

**HYBRID RICE IN INDIA :  
PROSPECTS AND FUTURE CHALLENGES**

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## Hybrid Rice in India : Historical Perspective

- Impressed with the success story of China, India revived hybrid rice breeding in 1990 and came up with the first generation hybrids in 1995
- Started as a public sector initiative the hybrid rice research has grown in a short period, a Public-Private Sector Programme encouraging national and multinational companies in research, seed production and marketing.
- Despite 59 notified and as many truthfully labelled hybrids with fairly improved seed production package, pace of adoption of the technology is too slow (Not even 2 million hectares could be planted in 15 years since the introduction of the technology)

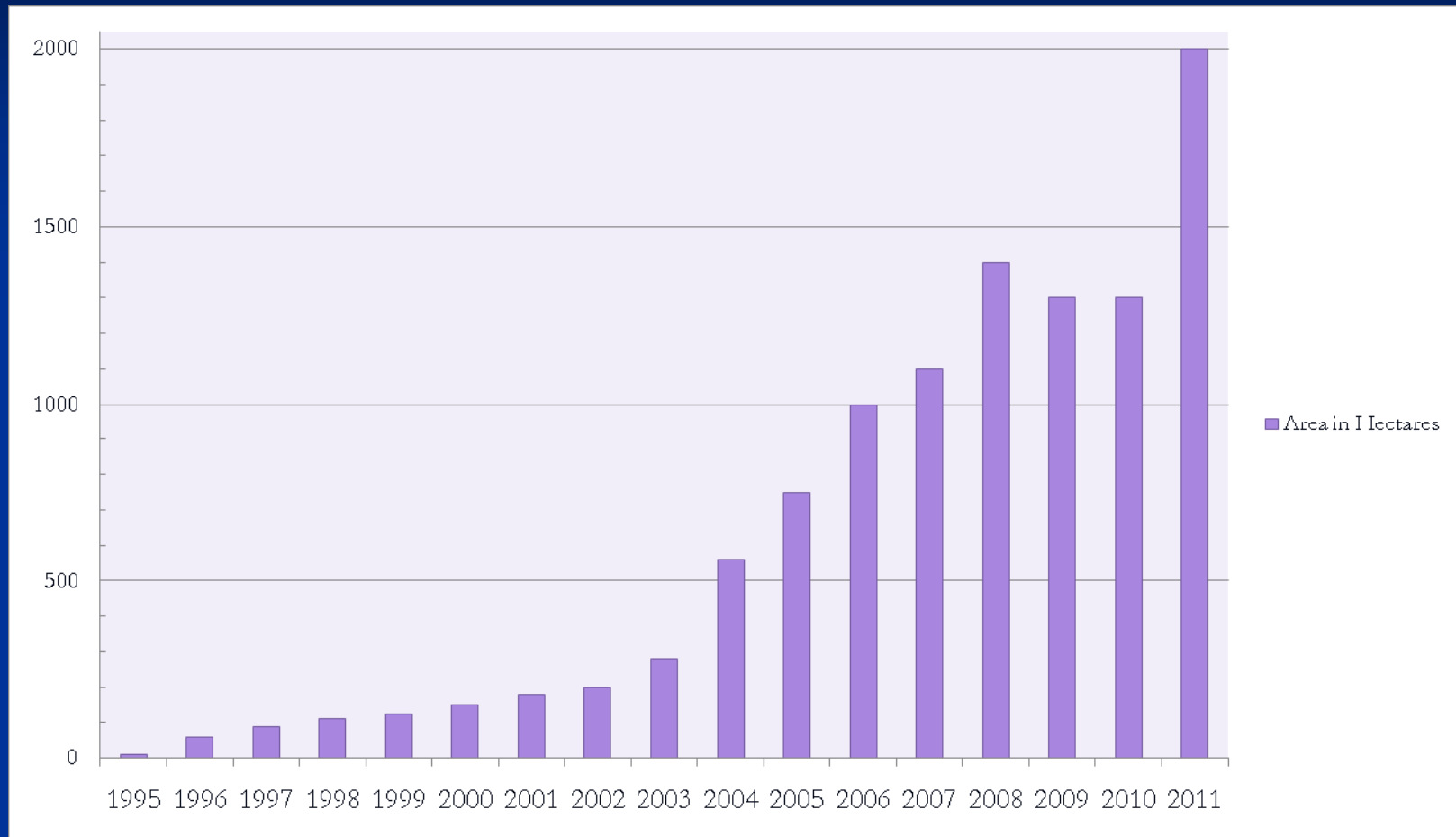
# Source of Notified Hybrids

Source/Duration	Number of Hybrids	Popular Hybrids
<b>Public</b>		
Early	11	DRRH2, Sahyadri 4
Mid Early	10	Pusa RH 10, Ajay
Medium	10	KRH2, DRRH3, CRHR 32
<b>Private</b>		
Early	3	PA6129
Mid Early	12	PA6201, US 312, DRH 775, GK 5003
Medium	12	PA 6444, HB 71, JKRH401, HRI 157
Medium Late	1	PA 6444, PHB 71, JKRH401, HRI 157
<b>(E14, ME22, M22)</b>	<b>59</b>	

# Major Reasons for Slow Pace of Adoption of Hybrid Rice Technology

- Yield advantage far short of the farmer expected level (> 1t/ha over the best inbred varieties)
- Inconsistency in their yield performance
- Less acceptable cooking quality
- Lack of productive hybrids for medium and medium late conditions, which account for over 80% of the rice area
- Vulnerability of most of the hybrids to all major pests
- Price discrimination against hybrids on account of perceived low head rice recovery.

