Science For A Better Life

Hybrid Rice Breeding – Private sector perspective

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Agenda

- Trends in Global Agriculture
- Rice Outlook
- The Challenges
- Hybrid Rice
- The Way Forward

Mega-Trends in Agriculture

Need for alternative energy feedstocks

- Increasing demand for renewable energy and biofuels

Growing world population

- Increasing demand for food, feed, fiber and renewable raw materials
- Decreasing farmland per capita

Growing wealth

- Increasing demand for high quality, healthy and affordable food
- Decreasing stocks to use

Climate change

- Yield losses through adverse weather conditions
- Need to reduce greenhouse gas emissions

Food and feed crops as well as renewable raw materials and fiber plants are competing for limited agriculture resources

Food Supply: A Global Challenge

World population*	2,500,000,000	6,100,000,000	9,200,000,000
Arable land per person	 0.52 ha	 0.25 ha	 0.16 ha
	1950	2000	2050

*Source: United Nations

productivity improvement is must to face the challenge

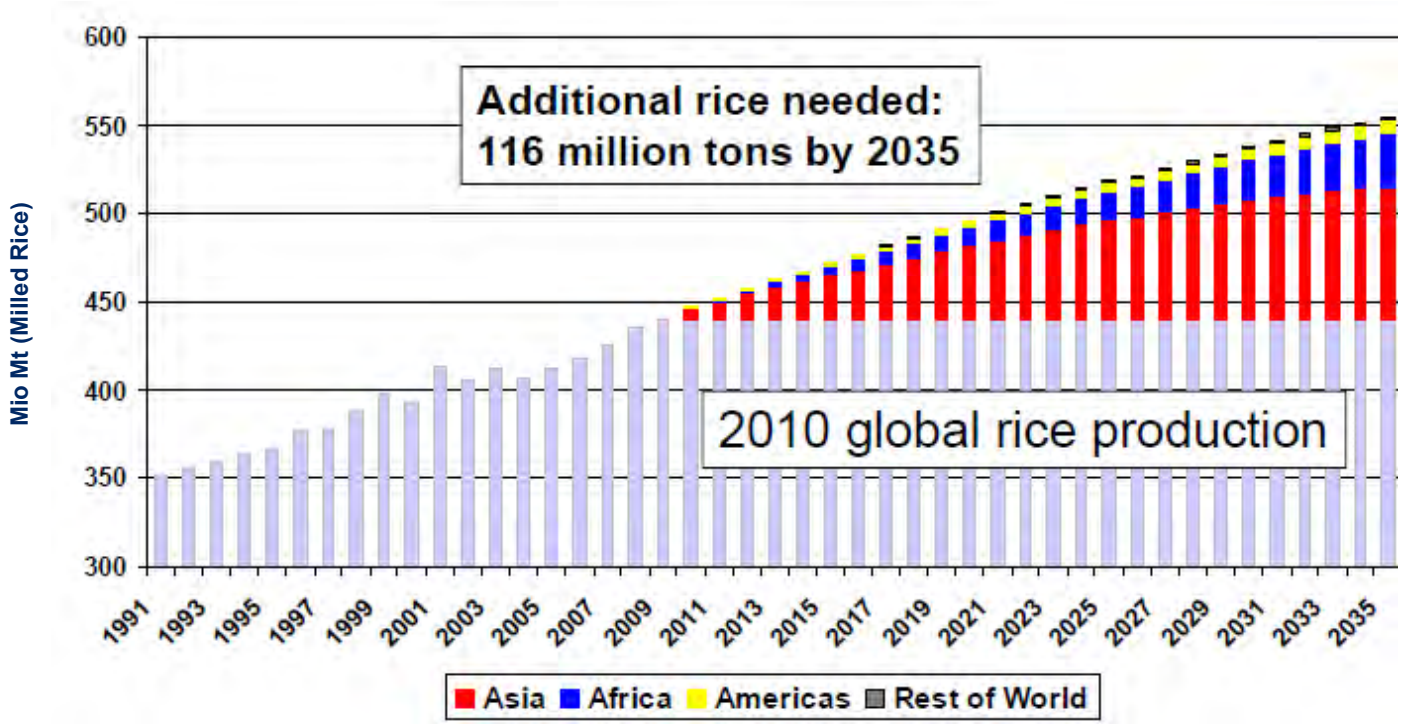
The Rice Challenge:
Feeding a growing world population

