

# 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>MESTISO</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 <sup>th</sup> country with the largest area planted to hybrid at 208,000 hectares
2005	The area planted to hybrid rice was 360,000 hectares

## HYBRID RICE COMMERCIALIZATION PROJECT (HRCP)

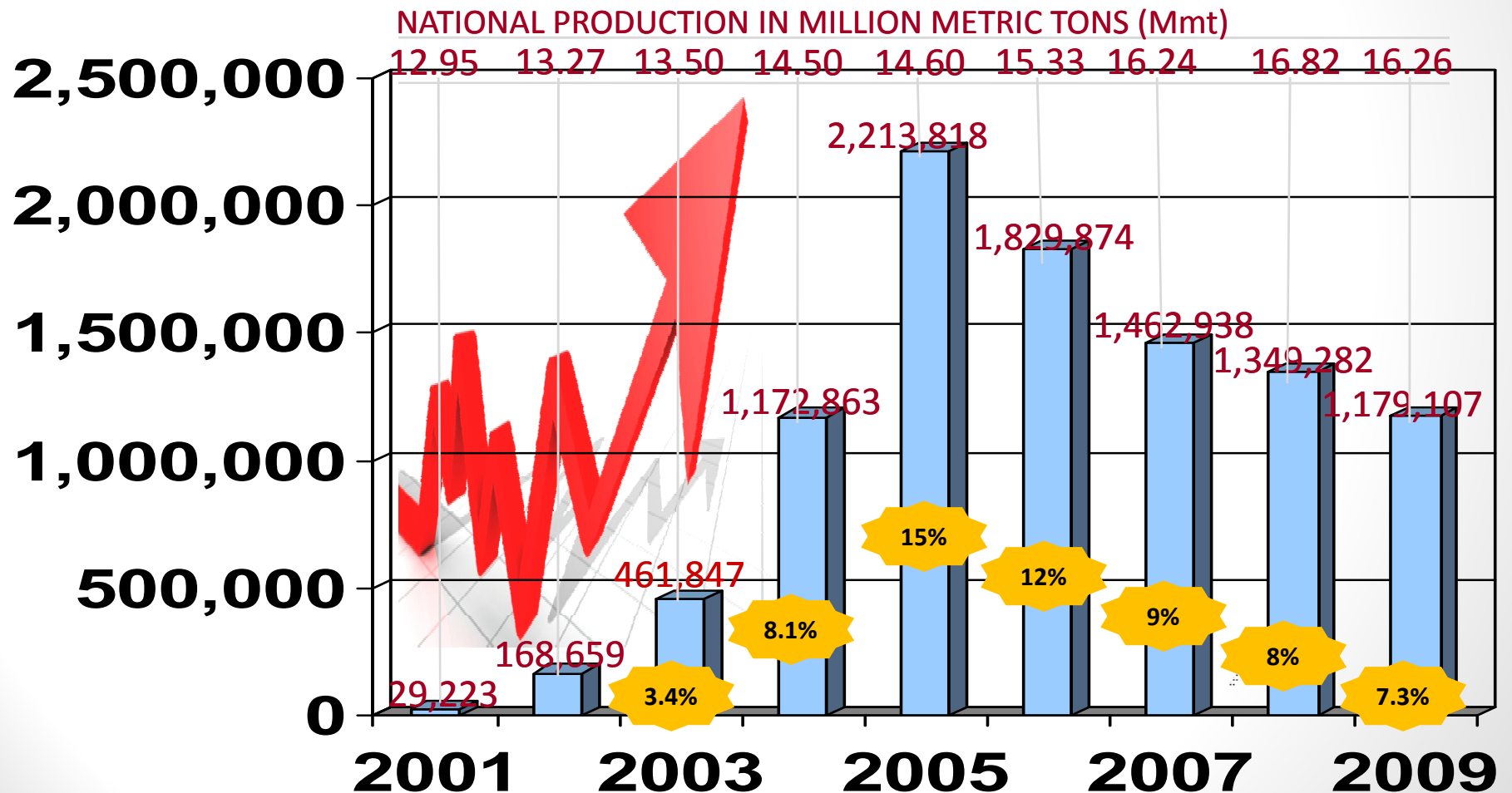
*Accomplishments and impacts*

# The Hybrid Rice Commercialization Project

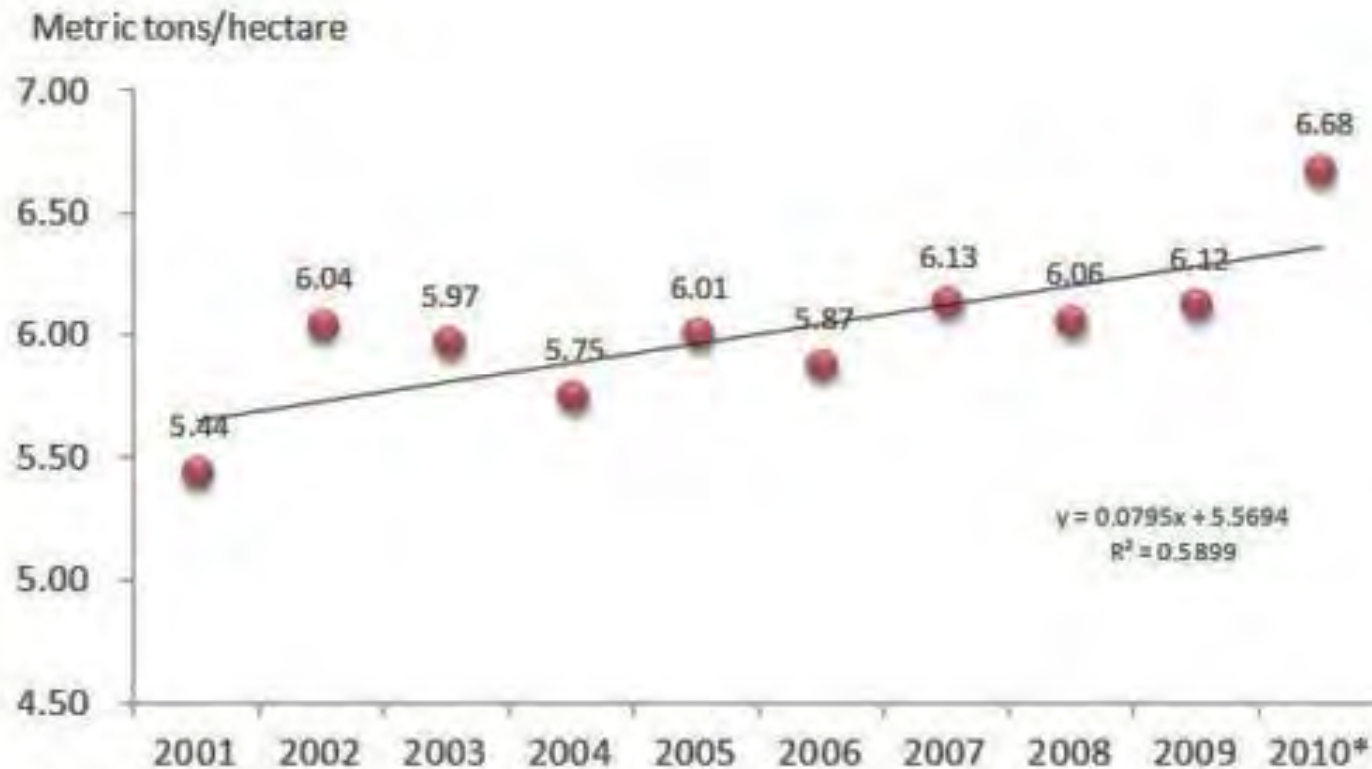
- **GOAL:** More rice for the Filipinos
- The HRCP was launched in December 2002 through Administrative Order No. 25 as a strategy to increase rice farming productivity and profitability.
- **PhilRice:** mandated to intensify its research activities toward rearing the hybrid rice program and in providing 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 of commercial hybrid rice production, 2002-2010



