

HYBRID RICE

in the Philippines



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The start of hybrid rice technology in the Philippines in 1998 was inspired by its spectacular gains in China.

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Hybrid Timeline

1988	Professor Li Zhengyou of Yunnan Agricultural University visited PhilRice and offered help to PhilRice to propagate the then new hybrid rice technology
1989	PhilRice forged partnership with Yunnan Agricultural University on hybrid rice R&D
1994	IRRI released the first hybrid variety in the Philippines—PSB Rc26H (<i>Magat</i>)
1995	PhilRice started sharing the technology to farmers
1997	PSB Rc72H (<i>Mestizo</i>) was released

Hybrid Timeline

1998	Pres. Fidel V. Ramos officially launched the use of hybrid rice technology as a national development strategy
1998	FAO awarded a technical cooperation project entitled “Strengthening National Capacity for Hybrid Rice Development and Use”
2002	Pres. Gloria M. Arroyo launched the Hybrid Rice Commercialization Project (HRCP) as a cornerstone of the rice self-sufficiency program
2004	The Philippines became the 4 th country with the largest area planted to hybrid at 208,000 hectares
2005	The area planted to hybrid rice was 360,000 hectares

Accomplishments and Impacts

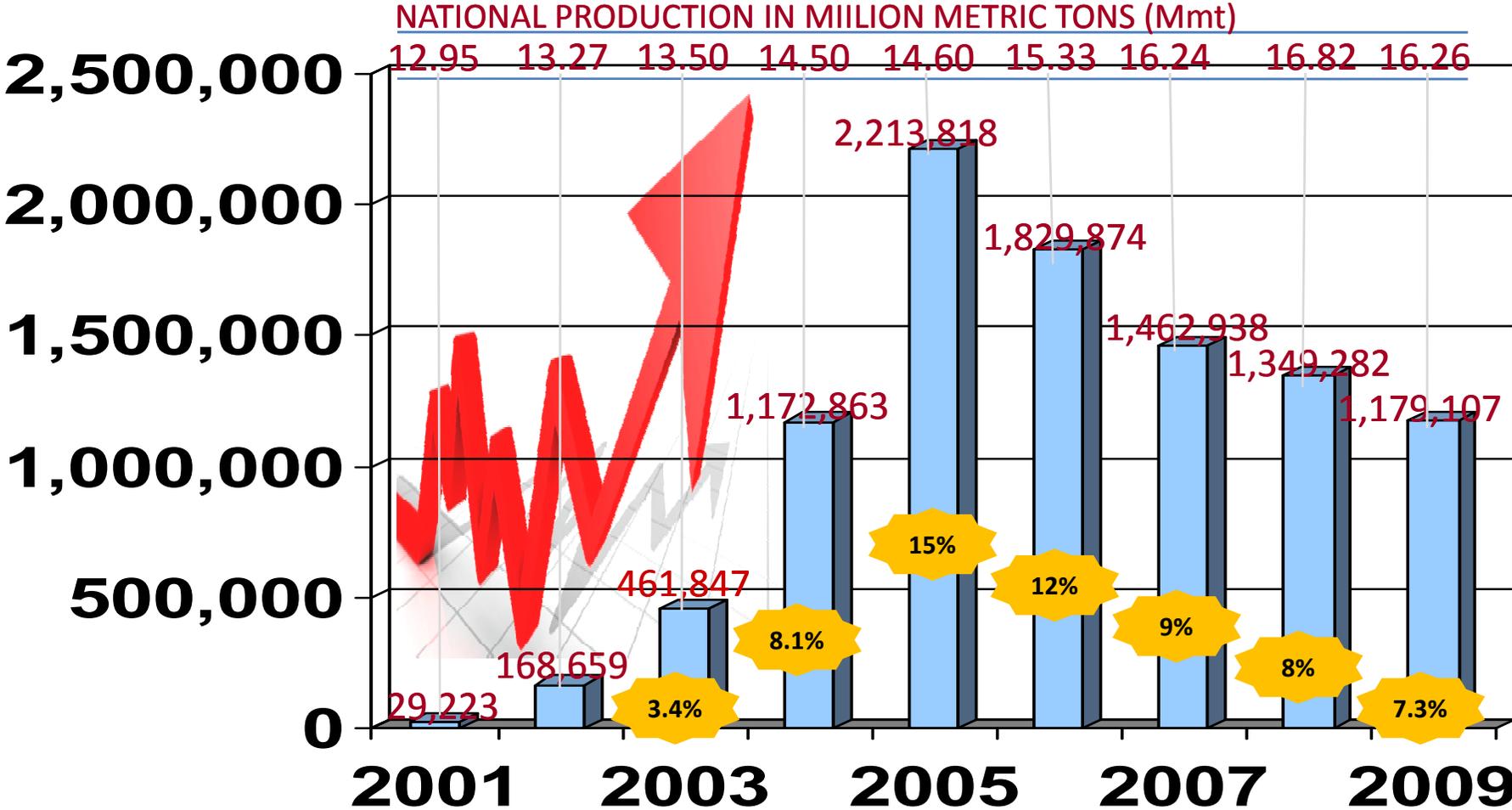
HYBRID RICE COMMERCIALIZATION PROJECT (HRCP)