- **Demand** … expected to increase by 30% in next 15-20 years (FAO, IRRI)
- **Consumption**… already above production
- **Yield Plateauing**….Decline in growth rate of yield with traditional varieties
- **Resources**….Pressure on arable land, labour & water supply

Need to improve rice productivity to address the challenge

Rice Outlook

Global Rice Production Increase Needed to Meet Demand by 2035



Source: IRRI

Asia – The Rice Hub

Scenario

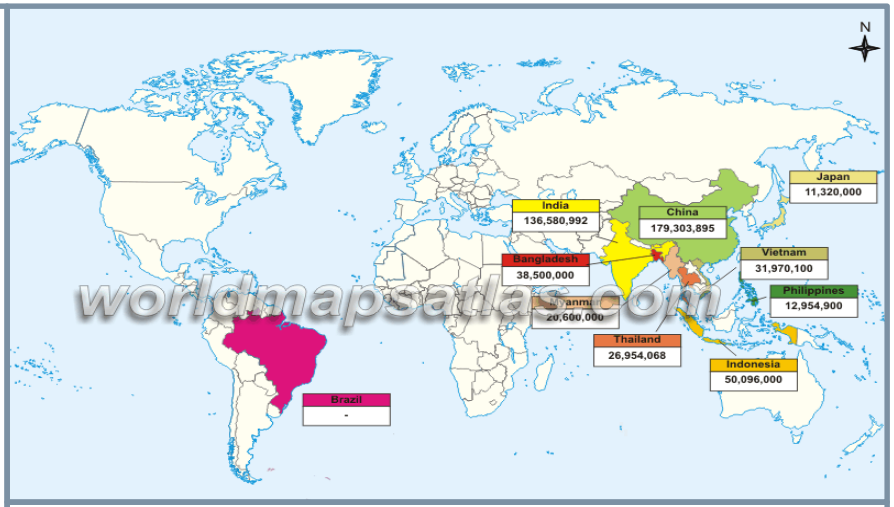
- About 90 % of the global rice is produced and consumed in Asia
- Livelihood of majority of the farmers

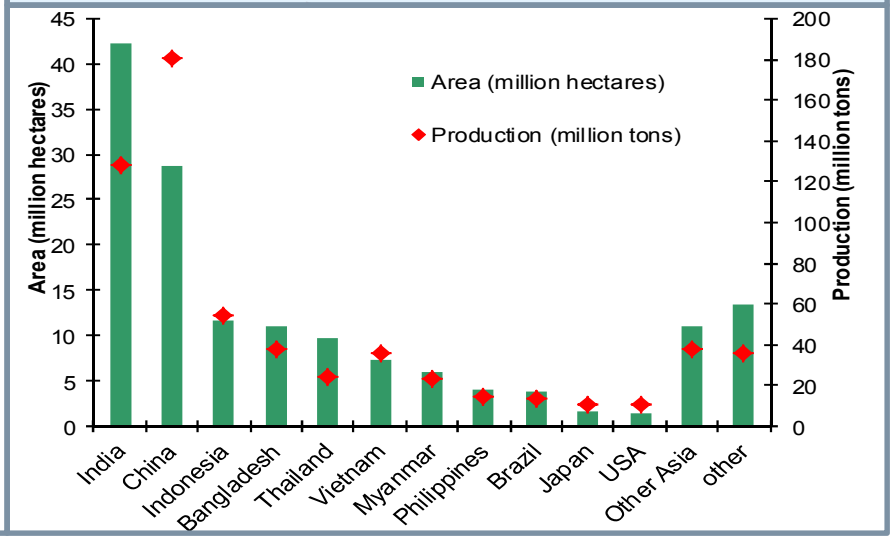
The Challenge

- The rice growth rate declining since 90's from more than two to less than one percent currently