\*2010 data is preliminary  
Source: DA - MID

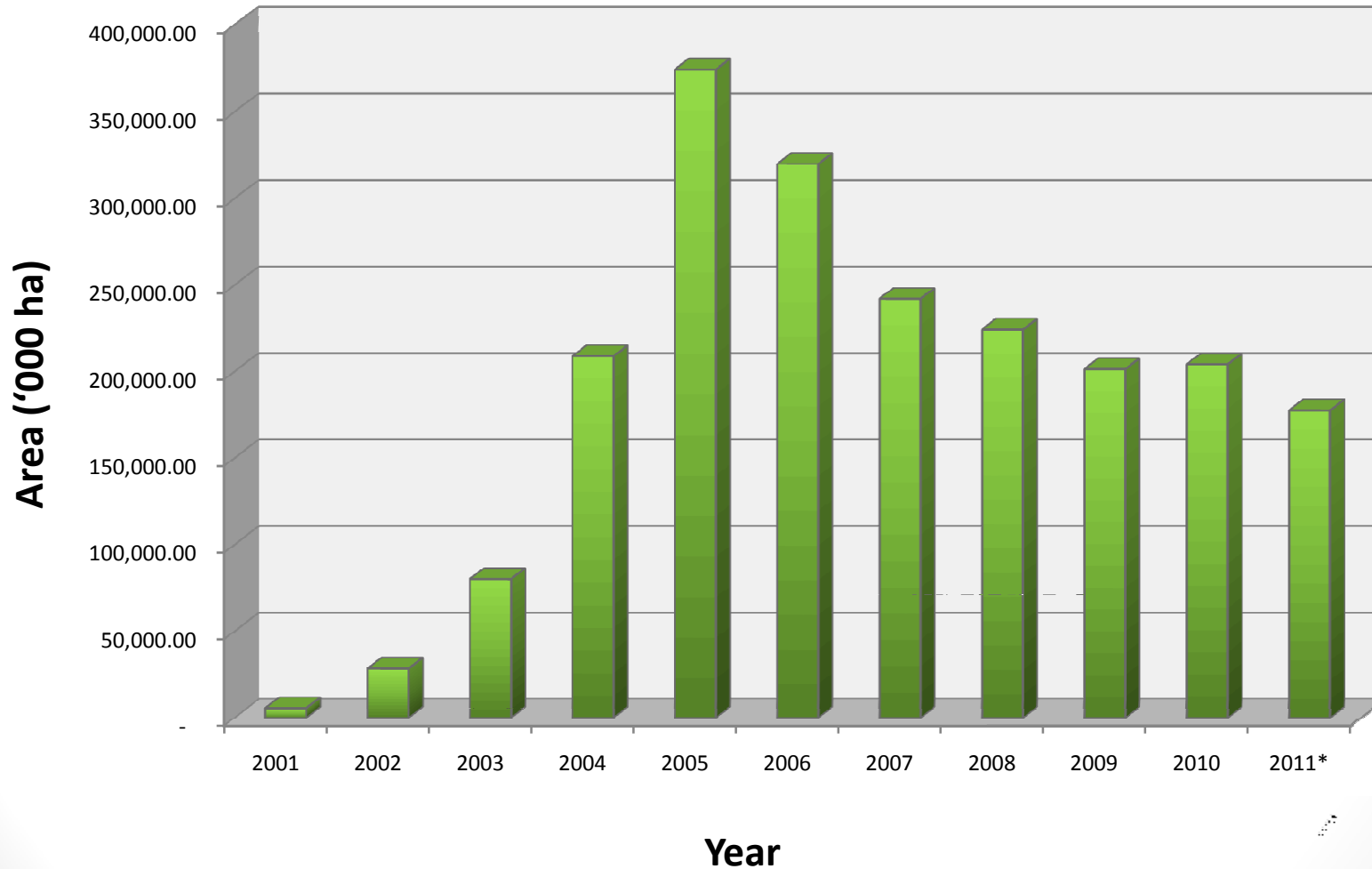


# Yield Difference of Hybrid Rice vs CS, 2001-2010

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

Source: DA-MID

# Hybrid rice area planted, 2001-2011



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
<b>CASH COSTS</b>	<b>10,194.00</b>	<b>10,494.00</b>	<b>13,453.00</b>
<b>NON-CASH COSTS</b>	<b>6,539.00</b>	<b>6,539.00</b>	<b>7,188.00</b>
<b>IMPUTED COSTS</b>	<b>6,511.00</b>	<b>6,511.00</b>	<b>6,748.00</b>
<b>TOTAL COSTS</b>	<b>23,244.00</b>	<b>23,544.00</b>	<b>27,389.00</b>
<b>GROSS RETURNS</b>	<b>29,790.80</b>	<b>40,443.00</b>	<b>60,050.00</b>
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
<b>NET RETURNS</b>	<b>6,546.80</b>	<b>16,899.00</b>	<b>32,661.00</b>
<b>NET PROFIT-COST RATIO</b>	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)