The Hybrid Rice Commercialization Project

- **GOAL:** More rice for the Filipinos
- The HRCP was launched in December 2002 through Administrative Order No. 25 as a strategy to increase rice farming productivity and profitability.
- **PhilRice:** mandated to intensify its research activities toward rearing the hybrid rice program and in providing the basic information and technical assistance to prospective farmers and seed growers
- **COMPONENTS:** seed production, training, credit services, technology demonstration & info campaign

Increased Production

Production of commercial hybrid *palay* grew from 29,223 mt in 2002 to as high 2.21 M mt in 2005



Yield Difference of Hybrid Rice vs CS, 2001-2010

YEAR	F1		CS		Yield Difference	
	Area Harvested (ha)	Yield (mt/ha)	Area Harvested (ha)	Yield (mt/ha)	Yield Difference	
					(mt/ha)	(%)
2001	5,371	5.44	599,961	4.28	1.16	27.07
2002	27,914	6.04	1,283,012	4.43	1.61	36.28
2003	77,358	5.97	1,233,210	4.47	1.50	33.43
2004	203,993	5.75	1,083,290	4.57	1.18	25.75
2005	368,634	6.01	915,095	4.54	1.46	32.20
2006	311,533	5.87	1,010,211	4.48	1.40	31.26
2007	238,681	6.13	1,584,705	4.35	1.78	40.82
2008	222,668	6.06	1,733,654	4.43	1.63	36.85
2009*	192,600	6.12	2,522,046	4.18	1.94	46.32
2010						
TOTAL	1,648,751	5.98	11,965,183	4.39	1.59	36.32

Source: DA-MID

Impact on Farm Productivity

- Average yield advantage of hybrid rice production over inbred is **8%-14%**
- From 2001-2009, the average yield difference of hybrid rice and certified seeds is **1.59mt/ha**

Impact on Farm Income

ITEM	Farmer's Home-Saved Seeds	Certified Seeds	Hybrid Seeds
CASH COSTS	10,194.00	10,494.00	13,453.00
NON-CASH COSTS	6,539.00	6,539.00	7,188.00
IMPUTED COSTS	6,511.00	6,511.00	6,748.00
TOTAL COSTS	23,244.00	23,544.00	27,389.00
GROSS RETURNS	29,790.80	40,443.00	60,050.00
RETURNS ABOVE CASH COST	19,596.80	29,949.00	46,597.00
RETURNS ABOVE CASH AND NON-CASH COST	13,057.80	23,410.00	39,409.00
NET RETURNS	6,546.80	16,899.00	32,661.00
NET PROFIT-COST RATIO	0.28	0.72	1.19
Cost per kg.	6.90	5.15	4.56
Yield per hectare (kg)	3,370.00	4,575.00	6,005.00
Farmgate price (peso/kg)	8.84	8.84	10.00