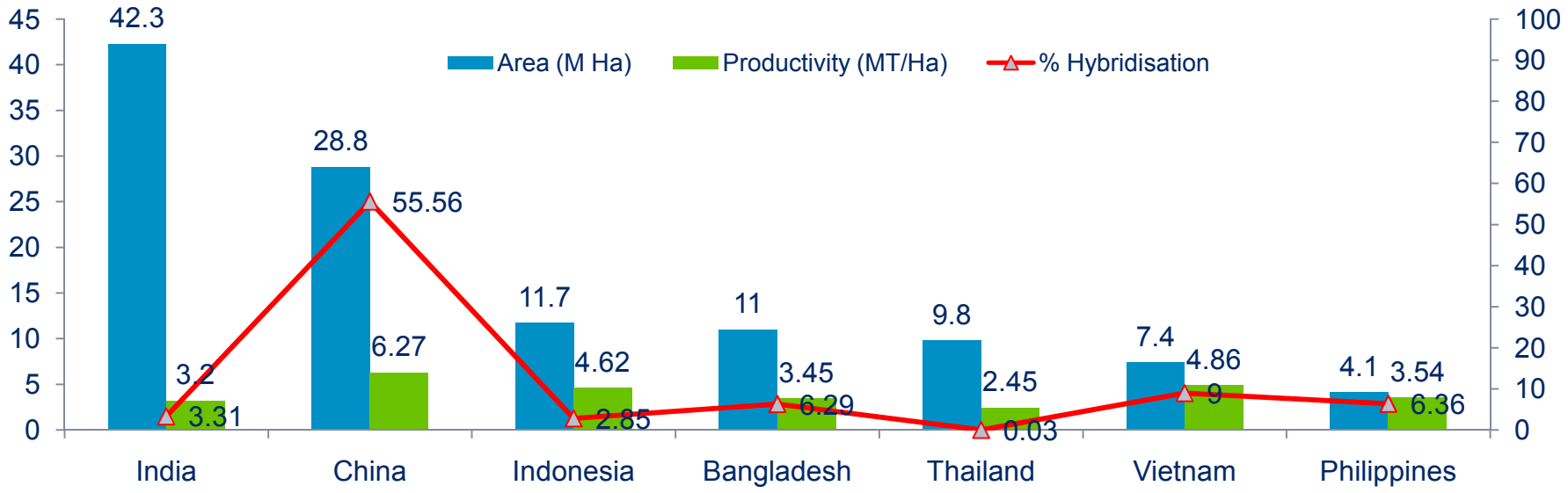
Opportunity

- Exploitation of heterosis to reverse the trend has been amply demonstrated
- China has shown the way by large scale development and adoption of rice hybrids





Hybrid Rice – the differentiator



- More than 85 % of hybrid rice is grown in China
- Fast expansion out-side specifically in Vietnam, India, Bangladesh & Pakistan
- Studies shows
  - >65% production from about 55% area in China
  - More than 6.5% production from about 3.3 % area in India

Tremendous opportunity and scope of further expansion of hybrid rice technology

Hybrid Rice Breeding and Development-India

- A systematic network of ICAR institutions and SAU participated in goal oriented hybrid development from 1989
- This helped in basic germplasm development, people development and technology advancement for hybrid rice

Source: DRR, Hyderabad

- During same time private sector started their breeding and seed production research, benefited from resources developed in public sector
- Initial hybrids performance and/or seed producebility posed limitation in early large scale commercialization

- Second generation hybrids with better producebility during beginning of 21st century found favor with growers and farmers
- Larger investment started in R&D in private sector
- About 45 hybrids released in the country
- Today reached nearly 2 M ha at farmers fields

