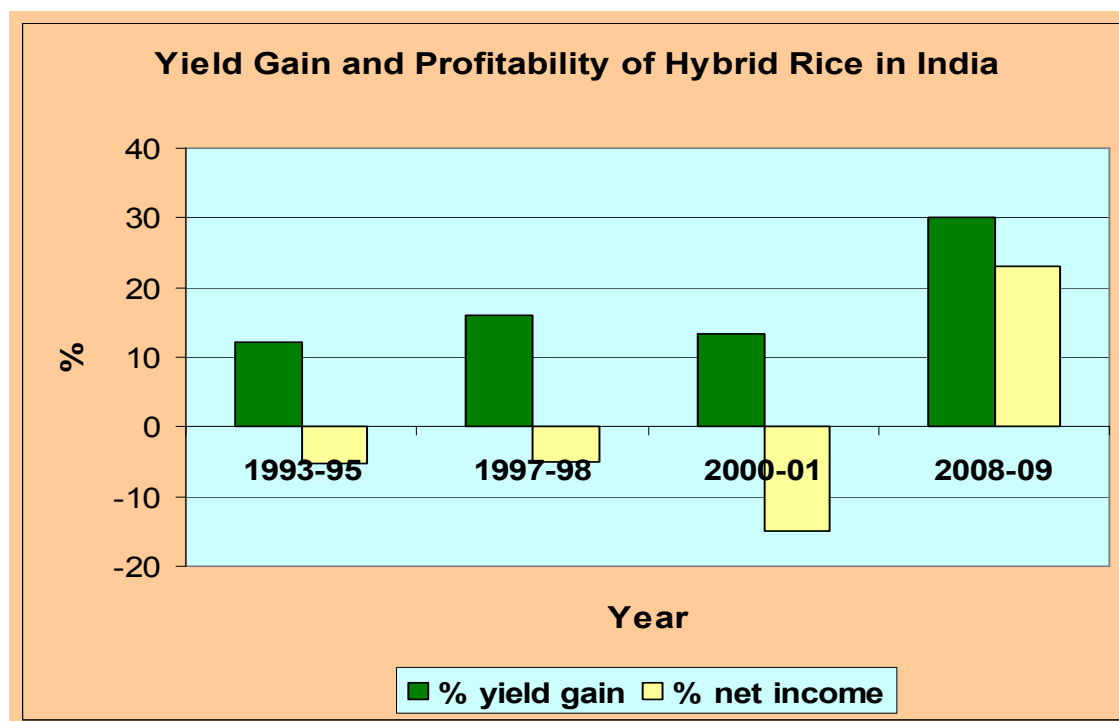
Details	Chattisgarh (east)		Uttar Pradesh (north)		Haryana (Basmati)	
	<u>Hybrid</u>	<u>Inbred</u>	<u>Hybrid</u>	<u>Inbred</u>	<u>Hybrid</u>	<u>Inbred</u>
Sample size	61		64		60	
Farm size (ha)	6.6		2.0		10.0	
Hybrid Yield (t/ha)	4.5	3.3	6.2	5.0	7.5	7.3
Advantage of Hybrid (%)	36.4		24.0		3.0	
Net Return (\$)	539	478	597	444	839	826
Economic grain of hybrid (%)	12.8		34.5		1.6	
Cost of Production (\$/t)	135	143	71	85	105	105

1. Side-by-Side Comparison

2. Aldas Janaiah (ANGRAU) 2008/9 Hybrid Rice Impact Study - HRDC

Yield Performance of Hybrid Rice, 2008-09 WS (t/ha)

State	Hybrid	Inbred	Gain	% Gain
Chattisgarh	4.5	3.3	1.2	36
Uttar Pradesh	6.2	5.0	1.2	24
Haryana (Basmati hybrid)	7.5	7.3	0.2	3





Annual Meeting

March 21-23, 2011

ABC, D.L. Umali Hall

IRRI RICE RESEARCH INSTITUTE
Los Baños, Laguna Philippines



HRDC members select breeding lines & observe MRYT



Hybrid rice research priorities at IRRI

- Increase and stabilize yields of seed production
- Enhance yield heterosis in both dry and wet seasons to >20%
- Improve hybrid rice grain quality
 - Reduce chalk
 - Increase head rice recovery
- Improve resistance to biotic stresses
- Develop hybrids for unfavorable environments
- Improve breeding efficiency (biotech)