Impact on Farm Practices

- The promotion of hybrid rice created greater awareness on the other component technologies that have been ignored in the past
- Farmers became interested in optimizing hybrid rice production, at less cost
- Farmers adopted a lower seeding rate from 80-120kg/hectare to 20-25kg/hectare for transplanted rice
- Farmers planting hybrid rice adopted synchronous planting

Impact on the Rice Economy

- The net present value (NPV) of the HRCP is PhP1.4B while its economic NPV amounts to PhP314M
- The HRCP led to foreign exchange savings equivalent to US\$23.25M during the period 2002-2004.

Social Impacts

Hybrid rice farmer

- 100% of hybrid rice adopters in Isabela considered themselves as better provided as their rice income increased by 20%
- Claimed to have acquired more assets after continuous planting of hybrid rice

Inbred rice farmer

- 60% of inbred farmers expressed satisfaction as income provider
- Claimed to have acquired more assets after continuous planting of hybrid rice

Hybrid Varieties (Public)

HYBRID	RELEASED AS	BREEDER	YEAR RELEASED
MAGAT	PSB Rc26H	IRRI	1994
MESTIZO 1	PSB Rc72H	IRRI	1997
MESTIZO 2	NSIC Rc114H	IRRI	2002
MESTIZO 3	NSIC Rc116H	IRRI	2002
MESTIZO 7	NSIC Rc136H	IRRI	2006
MESTIZO 12	NSIC Rc174H	PHILSCAT	2008
MESTIZO 13	NSIC Rc176H	PHILSCAT	2008
MESTIZO 14	NSIC Rc178H	PHILSCAT	2008
MESTIZO 16	NSIC Rc196H	PHILRICE	2009
MESTIZO 17	NSIC Rc198H	PHILRICE	2009

Hybrid Varieties (Public)

HYBRID	RELEASED AS	BREEDER	YEAR RELEASED
MESTIZO 19	NSIC Rc202H	PHILRICE, UPLB	2009
MESTIZO 20	NSIC Rc204H	PHILRICE, UPLB	2009
MESTIZO 21	NSIC Rc206H	IRRI	2009
MESTIZO 29	NSIC Rc114H	PHILRICE	2011
MESTIZO 30	NSIC Rc116H	IRRI	2011
MESTIZO 31	NSIC Rc136H	IRRI	2011
MESTIZO 32	NSIC Rc196H	PHILRICE	2011
MESTIZO 38	NSIC Rc198H	PHILRICE, PHILSCAT, CLSU	2011

Hybrid Varieties (Private)

HYBRID	RELEASED AS	BREEDER	YEAR RELEASED
PANAY	PSB Rc76H	MONSANTO	1998
MESTIZO 4	NSIC Rc124H	BAYER	2004
MESTIZO 5	NSIC Rc126H	MONSANTO	2004
MESTIZO 6	NSIC Rc132H	SL Agritech	2004
MESTIZO 8	NSIC Rc162H	BIOSEED	2007
MESTIZO 9	NSIC Rc164H	HYRICE	2007
MESTIZO 10	NSIC Rc166H	SYNGENTA	2007
MESTIZO 11	NSIC Rc168H	BAYER	2007
MESTIZO 15	NSIC Rc180H	BIOSEED	2008
MESTIZO 18	NSIC Rc200H	BAYER	2009

Hybrid Varieties (Private)