Hybrid Rice: Enhancing yields

- Currently Rice Hybrids have the potential to **yield up to 35%** more than the best inbred variety grown in similar conditions
- **More hardy in adverse growing conditions**, especially in unfavorable soil and climatic conditions (light soils / saline / alkaline soil , water stress as well **low lying cond.**)
- The higher seed price per kg is more than compensated by lower seed planting density and higher yield… better **Return on Investment (ROI)**

Hybrid Rice : A step toward ensuring National food security

Creating Value for all Stakeholders

Farmers - Incremental yield 1MT/ha means >Rs. 11000 ($200)

Labour – 250 MD/ha through seed production

Hybrid Rice

Seed growers - profit of Rs 20-25,000 ($400-500)/ha

Consumer – Abundant food at reasonable price

Environment – better water & nutrient use

Strengthening sustainable livelihood for the farming community

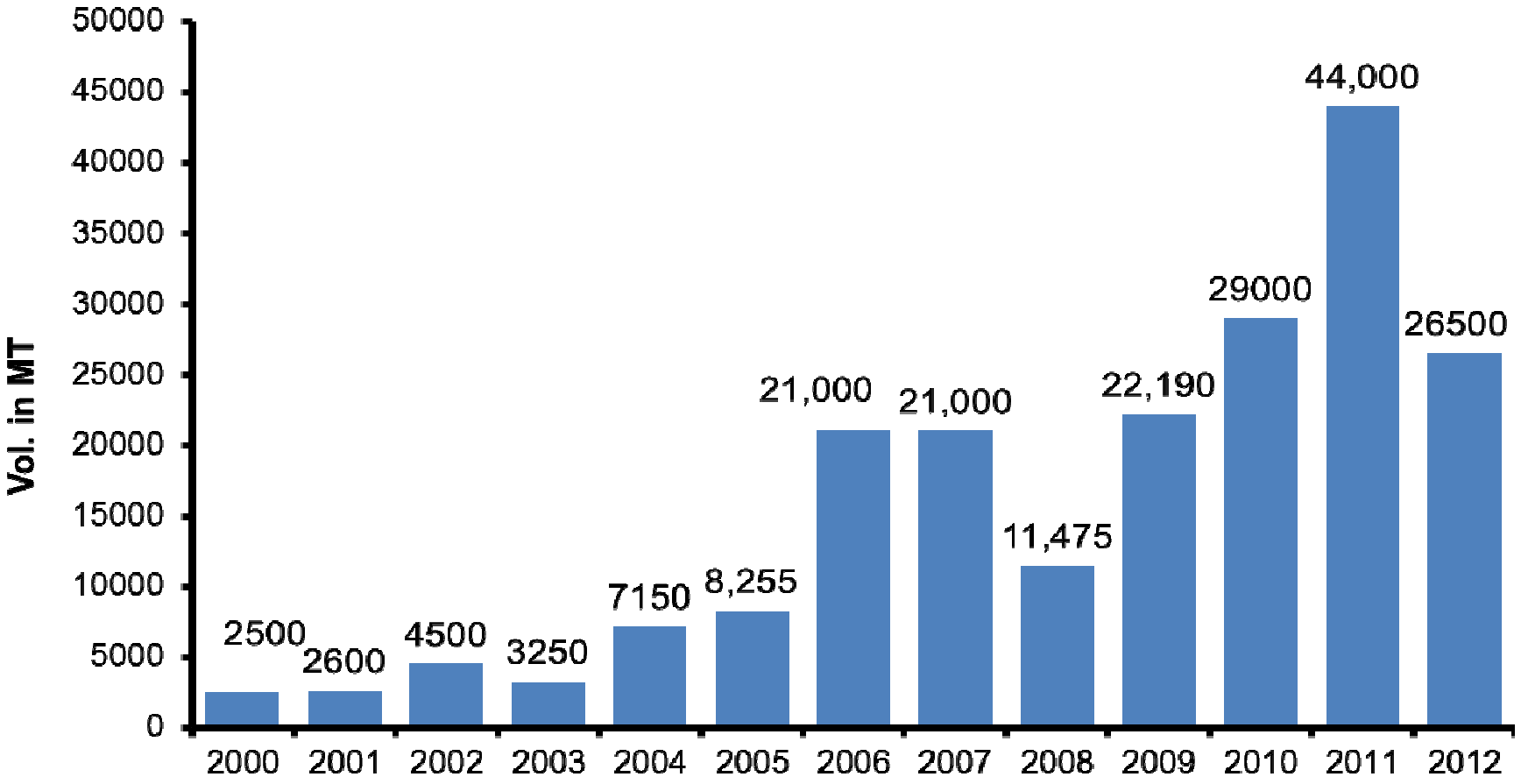
Hybrid Rice- Environmental Benefits

- With the increased productivity, Hybrid rice allows reduction in total rice-growing acreages thus making rice land available for **agricultural diversification**
- **Reduced usage of nitrogen fertilizers** in the highly fertile soils (Punjab & Haryana)*
- **Reduced water requirement** due to shortened durations & efficient water absorption capacity with the stronger root system**
- **Optimized crop protection usage** with the introduction of biotic stress tolerance/resistance

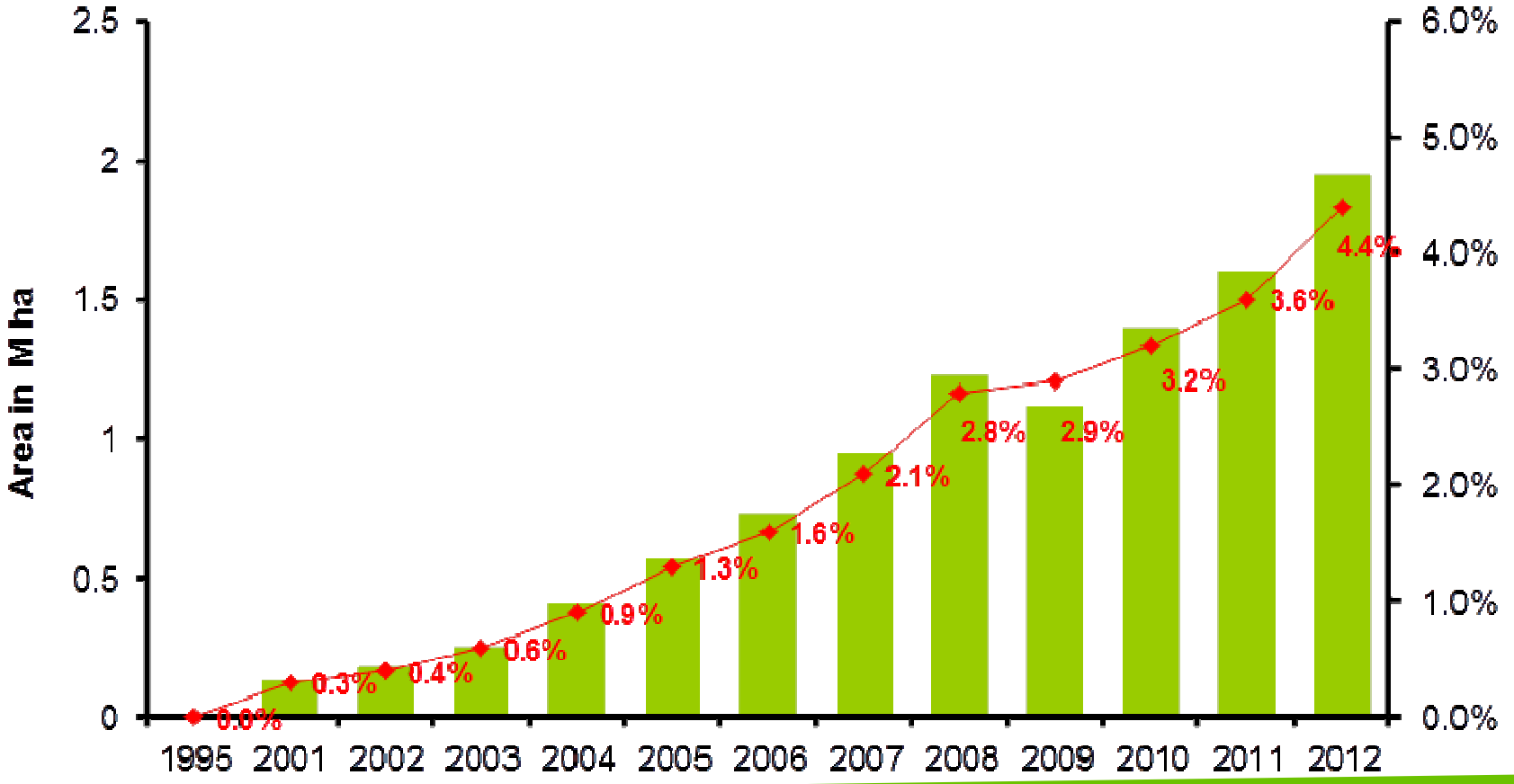
Help maintains “Ecological Balance” by using fewer resources per unit of output