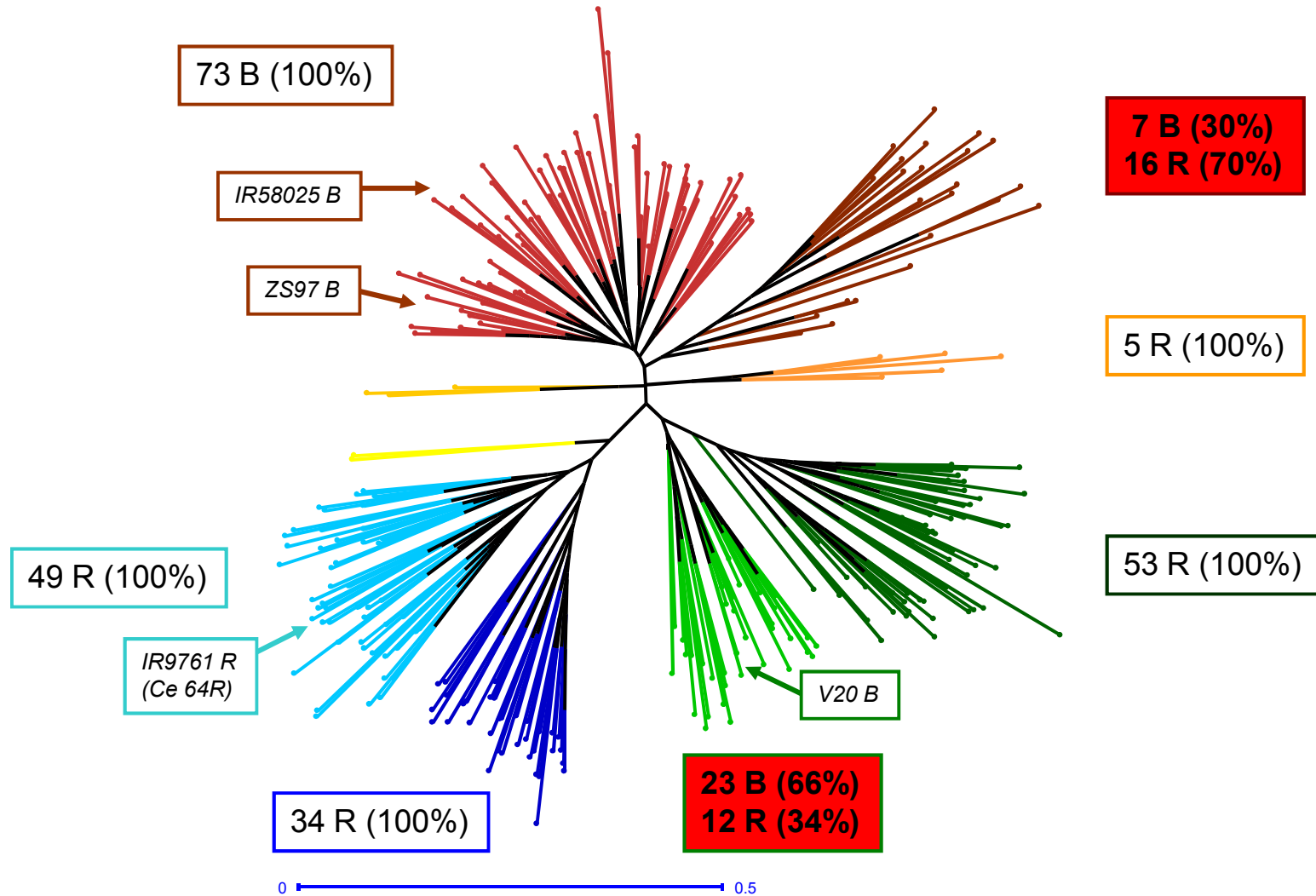
Other on-going Hybrid Rice R & D at IRRI

- Developing hybrid rice parents & hybrids using conventional & molecular marker technologies
 - Yield and yield heterosis
 - Bacterial blight resistance
 - Submergence tolerance
 - Drought tolerance
 - Low chalk
 - Outcrossing
- Heterosis study – genetics & molecular markers

IRRI Hybrid Rice Parents (278) genotyped with 21 SSRs using LiCor 4300

Dendrogram by DARwin 5 using Simple Matching dissimilarity and unweighted Neighbor Joining

Genotyping and scoring by M. Baraoidan, S. Quilloy, J. Ferrater Phylogenetic analysis by K. McNally



Future Opportunities

- Strength partnership with public and private sectors;
- Increase seed yield;
 - High seed yielding parents and seed production technology
 - Training seed growers
- Enhance yield and yield heterosis:
 - Applying biotechnology for parent selection (heterotic groups and/or heterotic gene blocks)
 - Exploiting sub-subspecies heterosis
- Develop hybrids for unfavorable environments
- Improve resistance/tolerance to stress, grain quality
- Improve agronomic management and deployment strategy

Announcement

The 6th International Hybrid Rice Symposium

Sept. 8 - 11, 2012

Hyderabad International Conference Center

Hyderabad, India