HYBRID	RELEASED AS	BREEDER	YEAR RELEASED
MESTIZO 22	NSIC Rc208H	SYNGENTA	2009
MESTIZO 23	NSIC Rc210H	PIONEER	2008
MESTIZO 33	NSIC Rc252H	ADVANTA INDIA LTD.	2011
MESTIZO 34	NSIC Rc254H	ADVANTA INDIA LTD.	2011
MESTIZO 35	NSIC Rc256H	BEIDAHUANG SEED	2011
MESTIZO 36	NSIC Rc258H	METAHELIX/DHAANYA	2011
MESTIZO 37	NSIC Rc260H	SEEDWORKS	2011
MESTIZO 39	NSIC Rc264H	METAHELIX/DHAANYA	2011
MESTIZO 40	NSIC Rc266H	DevGen	2011
MESTIZO 41	NSIC Rc268H	DevGen	2011
MESTIZO 42	NSIC Rc270H	DevGen	2011

Focus and Future Directions

HYBRID RICE RESEARCH AND DEVELOPMENT

Hybrid Rice Breeding Program

GOAL: To help ensure and optimize societal benefits of public-bred hybrids

OBJECTIVES:

- Produce basic germplasm for breeding new hybrids
- Develop and test three-line and two-line hybrids for commercial release
- Optimize seed production protocols
- Conduct field demonstration of new and upcoming hybrid varieties
- Manage breeding administration records
- Generate high quality patent applications and publications
- Support national goals of attaining rice self-sufficiency and competitiveness

Hybrid Breeding Priorities

Morpho-Agronomic Characteristics

1. Yield (Heterosis)
2. Plant architecture
3. Outcrossing rate (A line)
4. Pollen load and strong restoring ability (R line)
5. Stable sterility (CMS and TGMS line)
6. Good combining ability