## Pace of Adoption Hybrid Rice in India (1995-2011)



**Period**

## Hybrid Rice area statewise *Kharif* 2011 (based on the F1 seed sold)

States	Area in 000 ha
UP	770
Bihar	328
Chattisgarh	207
Jharkhand	202
Haryana	99
MP	83
Gujarat	80
Odisha	53
Others	158
<b>Total</b>	<b>1,980</b>

## Inconsistent Yield Performance of the Popular Early Hybrid PA 6129 over Locations and Years.

Location	Year		
	2009	2010	2011
Coimbatore	8033	7016	10974
Ludhiana	7667	3160	4134
Chiplima	4527	5467	3503
Nawagam	8902	1407	5581
Mandya	11827	7964	9423
Mean	6826	5002.8	6723
Inbred check mean	5885.2	4675.4	5673.8
Yield advantage over the Inbred check(%)	16	7	19

## Inconsistent Yield Performance of the Popular Medium Early Hybrid PA 6201 over Locations and Years.

Location	Year		
	2009	2010	2011
Coimbatore	7573	7311	11770
Ludhiana	----	5565	4368
Chiplima	5007	5556	4410
Nawagam	7765	4221	4592
Mandya	8874	6315	8799
Mean	7304.75	5793.6	6787.8
Inbred check mean	6904	5175.8	6025.6
Yield advantage over the Inbred check(%)	6	12	13



## Inconsistent Yield Performance of the Popular Medium Duration Hybrid KRH-2 over Locations and Years.

Location	Year		
	2009	2010	2011
Coimbatore	7533	5098	9865
Ludhiana	6306	6863	6145
Chiplima	6330	6173	4801
Nawagam	8838	2814	6151
Mandya	8386	6625	7466
Mean	7478.6	5514.6	6885.6
Inbred check mean	6417.8	5478.2	6513.4
Yield advantage over the Inbred check(%)	17	1	6

## Duration Range of the Commercially Planted Hybrids

Duration (Seed to Seed in days)	Number of Hybrids	Promising Hybrids
Early (<120d)	14	DRRH2, Sahyadri 4, PA6129
Mid Early (121-130d)	22	Pusa RH10, Ajay, Indam 200 017, HRI 161, PA6201, DRH 775, VNR204
Medium (131-145d)	22	JKRH401, PR6444, KRH2, PHB71, CRHR32, JKRH3333, HRI 157, Rajlaxmi, Sahyadri 5
Medium Late/ Late (>145d)	1	NPH-924-1