* Source: Internal trial data ** Study by PAU, Ludhiana

Hybrid Rice seed production trend (India)



Hybrid Rice Growth - India



Hybrid Rice commercialization growth for last 10 years at CAGR 28.6%,

Breeding advances in hybrid rice

- Improved yield heterosis & stability
- Improved seed producebility
- Biotic stress tolerance for BLB, Blast, BPH, Gall Midge…….
- Abiotic stress tolerance for salinity, moisture and sub-mergence
- Intensive use of molecular markers in breeding and QC
- Creating new germplasm

Bayer in Hybrid Rice: Arize

- Globally one of the leaders in the development of hybrid rice and market leader in India
- An efficient breeding program delivering high performing portfolio
- Further broadening our hybrid rice portfolio and also developing Value Added Traits
- Strong expertise in seed production
- Comprehensive farmer education activities with an extensive reach
- Currently Bayer Hybrid Rice being cultivated in approx 2 Million acres across the country.

Bayer : Leader in hybrid rice development

Arize® Hybrid Rice: High innovation rate

Hybrid	Maturity	Suitability
Arize 6444	Medium (135-140 Days)	Across Asia
Arize 6201	Mid Early (125-130 Days)	East, West & Central India
Arize 6129	Early (115-120 Days)	North, West , East & Central India
Arize SWIFT	Early (115-120 Days)	North ern Ecologies
Arize Tej	Mid Early (125-130 Days)	Across Asia
Arize Dhani*	Late (140-145 Days)	East, Central, West & South India
Arize Prima	Medium (135-140 Days)	North, Central, West & East India
Arize 6444 Gold*	Medium (135-140 Days)	Across Asia

A wide range of portfolio adaptable to diverse agro climatic conditions

* Trait Hybrids (Resistant to BLB)

Hybrid Rice – The way forward

- Encourage investment by seed industry in Hybrid rice R & D
- Establish effective protection for innovation in breeding and crop biotechnology
- Genetic enhancement and heterotic pools development
- Develop specialized screening technologies
- Molecular marker development
- Human resource development through capacity building initiatives
- Allow free movement of germplasm and seed in line with international standards
- Bring consistency in export/Import requirements between different countries

Need to create environment for extensive research & development

Hybrid Development & PPP

Breeding hybrid rice is an expensive proposition. Private sector investment is a way to bring more resources to tackle the challenge

Public and private sectors bring to the table different sets of resources, viewpoints and ideas. Greatest success of the Technology as a whole can be achieved through PPP efforts

Future thrust areas

- Intensive breeding efforts in improving heterosis and grain quality
- Development of hybrids for less water and saline conditions
- Incorporating resistance to major pests and diseases.
- Thru-put marker application in breeding
- Improving seed producebility to optimize seed cost
- Intensifying transfer of technology efforts

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Thank you!

Better Rice Better Life