Diseases/Pest

1. Bacterial Leaf Blight
2. Tungro
3. Blast
4. Brown planthopper
5. White-backed planthopper
6. Stemborer

Hybrid Breeding Priorities

Grain Quality Characteristics

1. Chalkiness
2. Milling yield (Head rice recovery)
3. Amylose content/GT/GC
4. Eating quality

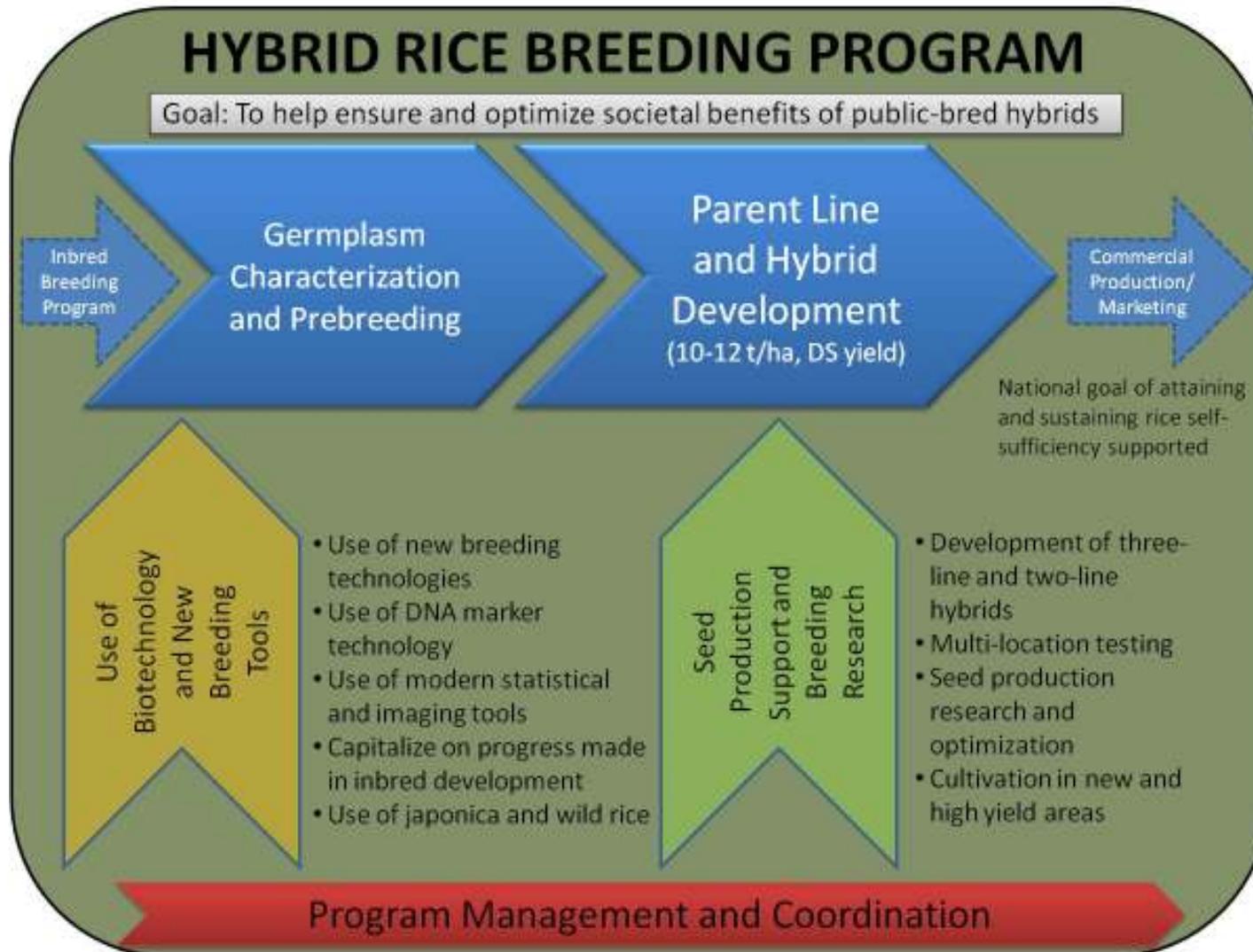
Abiotic stress

1. Drought
2. Submergence
3. Salinity

Value-adding

1. Vit A
2. Iron
3. Zinc

Research Strategies



Research Strategies

Pre-breeding researches and production of basic germplasm (3-line and 2-line system)

Strategies:

1. Capitalize on inbred breeding improvement/development
2. Test early generation breeding lines for combining ability
3. Use recurrent selection method utilizing nuclear male sterility (ms) system for simultaneous trait improvement
4. Directed RxR, BxB, SxI and IxI crosses for trait-specific improvement of hybrid parent lines
5. Employ anther culture technique to fast-track development of hybrid parent lines for testcrossing
6. Designate 2-3 broad testers to assess combining ability of newly developed parent lines

Research Strategies

Utilization of biotechnology and other new tools in hybrid rice breeding

Strategies:

1. Take advantage of high throughput genotyping platform (SNP) offered at IRRI
2. Introgress favorable chromosomal segments from Japonica, Javanica and related *Oryza* species.
3. Utilize molecular markers to locate chromosomal regions related to yield and heterosis
4. Harness marker-assisted selection strategy in mainstream breeding
5. Use practical imaging softwares for seed characterization i.e. chalkiness
6. Use improved statistical methods in data analysis i.e. QTL mapping, association breeding, heterosis prediction, GXE interaction.

Product Development & Delivery Strategies

- Increase number of test entries for yield trials
- Increase number of test locations for yield trials
- Develop protocol for internal yield testing (Adaptability Tests)
- Test in both high yielding and new environments (GIS data)
- Expand seed production research
- Scout for suitable seed production areas during wet season (e.g. rent, partnership, joint venture)
- Non-exclusive licensing

Future Directions

- Free market for hybrid rice seeds
- Self-regulation and truthful labeling for seed quality
- Building the local capacity to produce seeds
- Public-private partnership in hybrid rice variety development
- Strengthening of seed cooperatives to handle public hybrids
- Focused role of the national government