## Starch characterized and cooking quality of commercially planted Hybrids

Amylose Level	Number of Hybrids *	Hybrids
Low Amylose (<20%)	3	HKRH1, Pusa Shankar Dhan3
Intermediate Amylose (21-25%)	37	PHB71, PA 6444, PA 6201, Pusa RH10
High Amylose (>25%)	14	Ajay, Rajlaxmi, APRH2, DRRH 2

\* Estimation based on flour sample of grains harvested from F1 (hybrid) plants

## Hybrids with Desirable Milling and Cooking Quality \*

### Milling (>60% HRR) & Starch (Intermediate amylose content -20-25%) characteristics

PA 6129,	GK 5003	DRH 775 (Aromatic)	HRI 157	JKRH 3333
Rajalaxmi	Sahyadri 3 (Aromatic)	JKRH 40	CORH 3	NPH 924-1
NK 5251	DRRH 3	US 312 (Aromatic)	27P11	
VNR 202	VNR 204	US 382	27P 31	
HRI 169	RH 1531	PNPH 24	25P 25	

### Cooking and Taste parameters

US 312	Good cooking & aromatic	DRRH 3	Cooking quality similar to BPT 5204
KRH2	Good cooking & aromatic	27P61	Cooking quality similar to BPT 5204
Pusa RH10	Good cooking & aromatic	27P11	Cooking quality similar to BPT 5204
NK 5251	Good cooking non-aromatic	JKRH 3333	Cooking quality similar to BPT 5204
CORH 4	Good cooking non-aromatic		
PA 6201	Good cooking non-aromatic		

\* Source – DRR, Hyderabad

## Hybrids Resistant to Major Pathogens and Insect Pests \*

Resistant to	Number of Hybrids	Important Hybrids
6 Pests	1	US 382
5 Pests	4	Ajay, CORH 3, Sahyadri 4, HRI 169
4 Pests	8	PA 6444, Pusa RH 10, Rajlaxmi, JKRH 401, PA 6201
3 Pests	12	DRRH 3, US 312, VNR 202, 27 P 31
2 Pests	8	PAC 835, DRH 775, Indam 200-017
1 Pest	5	PA6129, CRHR 32, Sahyadri 5

\* Scored for Blast, Bacterial blight, RTV, SB, BPH, WBPA

## Hybrids with Multiple Resistance to Diseases & Insect Pests

S.NO.	HYBRID	BL	BLB	RTV	SB	BPH	WBPH
1	US382	√	√	√	√	√	√
2	AJAY	√	√		√	√	√
3	CORH-3	√	√	√		√	√
4	SAHYADRI-4	√		√	√	√	√
5	HRI 169	√		√	√	√	√
6	PA 6444	√		√	√	√	
7	PUSA RH - 10	√	√	√		√	
8	DRRH-2	√	√	√			√
9	RAJALAKSHMI	√	√		√	√	
10	SAHYADRI-3	√			√	√	√
11	JKRH-401	√		√	√		√
12	JKRH3333	√	√	√			√
13	27P61	√			√	√	√
14	PA 6201	√		√		√	
15	JRH-4	√				√	√
16	JRH-5	√				√	√
17	GK 5003	√		√			√
18	HRI-157	√	√	√			
19	DRRH-3	√		√			√
20	US 312	√		√			√

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21	VNR202	✓	✓	✓		
22	27P31	✓	✓	✓		
23	RH 1531	✓			✓	✓
24	PNPH21	✓	✓			✓
25	NPH924-1		✓		✓	✓
26	SAHYADRI-2	✓	✓			
27	HKRH-1	✓			✓	
28	DRH 775	✓		✓		
29	PAC 835	✓		✓		
30	PAC837	✓		✓		
31	INDAM 200-017	✓			✓	
32	27P11	✓	✓			
33	25P25	✓		✓		
34	INDIRA SONA	✓				
35	PA 6129	✓				
36	CRHR-32			✓		
37	VNR204			✓		
38	SAHYADRI-5		✓			
39	NK 5251					