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



# Hybrid Varieties (Public)

HYBRID	RELEASED AS	BREEDER	YEAR RELEASED
MESTISO 19	NSIC Rc202H	PHILRICE, UPLB	2009
MESTISO 20	NSIC Rc204H	PHILRICE, UPLB	2009
MESTISO 21	NSIC Rc206H	IRRI	2009
MESTISO 25	NSIC Rc230H	IRRI	2010
MESTISO 26	NSIC Rc232H	IRRI	2010
MESTISO 29	NSIC Rc114H	PHILRICE	2011
MESTISO 30	NSIC Rc116H	IRRI	2011
MESTISO 31	NSIC Rc136H	IRRI	2011
MESTISO 32	NSIC Rc196H	PHILRICE	2011
MESTISO 38	NSIC Rc198H	PHILRICE, PHILSCAT, CLSU	2011

# Hybrid Varieties (Private)

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

# Hybrid Varieties (Private)

<b>HYBRID</b>	<b>RELEASED AS</b>	<b>BREEDER</b>	<b>YEAR RELEASED</b>
<b>MESTISO 22</b>	<b>NSIC Rc208H</b>	<b>SYNGENTA</b>	<b>2009</b>
<b>MESTISO 23</b>	<b>NSIC Rc210H</b>	<b>PIONEER</b>	<b>2008</b>
<b>MESTISO 24</b>	<b>NSIC Rc228H</b>	<b>HYRICE</b>	<b>2010</b>
<b>MESTISO 27</b>	<b>NSIC Rc234H</b>	<b>SYNGENTA</b>	<b>2010</b>
<b>MESTISO 28</b>	<b>NSIC Rc236H</b>	<b>SEEDWORKS</b>	<b>2010</b>
<b>MESTISO 33</b>	<b>NSIC Rc252H</b>	<b>ADVANTA INDIA LTD.</b>	<b>2011</b>
<b>MESTISO 34</b>	<b>NSIC Rc254H</b>	<b>ADVANTA INDIA LTD.</b>	<b>2011</b>
<b>MESTISO 35</b>	<b>NSIC Rc256H</b>	<b>BEIDAHUANG SEED</b>	<b>2011</b>
<b>MESTISO 36</b>	<b>NSIC Rc258H</b>	<b>METAHELIX/DHAANYA</b>	<b>2011</b>
<b>MESTISO 37</b>	<b>NSIC Rc260H</b>	<b>SEEDWORKS</b>	<b>2011</b>

# Hybrid Varieties (Private)

<b>HYBRID</b>	<b>RELEASED AS</b>	<b>BREEDER</b>	<b>YEAR RELEASED</b>
<b>MESTISO 39</b>	<b>NSIC Rc264H</b>	<b>METAHELIX/DHAANYA</b>	<b>2011</b>
<b>MESTISO 40</b>	<b>NSIC Rc266H</b>	<b>DevGen</b>	<b>2011</b>
<b>MESTISO 41</b>	<b>NSIC Rc268H</b>	<b>DevGen</b>	<b>2011</b>
<b>MESTISO 42</b>	<b>NSIC Rc270H</b>	<b>DevGen</b>	<b>2011</b>

	Public hybrids	20
+	Private hybrids	24
<hr/>		
	Hybrids	44



IRRI

PhilSCAT  
Philippine-Sino Center for Agricultural Technology

syngenta

MONSANTO



SL AGRITECH CORPORATION  
"Agri-Technology for Markets"



Bayer

SEEDWORKS

PIONEER  
A DUPONT BUSINESS

deVGen

BIOSEED®

# HYBRID RICE RESEARCH AND DEVELOPMENT

*Focus and Future Directions*

# 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



# Hybrid Breeding Priorities

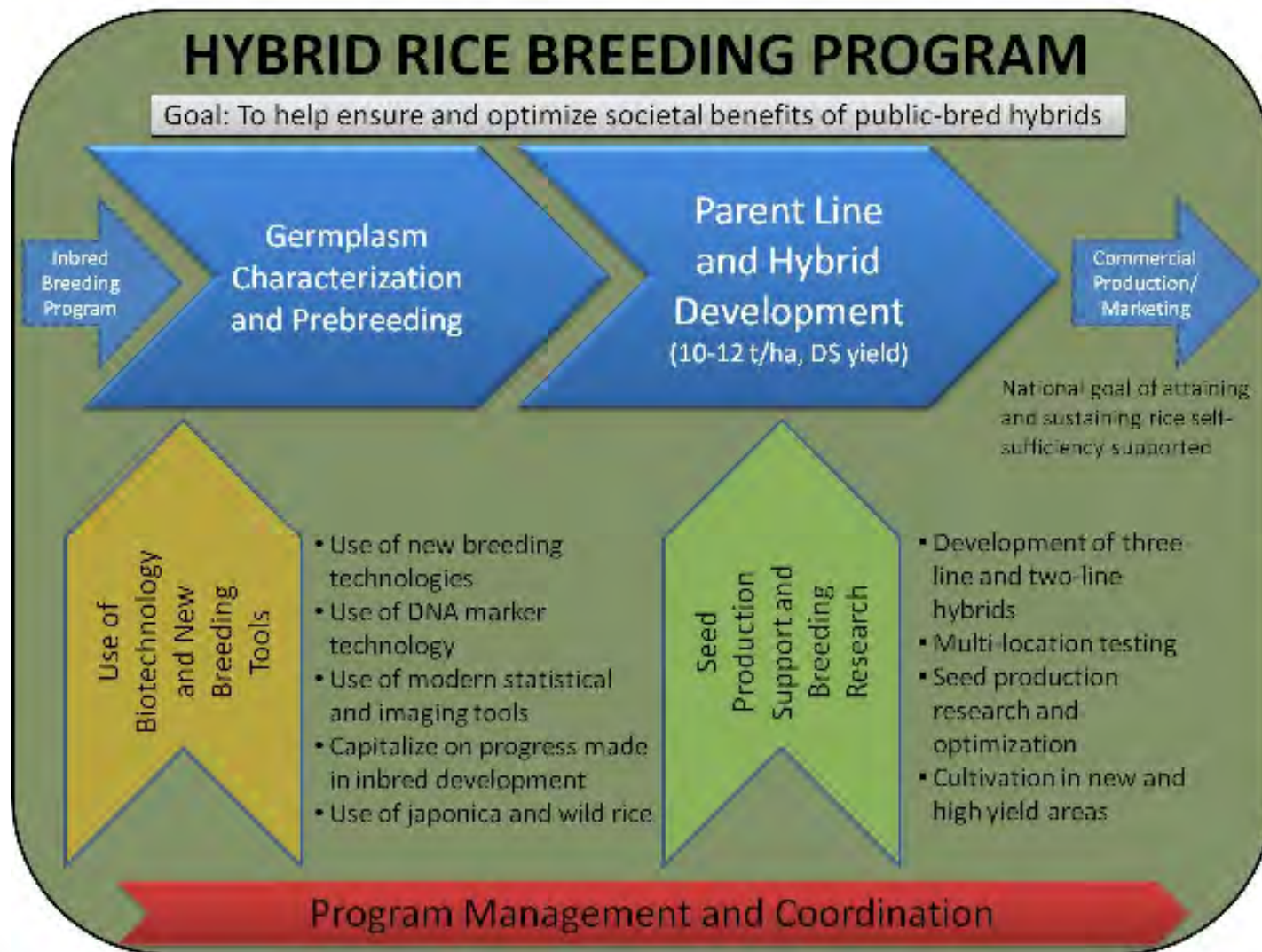
## Grain Quality Characteristics

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

## Abiotic stress (long-term goals)

1. Drought
2. Submergence
3. Salinity

# 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)
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