**Note: BL: Blast, BLB: Bacterial Leaf Blight, RTV: Rice Tungro Virus, SB: Stem Borer, BPH: Brown Planthopper, WBPH: White Backed Planthopper**

## Other constraints to Adoption of Hybrid Rice Technology

- No strong institutional mechanism for production and supply of seed of public sector bred hybrids.
- Continued 'Trust Deficit' between public and private sector institutions in exchange of knowledge and material.
- No uniform subsidy component on hybrid seed cost, which varies from State to State (0 to 100%)
- The condition that notified hybrids alone are entitled for subsidy on seed cost, restricts adoption of many good truthfully labelled hybrids from private sector
- Lack of focused extension strategy for popularization of new hybrids of promise.
- Price discrimination against hybrids because of apprehended low percentage head rice recovery.
- Number of breeders engaged in hybrid breeding especially in the public sector, is too low (<20) as compared to China (>150)



## Factors Favourable for Extensive Adoption of Hybrid Rice

- New generation hybrids devoid of many of the drawbacks of the earlier released ones already available and many in the pipeline
- Public policy in favour of increased private sector participation in research and development of new plant varieties/hybrids.
- Large and vibrant seed industry with proven capability to produce and supply quality seed
- Increasingly receptive farming community for adoption of hybrid technology.
- Seed certification continue to remain voluntary
- Subsidy on seed cost for notified hybrids
- Availability in abundance of qualified scientific and technical manpower for meeting the expanding seed industry need.
- Breeder strength in multinational companies is at desired level unlike in both public and Indian private sector companies
- Priority to hybrid rice research in the 12<sup>th</sup> Plan

## Revival and Strengthening of Hybrid Rice Research in Network Mode During 12<sup>th</sup> Plan Period

- The New Hybrid Rice Network Coordinated by DRR would comprise 17 centres (existing 12 + new 5)
- Its focus will be on the following aspects with each centre assigned with a specific area of research:
  - Improvement of parental lines - 5 Centres
  - Development of intersubspecific hybrid technology - 3 Centres
  - Development of hybrids for rainfed shallow lowlands - 3 Centres
  - Development of hybrids of basmati quality for export - 2 Centres
  - Development of breeder usable molecular tools for improved breeding-selection efficiency in hybrid rice research - 3 Centres

## Suggested Action Plan for Increased Pace of Adoption of Hybrid Rice

- Major Extension thrust for popularization of 20 notified hybrids through extensive Compact Block Frontline Demonstrations in the potential areas/ecologies

Ecology	Region/State	Choice of Hybrids	
Irrigated	Eastern UP, Bihar	Early	PA 6129
	Jharkand, Chattisgarh, Assam, Tamil Nadu, Andhra Pradesh	Mid. Early	GK 5003, PAC 837, US312, PA6201, DRH 775, Indam 200 017
		Medium	PHB 71, PA 6444
Rainfed Shallow Lowland	Eastern India	Rajlaxmi, CRHR 32	
Boro	Eastern India	Rajlaxmi, CRHR 32, NRH 924-1	
Basmati Quality	North-Western India	Pusa RH10	

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## **Suggested Action Plan for Increased Pace of Adoption of Hybrid Rice**

- Continued subsidy on seed cost (not less than 75%) for all the new generation notified hybrids
- Strengthening substantially scientific manpower for hybrid rice research in the public institutions
- Strengthening of the existing institutional mechanism for production and supply of breeder, foundation and certified seed of public hybrids (SFCI, NSC, State Seed Corporations)
- Institutional mechanisms like Indian Foundation Seed Services Association (IFSSA) be replicated